The first students will be admitted in fall, Doctor of Veterinary Medicine.

D. M. Gossett, Assistant Dean
Thomas J. Whatley, Assistant Dean
John A. Ewing, Dean

The Agricultural Experiment Station was established by the University's Board of Trustees on June 8, 1882, which was 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 16 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 20 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.

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 new 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 will be admitted in the fall of 1976.

Agricultural Experiment Station

John A. Ewing, Dean
Thomas J. Whatley, Assistant Dean
D. M. Gossett, Assistant Dean

The Agricultural Experiment Station was administered through 16 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 20 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

W. D. Bishop, Dean
M. L. Downen, Assistant Dean
T. W. Hinton, Assistant 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 95 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 informational 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 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 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, 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 and minors is shown on pages 9-9.

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 the 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 six 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 on which 24 hours must be at the 5000-level.
- 18 hours in agricultural economics.
- 9 hours of economic theory.
- 6 hours in qualitative 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 and Rural Sociology

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

1. A major area of concentration to be selected from the following:
   - General Agricultural Economics
   - Agricultural Marketing and Price Analysis
   - Farm Management and Production Economics
   - Economics of Agricultural Development
2. The Core Areas:
   - Agricultural Economics
   - Economic Theory
   - Mathematical and Quantitative Methods in Agricultural Economics

Course Requirements: A minimum of 108 quarter hours credit beyond the 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 30 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 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.
4. 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 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 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 of 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.

Professors:

C. J. Southards (Head), Ph.D. North Carolina State; L. F. Johnson, Ph.D. Louisiana State.

Associate Professors:

J. W. Hilly, Ph.D. Ohio State; C. P. Pate, Ph.D. Clemson; H. E. Reed, Ph.D. Ohio State; J. L. Wilson, Ph.D. Tennessee.

Assistant Professors:

R. Gerhardt, Ph.D. North Carolina State; P. L. Lambert, Ph.D. SU; E. H. Moody, Ph.D. Univ. of Calif. (Davis).

3130 Introductory Plant Pathology (4) Principles of plant pathology illustrated by diseases of common agricultural crop plants. Prereq: Introductory Botany or Zoology. Graduate credit for non-majors only. 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 forest, garden, orchard, and household. 2 hrs and 2 labs.

3220 Apiculture (3) Biology of the honey bee, with emphasis on beekeeping equipment and apary management practices relative to pollination of crops and 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 3130. 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

6010 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: 3130.

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. 2 hrs and 1 lab.

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.

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.
Agricultural Engineering

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.

MAJORS

Agricultural Engineering  M.S., Ph.D.
Agricultural Mechanization  M.S.

DEGREES

M.S., Ph.D.
Agricultural Mechanization

3210 Soil and Water Conservation Facilities (3) Leveling, topographic surveying, planning, construction, and maintenance of drainage, irrigation, and erosion-control systems. Prereq: Introductory level in General Mathematics; Soils. 2 hrs and 1 lab.

3220 Agricultural Structures (3) Functional planning of structures; environmental control construction methods, properties of building materials, and cost estimation. Prereq: Introduction to Agricultural Engineering; General Mathematics (8 hrs). 2 hrs and 1 lab.

3510 Agricultural Utilities and Processing Equipment (4) Electrical equipment; controls; water system; heating and refrigerating systems; waste disposal systems. Prereq: Introduction to Agricultural Engineering; Introductory Physics (5 hrs). 3 hrs and 1 lab.

4160 Agricultural Waste Utilization and Disposal (3) Techniques, equipment, and structures for utilizing, treating, and disposing of agricultural wastes by land spreading, lagooning, and processing. 2 hrs and 1 lab.

4170 Small Engines (3) Concepts and mechanics of small gasoline engines; selection, operation, adjustment, and repair of single-cylinder engines. 2 hrs and 1 lab.

4180 Equipment and Techniques for Application (3) Equipment, and structures for applying liquid, solid, and gaseous chemicals; system components; operational characteristics and considerations; calibration; selection and management; materials handling and disposal methods. 2 hrs and 1 lab.

4210 Agricultural Machinery and Tractors (4) Agricultural machinery and power units; adaptation to agricultural practices; field efficiencies, capacities, adjustment and servicing. Prereq: Introduction to Agricultural Engineering; General Mathematics (5 hrs). 3 hrs and 1 lab.

5000 Thesis

5110 Research Problems in Agricultural Mechanization (3) Research problems related to recent developments and current practices in agricultural mechanization. May be repeated. Maximum 9 hrs.

5210 Electro-Mechanical Systems in Agriculture (3) Integration of electric power, mechanical equipment, structures, and environment relative to planning and animal production, crop processing, and materials handling. Prereq: 3220 and 3510. 2 hrs and 1 lab.

5310 Instrumentation in Agriculture (3) Instrumentation application for measuring and controlling parameters related to agricultural materials, systems, and processes. Prereq: Consent of instructor. 2 hrs and 1 lab.

5410 Agricultural Machinery Systems Analysis (3) Analysis of current field machinery; adaptation planning for sequential operations; machinery for unique and alternate production and harvesting systems; operational management. Prereq: 3220 and 3510. 2 hrs and 1 lab.

5610 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

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 or statesman for a specified time.

5000 Thesis

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

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

5210 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 of agricultural extension methods. Prereq: 3110 or consent of instructor.

5320 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 clientele. Prereq: 5210 or consent of instructor.

5340 History, Philosophy, and Objectives (3) Historical and philosophical foundation of informal Adult Education in American Agriculture from the Agricultural Societies (1785) to present with attention to key figures, issues, legislative movements, farmer organizations and programs. Emphasis on Agricultural Extension Service, its origins, legislation and growth and the nature of present day objectives and programs. Prereq: 3110 or consent of instructor.

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. Emphasis given to analysis of place and importance of volunteer leadership function, techniques of effective leadership in small groups and methods of developing volunteer leadership in agricultural extension work. Prereq: 3110 or consent of instructor.

5330 Supervision of Agricultural Extension Programs and Personnel (3) Theories of human effectiveness; principles of successful supervision applied to various parts of county, district and other extension programs; and planning for effective office management. Prereq: 5220 or 5520 or consent of instructor.

Animal Science

MAJOR

Animal Science

DEGREES

M.S., Ph.D.

Professors:
R. R. Johnson (Head), Ph.D., Ohio State
M. C. Bell, Ph.D., Oklahoma State
J. K. Bolton, Ph.D., Ohio State
C. R. Chamberlain, Ph.D., Iowa State
G. M. Merriman, D.V.M., Michigan State
R. E. Murphey, Ph.D., Missouri State
D. O. Richardson, M.D., Ohio State
H. V. Shirley, Ph.D., Illinois
R. R. Shrode, Ph.D., Iowa State
E. W. Swanson, Ph.D., Missouri

Associate Professors:
W. R. Backus, Ph.D., Tennessee
K. M. Barth, Ph.D., Rutgers
E. R. Lidvall, M.S., Tennessee
J. R. McLaughlin, Ph.D., Auburn
M. J. Montgomery, Ph.D., Wisconsin

Assistant Professors:
J. A. Corr, Ph.D., Tennessee
J. P. Highcock, Ph.D., Michigan State
J. W. Holloway, Ph.D., Oklahoma State
F. B. Masnich, Ph.D., Kansas State
J. D. Smailing, Ph.D., Texas A & M

3210 Anatomy and Physiology of Farm Animals (4) Skeletal system; musculature, blood and blood circulation, and the nervous, cardiovascular, respiratory, digestive, renal and endocrine systems; demonstrations; physio-chemical phenomena. Prereq: General Biology or Animal Science for Agriculture. 3 hrs and 1 lab.

3220 Physiology of Reproduction (3) Comparative anatomy and physiology of the reproductive systems of higher vertebrates; gametogenesis, fertilization, implantation, prenatal growth and development and initiation of lactation; endocrine regulation of reproductive phenomena. Prereq: 3210 or consent of instructor. 2 hrs and 1 lab. (Same as Zoology 5220.)

3230 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 for agricultural majors. 3 hrs and 1 lab.

3330 Animal Nutrition (3) Principles, instrument, and techniques of interpreting, gathering, analyzing and using data to appraise planning and teaching and to determine clientele. Prereq: 3220 or consent of instructor.

4100 Heredity in Animals (3) Basic chromosomal mechanism of heredity with emphasis on Mendelian principles and exceptions to these such as linkage and cytoplasmic inheritance. Introduction to the biochemical basis of heredity and to quantitative inheritance. Illustrations of principles with examples in species with which students in agriculture are familiar. Prereq: Animal Science for Agriculture. 2 hrs and 1 lab.

4320 Principles of Animal Breeding (3) Genetic principles in the breeding of economic species. Genetic basis of variation. Partitioning of variation according to various kinds of characteristics and in genetic makeup and in environment. Selection and its consequences. Mating systems and their effects on populations. Prereq: 3410 or equivalent. 2 hrs and 1 lab.

3510 Animal Hygiene and Sanitation (4) Parasitic, viral and bacterial organisms in farm animals; immunization; control and protection against disease; veterinary regulations and quarantine; hospital practice. 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.

3810 Nutrition and Management of Laboratory Animals (3) Principles of feeding, breeding and handling of animals in scientific investigations; specific species' requirements, peculiarities and research for which best fitted; laws governing use and handling 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 function of mammary glands; endocrinology of development and milk secretion; factors affecting yield and composition of milk. Prereq: 3210.

4220 Avian Physiology (3) Anatomy and physiology of avian species 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 determina-
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 3420 (in the breeding of important classes and species). Team 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: Consent of instructor. 3 hrs and 1 lab.

4815 Cattle Breeding and Selection (3) Principles of reproduction, nutrition, selection and herd improvement programs. Topics will include the structure of the beef industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production responses and economic returns. Prereq: 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 responses and economic returns. Prereq: Consent of instructor. 3 hrs and 1 lab.

4840 Poultry Production and Management (4) Structural organization of the poultry industry, organization and management of poultry enterprises including rearing, housing, feeding, processing and marketing. Prereq: 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 practices; individual animal and herd improvement programs; tack, equipment and facilities for both pleasure and commercial producers. Alternatives will be evaluated in terms of pleasure, recreation, and economic returns. Prereq: 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 production practices; individual animal and herd improvement programs; techniques, current problems. May be repeated. Maximum 6 hrs.

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 rate and reproductive rate 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, in vivo 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 feed 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: 3520 or consent of instructor. 3 hrs and 1 lab.

5331 Proteins in Animal Nutrition (3) Proteins in feeds; amino acids and non-protein nitrogenous compounds, nutritional functions, metabolism, evaluation and requirements. Prereq: consent of instructor.

5341 Vitamins and Minerals in Animal Nutrition (3) Environmental factors and their measurement; physiological mechanisms of response to environmental factors and their measurement; interactions of animals and environment in terms of productivity and health. Prereq: Consent of instructor. 2 hrs and 1 lab.

5230 Animal Growth and Development (3) Physiological and nutritional aspects of growth of farm animals; effects of feeding rates on physiological and productive functions. Prereq: 5321 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 hrs.

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 indexes. Prereq: 5410 and 5710.

6511 Advanced Topics in Animal Products (1-6) Recent advances and concepts, research techniques, current problems; may be repeated. Maximum 6 hrs.

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

Professors:

J. T. Miles (Head), Ph.D. Wisconsin; W. W. Overcast, Ph.D. Iowa State.

Associate Professors:

J. L. Collins, Ph.D. Maryland; B. J. DaMott, Ph.D. Michigan State; H. O. Jaynes, Ph.D. Illinois; C. C. Melton, Ph.D. Kansas State.

Assistant Professors:

E. A. Childs, Ph.D. Georgia; S. L. Melton, Ph.D. Tennessee; M. J. Rieman, Ph.D. Kansas State.

3020 Dairy Products I (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 with attention to changes and interactions occurring during processing and storage. Prereq: General Chemistry. 2 hrs and 1 lab.

3220 Food Preservation (4) Survey of food industry and preservation methods for prevention of deterioration of food. Prereq: General Microbiology. 3 hrs and 1 lab.

3840 Meat Science (3) Processing methods, carcass characteristics of meat animals; slaughter, cutting, selection, curing, freezing and cookery. 2 hrs and 1 lab.

4010 Food Technology and Science Seminar (1-3) Review of literature, oral and written reports. May be repeated. Maximum 3 hrs.

4030 Dairy Products II (4) Principles in the manufacture of butter, cheese and special dairy products. Prereq: 3020. 3 hrs and 1 lab.

4500 Advanced Food Composition (3) Intensive study of food constituents and changes affecting processing and storage. Prereq: 3210 and Food Analysis or equivalent. 2 hrs and 1 lab.

4110 Food Plant Sanitation (3) Environment for manufacturing and preserving foods. 2 hrs and 1 lab.

4120 Food Quality Assurance (3) Systems for quality assurance in food industries. Various
methods including statistics used by food indus-
tries to assure desired quality of food prod-
ucts. Prereq: 3 hrs Statistics, 2 hrs and 1 lab.

4210 Food Additives (3) Substances used in
food manufacturing with emphasis on properties
and functions Prereq: Food Analysis or equi-

4310 Food Packaging (3) Characteristics and
application of materials, and containing to
packaging requirements of food. Prereq: 3220,
2 hrs and 1 lab.

4410 Food Crop Products (3) Food products
from crops with emphasis on types, manufactur-
ing systems, quality attributes and utility.

4810 Microbiology in Food Manufacturing (3)
Relationship of microbial organisms in fermentative
and enzymatic changes occurring during processing and
manufacturing of foods. Prereq: General Micro-
biology or equivalent. 1 hr and 2 labs.

4820 Fermented Foods (3) Role of micro-
organisms in preparing foods with emphasis on
development of certain desirable charac-
teristics, flavor, aroma, texture, and keeping
quality. Prereq: Food Microbiology, 2 hrs and 1 lab.

4840 Meat Products Manufacturing (3) Pre-
pared meat products with emphasis on sausage
making and information relating to cost control
inspections and meat science. Prereq: 3840 or
consistent of instructor. 1 hr and 2 labs.

1920 Physical Phenomena of Foods (4) Phys-
ical states of food materials, foams, emul-
sions, colloidal sols, hydrates, crystals, gels.
Effects of manufacturing practices on these
Properties. Prereq: Consistent of instructor. 3 hrs and 1 lab.

5000 Thesis

5100 Seminar (1) Reports and discussions of
selected topics from research literature. May
be repeated. Maximum 3 hrs.

5120 Food Color (3) Chemistry of natural food
pigments and their measurement, notation, and
preservation in food. Prereq: Food Analysis. 2
hrs and 1 lab.

5130 Food Enzymology (3) Commercial and
industrial importance. Weekly field trips during
scheduled lab period plus one weekend field
trip. Prereq: 8 hrs basic biology or botany. 2 hrs and 1 lab.

5150 Fats and Oils (3) The application of
scientifical 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) Funda-
mentals of the art, science and technology ap-
plicated to the research, development and market-
ing of new food processes and products. Pre-
req: 4210 or 4310. 2 hrs and 1 lab.

5320 Food Thermobiology (3) Fundamentals of
heat and mass transfer to the rate of destruc-
tion of microorganisms and to the rate of loss
of food quality through the calculation of mini-
 mum 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. Pre-
req: 4120. 2 hrs and 1 lab.
4340 Aerial Photography in Forest-Resource Management (3) Use of conventional aerial photographs in forest-resource management; interpretation of detail, aerial inventories, preparation of contour maps, use of other remotely sensed imagery. Prereq: Civil Engr. 4260 and Forestry 3110 or equivalent. 1 hr and 2 labs.

4420 Forest Tree Improvement (3) Forest tree improvement related to silviculture; nature and purposes of tree improvement and forest genetics; principles of tree cytology and population genetics; improvement of seed sources; selection of superior phenotypes and development of seed orchards; hybridization; seed production and seed certification. Prereq: 4006, 2 hrs and 1 lab.

4430 Regional Silviculture of the United States (3) Factors that influence the silviculture management of the important tree species in North America. Importance of forests and forestry to a region; geology, geography, soils, climate, and weather; sites and site types, ecology, problems of protection, and silvical characteristics of the more important species. Prereq: 4006 and 4210.

4440 Forest Recreation (3) Forest lands as a recreation resource; the interrelationships of forest recreation and other recreation activities; development and management of forest recreation; the socio-economic and political determinants of recreation development and management; Prereq: 6 credits in sociology and/or economics. 2 hrs and 1 lab.

4630 Seminar (1) Review of literature. Oral and written reports.

5000 Thesis

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

5220 Seminar in Forest Tree Biology (3) Growth, reproduction, and physiology of forest trees; forest ecology; variability and taxonomy of forest trees. Prereq: 3320 or Botany 4310.

5230 Seminar in Forest Management (3) Newly developed systems in forest organization and regulation; financial and operational planning in forest management. Prereq: 4230 or equivalent.

5240 Seminar in Forest Genetics (3) Population genetics and speciation, variation patterns and heritability in forest trees; gains with different breeding methods; planning and conducting experiments. 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 associated lands; analysis and critique of specific contemporary plans. 2 hrs and 1 lab. Overnight field trips may be required.

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

Wildlife and Fisheries Science

3200 Wildlife Resources and Their Conservation (3) Wildlife animal resources of the United States; their interrelationships with soil, water, and forests and other plant life; contribution to economic and social development; importance and methods of conserving wildlife. General course for non-wildlife and fisheries science majors.

3230 Wildlife Management (3) (Same as Forestry 3230.)

4450 Game Mammals (4) The classification, identification, distribution, natural history, and management principles of game mammals in North America. Prereq: 3230 or 1 year of zoology. 2 hrs and 2 labs.

4460 Game Birds (4) The biology, classification, identification, distribution, and management of game birds in North America. Prereq: 3230 or 1 year of zoology. 2 hrs and 2 labs.

4510 Freshwater Fishery Biology (4) Principles and method of fish population dynamics; sampling techniques and equipment; warm and cold-water environments as commercial and sport fisheries. Prereq: 1 yr. biology and 8 hrs mathematics or consent of instructor. 3 hrs and 1 lab or field period. (Same as Zoology 4510.)

4520 Management of Lakes and Ponds (4) Principles and method of lake and pond management for commercial and sport fishes; design, renovation, and stocking procedures; biology and culture of managed species. Prereq: 4510 or consent of instructor. 3 hrs and 1 lab or field period.

5000 Thesis

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

5210 Seminar in Wildlife Conservation (3) Current studies, problems and issues in wildlife conservation, public agencies and organizations and their programs. Prereq: 3230 or consent of instructor.


5400 Advanced Topics in Wildlife Science (3) Recent advances and concepts, research techniques, and analysis of current problems. Prereq: 4450 and 4460 or consent of instructor. May be repeated. Maximum 6 hrs.

5450 Wildlife Diseases (3) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials. Prerequisites in the field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 yr. zoology, 1 quarter microbiology, pathology or parasitology, 4450 or 4460, or consent of instructor. 2 hrs and 1 lab.


5500 Advanced Topics in Fishery 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

DEGREE

Ornamental Horticulture and Landscape Design M.S.

Professor: D. B. Williams (Head), Ph.D. Pennsylvania State University.

Associate Professors: J. S. Alexander, M.S. Tennessee; L. M. Callahan, Ph.D. Rutgers; H. v.d. Werken, GAUST, Horticulture College, Frederiksoord, Holland.

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. 1 hr and 2 labs.

3110 Greenhouse Management (3) Factors involved in management of greenhouses for propagation and research. Structures, soils, pest 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 installation, 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. Emphasis on recreational design, analysis of contemporary trends and objectives, projected needs and development of properties. Prereq: 4120 or equivalent. 2 hrs and 2 labs.

150-60 Nursery Management I and II (3, 3) Production, labor, and sales management; retail and wholesale nurseries; location, layout, culture, equipment, and facilities. Prereq: 3530. 1 hr and 2 labs.

4180 Park Design (4) Design criteria for parks and outdoor recreation systems. Park site selection, analysis, planning and management as related to needs and resources. Prereq: 4120. Recommended: 4140. 2 hrs and 2 labs.

4210 Principles of Turf Management (4) Principles of turfgrass management; history, varietal selection and identification, adaptation, ecology, physiology, soil fertility and grass nutrition; basic applied fertility programs; and weed, disease, insect, and other pest relationships in turf grasses and basic pest control programs. Prereq: Soils and 8 hrs of biological science. 3 hrs and 1 lab.

4310 Floriculture I (3) Principles and practices employed in producing cut flower crops. Application 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 producing floricultural crops in pots and other containers. Analysis of problems associated with using 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, 3-5)

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 design, development, and management of a golf course. Selection and utilization of grass varieties and other plant materials and development of specifications for their nutritional, chemical, and mechanical maintenance. Financing, equipment, and labor management; and public relations. Prereq: 4210 and consent of instructor. 2 hrs and 2 labs.

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

Plant and Soil Science

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

Professors: L. F. Stieritz (Head), Ph.D. North Carolina State; 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. E. Springer, Ph.D. California (Berkeley); H. D. Zimm, Ph.D. Louisiana State.


Assistant Professors: F. L. Allen, Ph.D. Minnesota; G. M. Leisman, Ph.D. Michigan State; V. H. Reich, Ph.D. Iowa State.

3020 Crop Ecology (3) Crops and environment; geographic location; site, heat, light, water, and interplant relationships as a basis for judgment of cultural practices used to modify environmental factors. 2 hrs and 1 lab.

3040 Crop Physiology (3) Physiology of crop plants; growth phenomena related to crop production; use of general theories of physiology; effects of season, growth regulating substances, functions of light, heat, air, minerals and water. 2 hrs and 1 lab.

3110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability, absorption, 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, culture, harvesting, and utilization of corn, small grains, grain sorghum, soybeans and related crops. Prereq: 8 hrs of biological science. 2 hrs and 1 lab.

3140 Forage Crops (4) Characteristics, adaptation, improvement, culture, harvesting, and marketing of cotton and tobacco. Prereq: 8 hrs of biological science. 3 hrs and 1 lab.

3160 Cotton and Tobacco (4) Characteristics, adaptation, improvement, culture, harvesting, and marketing of cotton and tobacco. Prereq: 8 hrs of biological science. 3 hrs and 1 lab.

3180 Fruit Crops Management (4) Soils, planting, cultivation, development of fruit crops plantations; protection, harvesting, packing, storage, and pruning. 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. 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. 2 hrs and 1 lab.

3510-20 Commercial Vegetable Production (3, 3) Characteristics, economic importance, adaptability, and production of important vegetable crops for fresh and processing markets. Need not be taken in sequence. 2 hrs and 1 lab.

3610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results.

3710 Principles of Weed Science (4) Basic principles of weed science; history, ecology, economic losses, means of control, types of herbicides, and specific recommendations for various crop and non-crop uses. 3 hrs and 1 lab.

4110 Soil Chemistry (4) Colloidal systems; properties and behavior of colloidal soil materials; relations of chemical properties to plant nutrient availability. 3 hrs and 1 lab.

4120 Principles of Crop Breeding (4) Genetic principles and techniques. Prereq: 1 year of fundamentals of botany or general zoology, or permission of instructor. 3 hrs and 1 lab.

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

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

4320 Soil Formation, Morphology, and Classification (4) Soil formation; properties, distribution, and relationships among the solid, liquid, and gaseous phases of the soil mass; their relation to plant nutrient availability, 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 and classification of soils; soil-ecosystem; classification of soils. Prereq: 4320 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 experiment and problem dealing with the analysis of data. Prereq: 3610.

5340 Soil Physics (3) Chemical and physical relationships among the soil, liquid, and gaseous phases of the soil mass; their relation to plant growth and soil management. Prereq: 4110. 2 hrs and 1 lab.

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, examining their physicochemical reactions, ion exchange, Donnan equilibrium, double layer theory. Prereq: 4110; Chemistry 4110 or concurrent registration.

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

5710 Advanced Plant Genetics (3) Importance of polyploidy in plants; detailed study 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 population 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, hybridization, crossing, 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 growth; crop distribution centers of origin; general and specific climatic, weather, and vegetative systems; micrometeorological influences on crop 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; relationships 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.

5880 Mechanisms of Heribicide 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.

6340 Advanced Soil Physics (3) A theoretical consideration of the soil as a physical body. Physical characteristics of soils and principles underlying moisture, gas, and heat flow potentials in soils. Prereq: 5340, Chemistry 4110, Mathematical Analysis.

6390 Advanced Soil Physical Chemistry (3) Electrokinetic properties of colloidal systems, including electrical potentials, ionic mobilities, and their relation to general nutrition of plants. Prereq: 5380 and Chemistry 3430.

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) Chemistry, physiology, mode 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.
Graduate programs of the College of Business Administration are designed to prepare men and women to assume executive, managerial and professional positions in the increasingly complex world of domestic and international business and industry, teaching and research, government, and institutional management.

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.

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, Management Science and Statistics, and the Master of Business Administration. See page 8 for areas of study. Also, the Department of Industrial and Personnel Management participates with the Department of Psychology in the College of Liberal Arts in offering an inter-collegiate program in Industrial and Organizational Psychology leading to the Master of Science and Doctor of Philosophy degrees. (See page 93.)

The two college-wide programs, the MBA and the DBA, are described below. Descriptions of other degree programs will be found under the appropriate departmental or program headings.

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.

There is no thesis requirement although ample opportunity is provided for research and writing in course work. Students may begin the program in any of the four quarters of the academic year; however, sequencing of courses is such that entry in the summer or fall terms may be advantageous.

The MBA student may select an area of concentration from the following fields:

- Accounting
- Economics
- Finance
- Governmental Administration
- Industrial Administration
- Management

- Management Science
- Marketing
- Real Estate and Urban Development
- Statistics
- 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.

Group A—Foundation Courses. Required for students who lack adequate preparation in the areas listed. Any or all
of these courses may be waived if the student has completed undergraduate course equivalents. Additional prerequisite courses may be required for certain concentration areas. These courses are available only to satisfy Group A requirements and as stated on page 64.

Quarter Hours

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acctg. 5050-60 Financial Accounting</td>
<td>6</td>
</tr>
<tr>
<td>Bus. Law 5050 Legal Environment of Business</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 5050-60 Economic Analysis, Problems and Policies</td>
<td>6</td>
</tr>
<tr>
<td>Fin. 5050 Survey of Finance</td>
<td>3</td>
</tr>
<tr>
<td>Ind. Mgt. 5050 Production Management</td>
<td>3</td>
</tr>
<tr>
<td>Mktg. 5050 Survey of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>Off. Admin. 5050 Data Processing in Business</td>
<td>3</td>
</tr>
<tr>
<td>Group B—Core for all Candidates.</td>
<td></td>
</tr>
<tr>
<td>Acctg. 5810, Accounting for Control</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 5070-80, The Firm and Its Environment</td>
<td>6</td>
</tr>
<tr>
<td>Fin. 5110 Theory of Financial Management</td>
<td>3</td>
</tr>
<tr>
<td>Ind. Mgt. 5230, Human Problems in Administration</td>
<td>3</td>
</tr>
<tr>
<td>Mktg. 5200, Marketing Management</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 5311, Probability Theory</td>
<td>3</td>
</tr>
<tr>
<td>Quantitative Option (select one):</td>
<td></td>
</tr>
<tr>
<td>Mgt. Sci. 5100, Introduction to Management Science or Stat. 5312, Statistical Methods</td>
<td></td>
</tr>
<tr>
<td>Bus. Adm. 5310, Business Policy</td>
<td>3</td>
</tr>
<tr>
<td>Total, Group B</td>
<td>27</td>
</tr>
</tbody>
</table>

Group C—Concentration. At least 12 but not in excess of 18 quarter hours of graduate level courses are required in one area of concentration. To the extent that the concentration area is decreased below 18 hours, Group D—Electives is increased. A student may elect two areas of concentration of 12 quarter hours each, in which case no courses are required in Group D—Electives. (All double concentration programs should be coordinated through the Graduate Programs Office of the College of Business Administration.)

Total, Group C 12 - 18

MBA CONCENTRATIONS: Typical course groupings are listed below. Area prerequisites may be taken in one's 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 prerequisite: Introductory Financial Accounting (6); Introductory Cost Accounting (6); Intermediate Theory (9); and Federal Income Tax (3).

The following areas must be included in the concentration unless taken in undergraduate program: Auditing, Consolidations, 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 Masters and Ph.D. programs in this area.) Area prerequisite: Intermediate Macro- and Micro-Economic Theory (6). Any combination of 12-18 quarter hours of Economics courses listed in this catalog as approved by the faculty advisor.

Finance. Area prerequisite: 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 and Fiscal Policy: 5210, 5220, 5320, 5810, 5910
- Management of Financial Administration

Group D—Electives. Unless the student elects two areas of concentration, a minimum of six but not in excess of 12 quarter hours of graduate level course work may be taken in any of the colleges of the University subject to approval of the student's faculty advisor.

Total, Group D 6 - 12

Total Program (except Group A) 51

Other Requirements. The application for Admission to Candidacy (see p. 18) must be approved by two faculty members in the student's 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.

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 features. First, it recognizes the interdisciplinary thrust of graduate education and provides an advanced level foundation for expanding the body of knowledge related to business systems.
and their interactions with other socio-economic systems and environmental forces. Second, the student's program is flexible enough to respond to individual needs and interests yet formulated within a sound framework so as to achieve overall objectives. Third, emphasis is placed upon conceptual foundations and analysis of decision-making processes rather than the descriptive aspects of business administration. Fourth, the student does work in both the behavioral and quantitative sciences coupled with an in-depth assessment of one of the two areas.

Program Framework. Program prerequisites include at least one year of college mathematics to include college algebra, matrix algebra, calculus of a single variable and partial differentiation; knowledge of computer programming (FORTRAN); intermediate economic theory; and introductory courses in financial accounting, financial management, marketing management, operations (production) management and the legal environment of business. Entering students deficient in any of these prerequisite areas may enroll in courses especially designed to meet these requirements. Previously completed graduate courses will be evaluated against DBA program requirements and where equivalence is found, credit will be allowed. Each student's program consists of three major segments:

I. Course Work

A. CORE FOR ALL STUDENTS. The courses listed below provide a graduate level foundation in the key decision-making, or functional, areas of business coupled with a study of economic theory, behavioral science and quantitative analysis.

<table>
<thead>
<tr>
<th>Quarter Hours</th>
</tr>
</thead>
</table>

Acct. 5810 Accounting for Control 3
Acct. 5820 Corp. Reporting Prob. 3
Econ. 5111-12 Microecon. Theory (3,3)
Econ. 5121 Macroecon. Theory (3)
OR Econ. 5111 Microecon. Theory (3)
Econ. 5121-22 Macroecon. Theory (3,3)
Fin. 5110 Theory of Financial Mgt. 3
Ind. Mgt. 5110 Organizational Theory 3
Ind. Mgt. 5610-20 Organizational Behavior 6
Mktg. 5200 Marketing Management 3
Mgt. Sci. 5100 Mgt. Science Techniques 3
Stat. 5311 Probability Theory 3
Stat. 5312 Statistical Methods 3
Trans. 5210 Business Logistics 3

Total Core 42

The above requirements may be satisfied by completing course work at this or another accredited institution or by passing proficiency examinations in certain of the areas. These courses may be taken concurrently with courses required under B, C, D, and E below.

B. 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 15 quarter hours (including at least 9 quarter hours of doctoral-level work taken at The University of Tennessee, Knoxville) is taken in one of the following areas:

- Accounting
- Finance
- Management
- Marketing
- Transportation and Logistics

C. SUPPORTING AREA (minimum of 12 quarter hours). The purpose of this work is to expand the student's understanding of business beyond the area of concentration and to complement the dissertation research effort. The chosen area should have a clear relationship to the concentration and serve to strengthen the student's overall capacity to do scholarly work in specific areas of research interest within his concentration. The area may be selected from those offered within the College of Business Administration or in other fields within the University, including but not limited to mathematics, engineering, communications, public administration and political science, history, philosophy, psychology, sociology, law, and other relevant areas.

D. OPTIONAL AREA (Minimum of 12 quarter hours). The student has the option of choosing either behavioral science or quantitative methods as an area in which to gain proficiency beyond work completed in the core. Requirements for this area are as follows:

<table>
<thead>
<tr>
<th>Quarter Hours</th>
</tr>
</thead>
</table>

Behavioral Science 9
Ind. Mgt. 6250-60-70 Seminar in Ind. and Org. Psy. (select two courses) 6
Electives in Behavioral Science (6000 level) 6

Quantitative Methods. Select one of the following two options with substitution of core quantitative courses as indicated:

<table>
<thead>
<tr>
<th>Quarter Hours</th>
</tr>
</thead>
</table>

1. (Core: Stat. 5050, 5060; Mgt. Sci. 5100)
   - Statistics 5070, 6060, 6070 9
   - Elective in statistics, mathematics, management science or computer science 3
2. (Core: Stat. 5311 or 5311, 5312)

E. RESEARCH METHODS AND ACADEMIC PRACTICUM (minimum of six quarter hours). The objective of work in this area is to develop the student's capabilities in research and university level teaching methods and techniques.

<table>
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<th>Quarter Hours</th>
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Business Adm. 6900 Res. Meth. In Business 3
Business Adm. 5900 Academic Practicum 3

II. Admission to Candidacy. A student may apply for Admission to Candidacy for the DBA degree after maintenance of at least a B average in course work, successful completion of preliminary examinations in the concentration area, supporting area and option area, and acceptance of his/her research proposal for the dissertation.

III. Research and Dissertation (minimum of 36 quarter hours). The purpose of this segment is to provide the candidate with a research experience that meets the general standards of the profession. The dissertation is supervised by the candidate's faculty committee, who must certify its completion and acceptability after the candidate's oral defense of his/her research effort.

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) including both the aptitude and advanced tests. 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 Educational Testing Service, P.O. Box 966, Princeton, New Jersey 08540, and from most colleges and universities.

In addition to procedures required for admission to the Graduate School (pp. 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 other leading graduate schools of business as a member of the Admission Council for Graduate Study in Management.

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 various research centers of the University range up to $5500 per year for half-time service. Awards are generally made on the basis of scholarship and performance on the admission test. Application forms may be obtained in any of the departments or from the office of the Assistant Dean for Graduate Programs. Applications must be received by April 1 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 socioeconomic 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 achieve 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 major objective of the program is to prepare and develop executives for increasingly higher levels of management responsibility and to sharpen their 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 32 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 outstanding practitioners in their fields of business and industry.

Departments of Instruction

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

Accounting

M A J O R  

MAJOR DEGREES

Accounting M.B.A., D.B.A.

Professors:

N. E. Dittrich (Head), Ph.D. Ohio State, C.P.A.;

J. B. Ross, Ph.D. Alabama, C.P.A.

Associate Professors:

G. E. Nichols, Ph.D. Louisiana State, C.P.A.;


R. L. Townsend, Ph.D. Texas, C.P.A.;

F. W. Watkins, Ph.D. Louisiana State, C.P.A.

Assistant Professors:

P. R. Bremer, Ph.D. T.E.D., Iowa; W. H. Hawthorne, Ph.D. Tennessee;


4110 Theory and Practice of Auditing (3)

Theory and practice of professional and general auditing. A cooperative program is maintained with national and local public accounting firms for selected students who spend winter quarter working on staffs of these firms. Prereq: Intermediate Accounting.

4120 Advanced Auditing (3) Legal and professional responsibilities of the auditor, evaluation of internal control, utilization of EDP and statistical techniques in auditing, and auditing reports. Prereq: 4110.


4950 Individual Research in Accounting (3) Special projects undertaken by majors in accounting under the direction of faculty members of professional rank.

4990 Senior Seminar (3) Advanced problems in the financial accounting area are analyzed and discussed by students.

5000 Thesis

5050-60 Introduction to Financial Accounting (3, 3) Classification and presentation of financial data, basic accounting concepts underlying asset valuation and income measurement, interpretation of financial statements. (Available only as stated on page 33.)

5110 Seminar in Accounting Theory (3) Accounting postulates, principles, and procedures. Concepts of value as they relate to the measurement of performance and position. Prereq: Two quarters of intermediate accounting or equivalent.

5210 Seminar in Advanced Auditing (3) Standards and procedures in audits and special investigations; audit reports and reports filed with the S.E.C. Auditing EDP systems and use of statistical sampling are emphasized. Prereq: Theory and Practice of Auditing or equivalent.

5310 Seminar in Current Accounting Topics (3) Current controversial issues in accounting. Prereq: Two quarters of intermediate accounting or equivalent.

5410 Seminar in Advanced Cost Accounting (3) Direct costing, return on investment, capital budgeting, cost analysis, distribution costs, cost justification under the Robinson-Patman Act, and others. Prereq: Second quarter of Introductory Cost Accounting or equivalent.

5420 Seminar in Advanced Taxation (3) Income determination, tax planning and organization of the Internal Revenue Service, administrative settlements in tax disputes. Prereq: Theory and Practice of Auditing or equivalent.

5510 Governmental Accounting (3) Theory and practice of budgetary and fund accounting, financial reporting, measures of output and accomplishment, and financial and performance auditing for governmental and nonprofit organizations. Prereq: 9 hrs of accounting and consent of instructor.

5530 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: Introduction to Computer and Knowledge of a computer programming language.

5640 Seminar in Management Information Systems
Systems (3) Survey of the literature on business information systems and advanced systems analyses and design concepts. The informational needs of all functional areas and the interfacing of these areas will be considered. Prereq: 5630 and consent of instructor.

5810 Accounting for Control (3) Funds statements, analysis of financial statements, budgets, responsibility accounting, impact of income taxes on planning and of quantitative techniques on management accounting. Prereq: 5050-60 or equivalent.

5820 Corporate Reporting Problems (3) A user-oriented analysis of current corporate financial reporting problems and issues. Prereq: 5630 and consent of instructor.

6000 Doctoral Research and Dissertation

6110-20-30 Doctoral Seminar in Accounting (3, 3, 3) Analysis of issues reflected in accounting literature. Prereq: 5810 or consent of instructor.

Business Administration

5310 Business Policy (3) Case studies covering policy formulation and administration; point of departure—top and middle management, where company-wide objectives are set and departmental policies and activities coordinated; emphasis on setting up company's situation, determining objectives, developing sound policies, organizing and administering personnel to reach company objectives, continuous administrative reappraisal. Enrollment priority given M.B.A. students in last quarter of their program. Prereq: All other Group B (core) courses of M.B.A. program.

5410 Business and Its Societal Environment (3) An analysis of current forces and changes in society and the inter-relationship of plans and actions in business firms with environmental factors. Prereq: Consent of instructor.

5610 Seminar in Applied Business Analysis (3) Application of business concepts and analytical skills to the problems of small businesses in the community. Students work in teams under the supervision of a participating professor. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5900 Academic Practicum (3) Concepts, methods, and materials in the instruction of Business Administration subjects at the college level.

6900 Research Methodology (3) Philosophy and design of research in Business Administration.

Business Education

See College of Education

Business Law

Professor: M. L. Townsend, J. D. Tennessee.

Associate Professor: B. D. Fisher, L.L.M. George Washington.

Assistant Professor: N. E. Shurtz, J.D. Ohio State.

5050 Legal Environment of Business (3) Surveys legal and quasi-legal institutions with emphasis on the administrative agencies which have particular significance to the business man; examines government regulation of business; explains basic legal notions and principles that pertain to businessmen. (Available only as stated on page 33.)

Economics

MAJOR DEGREES

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

Professors: J. R. Moore (Head), Ph.D. Cornell; R. L. Bowby, Ph.D., Texas; W. E. Cole, Ph.D., Texas; G. R. Feiwel, Ph.D., Cornell; J. F. Holly, Ph.D. D. Clerk; H. E. Jensen, Ph.D., Texas; F. Y. Lee, Ph.D. Michigan State; W. C. Neale, Ph.D. Texas; R. H. Wolf, Ph.D. Vanderbilt.

Associate Professors: S. L. Carroll, Ph.D. Harvard; C. B. Garrison, Ph.D. Kentucky, E. Gerzof, Ph.D. Stanford; H. R. Shankle, Ph.D., Florida; A. Mayhew, Ph.D., Texas; D. A. Patterson, D.B.A. Indiana; K. E. Phillips, Ph.D. Washington (Seattle); G. A. Spive, Ph.D. Texas.

Assistant Professors: H. S. Chang, Ph.D. Vanderbilt; R. J. Gaston, Ph.D. California (Los Angeles); H. W. Herzog, Ph.D. Maryland; A. M. Schiottmann, Ph.D. Washington (St. Louis); G. Vanugh, Ph.D. Duke; K. I. Vaughn, Ph.D. Duke.

MASTER'S PROGRAM

The minimum requirements for a graduate major in Economics for the Master of Arts and the Master of Science degree consist of the following: (1) Economics 5111-5112 and Economics 5121-5122, (2) nine additional hours in economics at the 4000 or above level, (3) a thesis, or an additional nine hours in economics at the 5000 level or above to be concentrated in one field. Students electing the non-thesis option will be required to pass a final written comprehensive examination.

The requirements for a graduate minor in Economics are as follows: Either (1) 5111-12 and 5121, or (2) 5111 and 5121-22, (3) 5111 or 5112, or 5140, and one other 4000 or 5000 series economics course, or (4) with the consent of the head of the Economics Department, an alternative sequence of nine hours to meet unusual conditions.

MASTER OF ARTS IN COLLEGE TEACHING DEGREE

The requirements for the MACT degree are listed on page 17. A thesis is required.

DOCTORAL PROGRAM

Subject Area Requirements.

1. Students will be required to demonstrate their competence in the core subject fields as indicated:
   b. Economic History, by completing six hours in Economic History at the 5000 level or above with an average grade of B or better or by satisfying an examining committee.
   c. History of Economic Thought, by completing Economics 5150 and three additional hours in Economics 5160-20 in this area at the 5000 level with an average grade of B or better or by satisfying an examining committee.
   d. Mathematical and Quantitative Methods in Economics, by completing Economics 5180, 5190, and 5150 with the grade of B or better or by satisfying an examining committee. (Note: The Economics 5510 requirement may be waived for those students completing Economics 6170, 6180, and 6190.)
   2. Students will be required to demonstrate their competence by preliminary examination in three fields with the approval of the department, at least two of which must be selected from the following list and only one of which may be from the first three fields listed:
      Advanced Economic Theory
      Economic History
      History of Economic Thought
      Economic Policy
      Economic Development
      Economics of Central and Planned Economies
      Economics of Labor and Manpower
      Industrial Organization
      International Economics
      Regional and Urban Economics
      Agricultural Economics
      Monetary Economics
      Public Finance and Fiscal Policy

Fields, as offered by the department, combining two of the above fields (in some cases, a combined field may "count" as two fields.)

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

5011-12 Problems in Lieu of Thesis (3, 3)

5910-20-30 Economics Seminar (1, 1, 1) Research in progress and discussion of selected topics. May be repeated. S/N/C 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 economic system; subjects discussed are the historical facts concerning booms and depressions, the statistical methods for analyzing business fluctuations, the theoretical explanations of cycles, and the policies that have been proposed to combat them. Prereq: Intermediate Macro Theory or consent of the instructor.

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 socio-economic conditions which influenced this development. Period covered: 1776 through 1936. Prereq: 1 yr of Principles of Economics and consent of instructor.

4170-30 Introduction to Mathematical Economics (3) Application of mathematical methods in the theoretical study of micro- and macroeconomic phenomena. Designed for be-
gaining graduate students who have limited training in analytic geometry and calculus. Must be taken in sequence. Prereq: Intermediate Micro Theory and college algebra, calculus, and analytic geometry or the equivalent.

505 Introduction to Economic Analysis (3) The nature of economic problems; economics as a science; brief survey of the evolution of economics; analytical tools of macro- and microeconomics. (Available only as stated on page 33.)

506 Introduction to Economic Problems and Policies (3) Economic theory as a basis for problem solving; tools of public and private policy on the demand and supply, growth and minimum income, international economic relations and the problems of the developing economies. (Available only as stated on page 33.)

5070-80 The Firm and Its Environment (3, 3) Macroeconomic environment; economic forecasting; microeconomic environment; organizational analysis; behavioral aspects of imperfect markets; legal aspects of imperfect markets; responsibilities of the businessman. Must be taken in sequence. Prereq: 5050-60.

5111-12 Microeconomic Theory (3, 3) Fundamental theory of price determination in partial and general equilibrium settings, including theories of preferences and consumer behavior, production, short and long-run profit maximization under conditions of perfect and imperfect competition, microeconomic production and distribution. Prereq: 4170 and Intermediate Economic Theory or equivalent.

5121-22 Macroeconomic Theory (3, 3) Determination of the levels of employment and prices for the economy as a whole, focusing on the relationships between interest rates, price expectations, productivity, and the quantity of money, on the one hand, and aggregate saving, investment, and liquidity preference on the other. Prereq: Intermediate Economic Theory or equivalent.

5150 History of Economic Thought (3) Development of economic ideas from the mercantilists through Alfred Marshall; emphasis given to current economic problems. Prereq: Intermediate Econ Theory or equivalent.

5180-90 Mathematical Methods in Economics (3, 3) Applications of basic concepts in the differential and integral calculus, difference and differential equations, linear algebra and stochastic models to topics in the theory of the firm, growth models, game theory, linear programming, and decision making under uncertainty. Prereq: 1 year of calculus.

5510 Quantitative Methods in Economic Research (3) Methods of estimation and testing of economic relationships with the use of time series and cross-section data, with applications to current economic problems. Prereq: Introductory Statistics or Statistics 5211 or the equivalent.

5520 Introduction to Econometrics (3) Statistical techniques in the analysis of economic time series and cross-section data, distribution of income and wealth, models of growth and cycles, macroeconomic applications. Should not be taken by students who contemplate taking Economics 6170-80-90.

5610 Financial Markets and Intermediaries (3) (Same as Finance 5610.)

5620 Monetary Theory and Policy (3) (Same as Finance 5620.)

5630 Commercial Bank Management (3) (Same as Finance 5630.)

6111 Seminar in Advanced Microeconomic Theory (3) Topics in microeconomic theory. May be repeated for credit with permission of the department. Prereq: 5111, 5112 and consent of instructor.

6121 Seminar in Advanced Macroeconomic Theory (3) Topics in macroeconomic theory. May be repeated for credit with permission of the department. Prereq: 5121, 5122 and consent of the instructor.

6150-60 History of Economic Doctrines (3, 3) Important ideas of economic thinkers from the Middle Ages to the present. Prereq: Consent of instructor.

6170-80-90 Econometric Methods (3, 3, 3) Theory and techniques of statistical testing of economic hypotheses and construction and estimation of econometric models. Review of the classical estimation model and extensions of the least squares regression model, and approaches to simultaneous equation models. Prereq: 5180-90 and 5650 or the equivalent.

INTERNATIONAL TRADE AND ECONOMIC DEVELOPMENT

4230 Problems in International Trade and Economics. (3) Theories of development or problem areas of current importance in the fields both of international economics and economic development.

4240 Economic Development of the United States (3) Economic growth in agriculture, industry, communications, transportation, banking, and trade and of changes in governmental economic policy.

4250 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.

4260 Economics of Resources (3) Description and allocation of resources. Benefits and costs of development and use of resources in industrial society.

5210-20 Seminar in International Trade and Economic Development (3, 3) Study of areas such as the theory of international trade, the theory of economic growth, commercial policy.


5610 Location and Regional Development Theory (3) Theory of industrial, agricultural, and business location. Basic theory of regional interaction and development.

5620 Regional and Interregional Social Accounting (3) Income and product, money flows, input-output, and balance of payments accounts for localities, states, regions, and nations.

6211-12, 6221-22 Seminar in International Economics (3, 3, 3, 3) Theory of specialization and trade. Openings 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.

6240 Economic Development of the United States (3) Economic growth in agriculture, industry, communications, transportation, banking, and trade and of changes in governmental economic policy.

6250 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.

6260 Seminar in American Economic History (3, 3) The nature of economic problems; economics as a science; brief survey of the evolution of economics; analytical tools of macro- and microeconomics. (Available only as stated on page 33.)


6351-52, 6361-62 Seminar in International Organization (3, 3) The structure of contemporary industry, factors in its development, and consequences for business conduct and performance; social control of business through antitrust and other government regulation.

6351-52, 6361-62 Seminar in International Organization (3, 3) The structure of contemporary industry, factors in its development, and consequences for business conduct and performance; social control of business through antitrust and other government regulation.

5310 Economic Systems (3) Study and appraisal of underlying theories and operation of capitalism, socialism, communism, and other economic systems.

6331 Theory and Practice of Economic Planning (3, 3) Principles of economic planning and indicative planning. Prereq: Consent of instructor. May be repeated for credit with consent of department.

ECONOMICS OF LABOR AND MANPOWER


4430-40 Labor Legislation (3, 3) Economic background and effects of governmental regulation of labor relations, with emphasis on a detailed examination of the National Labor Relations Act as amended and its impact on labor relations and the Fair Labor Standards Act, the Social Security Act, workers' compensation acts, and related legislation affecting labor relations.


5410 Seminar in Wage Determination (3) Wage theories and policies; emphasis on wage
determination under collective bargaining. Prereq: Consent of instructor.

5420 Seminar in Labor Economics (3) Problems created by the presence of organized labor movement in the American economy. Prereq: 5410.

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

Finance

MAJOR DEGREES
Finance M.B.A., D.B.A.
Governmental Financial Administration M.B.A.
Real Estate and Urban Development M.B.A.

Professors:

Associate Professors:
J. A. Bachmann, Ph.D. Virginia Polytechnic Institute; S. B. Osborn, Ph.D. Wisconsin (Milwaukee); Mary Lindahl, Ph.D. Illinois (Champaign-Urbana); W. L. Shreve, Ph.D. California (Los Angeles); R. A. Weir, Ph.D. North Carolina.

5000 Thesis

6000 Doctoral Research and Dissertation

FINANCE AND INVESTMENTS

5050 Survey of Finance Functions in Business (3) The scope and nature of managerial finance: financial analysis, 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 fundamental of financial accounting. (Available only as stated on page 33.)

5100 Theory of Financial Management (3) Financial decision making in the firm with the objective of maximizing shareholder wealth. Decision areas include investment in capital assets, 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 statistics to model building and testing in finance. Prereq: 5110 and Statistics 5311 or equivalent.

5130 Financial Administration (3) Cases and readings within the firm; refined techniques of financial management. Prereq: Principles of economics and fundamental of financial accounting; consent of instructor.

5140 Seminar: Managerial Finance (3) Applications of theory and quantitative techniques to the solution of current problems in management finance. Prereq: 5120, 5130.

5420-30 Investments (3, 3) The investment decision under changing circumstances involving portfolio policies and security prices; financial statement analysis; and stock-price valuation models. Must be taken in sequence.

5620 Taxation and Business Decisions (3) Impact of the tax-expenditure policy on decisions of the firm. Description of tax systems; tax shifting and incidence; implications of specific taxes to price, employment, financial, and other decisions of the firm. The impact of taxes on industrial structure, international operations, and location.

5800 Executive-In-Residence Seminar for M.B.A. (3) This course develops the practical aspects of financial management and investments. Leading industry, banking, and governmental personnel will conduct the class. Prereq: Consent of the department.

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.


6420 Theory of Finance (3) The theory of financial decision making under conditions of certainty and uncertainty. The application of the theory of choice to the allocation of financial resources over time with reference to financing decisions, investment decisions, and the determinants of the cost of capital.

6510 Seminar in Financial Management (3) Employment of quantitative techniques in the formulation and solution of financial management problems.

MONETARY POLICY AND FINANCIAL INSTITUTIONS

5810 Financial Markets and Intermediaries (3) A study of capital formation and the allocation of capital in both the U.S. economy and abroad. The analysis covers the process of saving, the partial institutionalization of financial markets, the investment process, financial intermediaries, the efficiency of the allocation process and its effect on the economy, and the impact of financial institutions on financial markets. (Same as Economics 5810.)

5820 Monetary Theory and Policy (3) A survey of the relationship of money, credit and liquidity to income, interest rates, employment and prices as well as examination of the effect of monetary policy on economic activity. Prereq: Economics 5080 or equivalent. (Same as Economics 5820.)

5830 Commercial Bank Management (3) Bank management decision-making analysis of changes in banking environment and structure; acquisition and management of funds; current banking problems. Prereq: Consent of instructor. (Same as Economics 5830.)

6110-20 Seminar: Money Theory (3, 3) Study of money, credit and liquidity as related to income, interest rates, employment, output, and prices.

6310-20 Seminar: Monetary and Fiscal Policy (3, 3) Study of goals and effectiveness of monetary and fiscal policy. Critical evaluation of impact of monetary and fiscal policy upon economic stability, employment, prices, and national income.

GOVERNMENTAL FINANCIAL ADMINISTRATION

5210-20 Public Finance (3, 3) Role of the public sector and the problem of social balance, collective and quasicollective goods and their financing. Newer trends discussed; role of computer and systems analysis. Must be taken in sequence. Prereq: Economics 5080 or equivalent.


5630 Fiscal Theory and Public Finance (3, 3) Historical and current theories of public economy and objectives of modern budget policy. Nature of public goods, the allocation and distribution significance of taxes, expenditure programs. Collective decision-making processes, criteria of equity, shifting and incidence, excess burden, compensatory

other decisions of the firm. The impact of taxes on industrial structure, international operations, and location.

5800 Executive-In-Residence Seminar for M.B.A. (3) This course develops the practical aspects of financial management and investments. Leading industry, banking, and government personnel will conduct the class. Prereq: Consent of the department.

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.


6420 Theory of Finance (3) The theory of financial decision making under conditions of certainty and uncertainty. The application of the theory of choice to the allocation of financial resources over time with reference to financing decisions, investment decisions, and the determinants of the cost of capital.

6510 Seminar in Financial Management (3) Employment of quantitative techniques in the formulation and solution of financial management problems.

MONETARY POLICY AND FINANCIAL INSTITUTIONS

5810 Financial Markets and Intermediaries (3) A study of capital formation and the allocation of capital in both the U.S. economy and abroad. The analysis covers the process of saving, the partial institutionalization of financial markets, the investment process, financial intermediaries, the efficiency of the allocation process and its effect on the economy, and the impact of financial institutions on financial markets. (Same as Economics 5810.)

5820 Monetary Theory and Policy (3) A survey of the relationship of money, credit and liquidity to income, interest rates, employment and prices as well as examination of the effect of monetary policy on economic activity. Prereq: Economics 5080 or equivalent. (Same as Economics 5820.)

5830 Commercial Bank Management (3) Bank management decision-making analysis of changes in banking environment and structure; acquisition and management of funds; current banking problems. Prereq: Consent of instructor. (Same as Economics 5830.)

6110-20 Seminar: Money Theory (3, 3) Study of money, credit and liquidity as related to income, interest rates, employment, output, and prices.

6310-20 Seminar: Monetary and Fiscal Policy (3, 3) Study of goals and effectiveness of monetary and fiscal policy. Critical evaluation of impact of monetary and fiscal policy upon economic stability, employment, prices, and national income.

GOVERNMENTAL FINANCIAL ADMINISTRATION

5210-20 Public Finance (3, 3) Role of the public sector and the problem of social balance, collective and quasicollective goods and their financing. Newer trends discussed; role of computer and systems analysis. Must be taken in sequence. Prereq: Economics 5080 or equivalent.


5630 Fiscal Theory and Public Finance (3, 3) Historical and current theories of public economy and objectives of modern budget policy. Nature of public goods, the allocation and distribution significance of taxes, expenditure programs. Collective decision-making processes, criteria of equity, shifting and incidence, excess burden, compensatory

finance, debt policy, and intergovernmental fiscal relationships.

INSURANCE

5110 Theory of Risk Management (3) For students with no background in risk and insurance. Study of the theory of risk management and of manageable risks facing the individual and the firm. Analysis of risk management techniques with emphasis on insurance as a tool.

5210 Seminar in Insurance (3) Analysis and discussion of current developments and problems in the field of life, health, property, liability and social insurance. Emphasis is on vital social issues touching upon the insurance mechanism and philosophy. Prereq: Consent of instructor.

REAL ESTATE AND URBAN DEVELOPMENT

4900 Aspects of Urban Environment I (3) An interdisciplinary analysis of urban policy. Prereq: Consent of Instructor. (Same as Psychology 4900, Architecture 4900, Political Science 4900.)


5120 Real Estate Analysis (3) Analysis of real estate property investment, real estate finance 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 Federal 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 decision making. Case method is utilized. Prereq: 5120 or consent of instructor.

Industrial and Personnel Management

MAJORS DEGREES
Industrial Management M.B.A. D.B.A.

Professors:

Associate Professors:
R. D. Arvey, Ph.D. Minnesota; F. A. Chamblin, M.B.A. Indiana; H. D. Dewhurst, Ph.D. Texas; M. Gordon, Ph.D. California; R. C. Maddox Ph.D. Texas; C. W. Neel, Ph.D. Alabama.

Assistant Professors:
J. A. Bachmann, Ph.D. Virginia Polytechnic Institute; R. L. Deboyne, Ph.D. Purdue; O. S. Fowler, Ph.D. Georgia; W. Henderson, Ph.D. Purdue.

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

5000 Thesis
Management Science

MAJOR DEGREES

Management Science M.S., M.B.A., Ph.D.

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

Assistant Professors: R. E. Rosenfeld, Ph.D. Georgia Institute of Technology.

Management Science Committee:

Members of the Management Science faculty in addition to: R. W. Boling, Industrial Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; W. H. Hathorne, Accounting; D. H. Pike, Industrial Engineering; C. G. Thippen, Statistics.

MASTER OF SCIENCE 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 his 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 Quarter Hours

Management Science 5310-20-30-40 12

Applied Concentration Area (approved by advisor) 12

Statistics 5110 3

Statistics elective (5000-level or above) 3

Mathematics (4000-level or above) 6

Electives selected from mathematics, statistics, computer science, and/or management science 6

Electives in any area approved by advisor 6

Total 48

A thesis option is available which substitutes nine hours of thesis credit for the following 12 hours of course work: Management Science 5340, one three-hour course in the applied concentration area and six 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 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 expected to achieve a basic understanding of the above requirements on an individual basis. For example, an undergraduate mathematics major with a strong background may be allowed to take additional hours of electives in place of the 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 reasonably be expected to vary between six and 18 as a function of prior background.

MBA CONCENTRATION

Management Science 5310-20-30 forms the nucleus of a 12 to 18 hour concentration in Management Science for MBA students. See pages 32-33 for further MBA details.

DOCTORAL PROGRAM

The Ph.D. program in Management Science is designed to prepare students for meaningful research in the development of quantitative concepts and methods for solutions to management problems. A candidate for the degree is expected to achieve a doctoral level of understanding of the current state of development of quantitative methods for management and, in the course of the student's own research, to make a significant contribution to the science. As a part of the student's program of study the doctoral candidate will be expected to achieve a basic understanding of the pertinent operational and theoretical areas of mathematics, probability and statistics, and be expected to undertake graduate study in certain management science related business areas. The program normally consists of three calendar years of graduate study with the student's first two years being devoted mainly to formal course work and the third year to full-time research. The prerequisites are the same as for the Master's program.

Coursework and Research

A minimum of 72 quarter hours of formal coursework (not to include the Master's thesis) taken for graduate credit, of which at least 36 quarter hours must be completed at The University of Tennessee, are required. Students' programs will consist of basic and advanced courses in mathematics, statistics, com-
Computer science, and management science, and will also include a business concentration. At least 36 quarter hours of credit must be earned in Management Science courses numbered above 6000.

In addition to the above, students must earn at least 36 quarter hours credit at the 6000 level for an acceptable dissertation in a management science related area. The academic program and research area of each student must be approved by the Management Science Committee and by the Vice Chancellor for Graduate Studies and Research.

Qualifying Examinations
Written qualifying examinations taken normally at the end of the first year of graduate study cover the basic quantitative areas of advanced calculus, matrix algebra, computer methods, probability theory, and statistical inference. Students must pass the qualifying examinations prior to enrolling in Management Science courses numbered 6000 and above.

Preliminary Examination
Students will be required to demonstrate their competence in management science theory and methodology by satisfactory performance on a written preliminary examination to be taken normally after the second year of graduate study.

Business Concentration
Students will be required to have an approved business concentration consisting of a minimum of 21 hours of coursework, at least nine hours of which must be in Management Science courses numbered above 6000. Students without prior equivalent education in business will, in addition, be required to take Economics 5050-60 and at least one course in Accounting.

Admission to Candidacy
A student's doctoral committee may recommend his admission to candidacy if he has an overall grade point average of 3.00 or higher and has satisfactorily completed:

- a. a majority of his coursework requirements,
- b. the qualifying examinations,
- c. the preliminary examination.

Final Oral Examination
After the student completes a formal program of coursework and research, he/she must pass a final oral examination. The candidate's doctoral committee will evaluate the student's performance on this examination. The final oral examination is open to any member of the University faculty.

5000 Thesis
5100 Introduction to Management Science

5340 Application of Management Science Methods
5500 Optimization Theory and Techniques
5610 Markov Chain Models
5620 Queuing Theory
5630 Decision Theory

5620 Queuing Theory (3) A study of queuing theory and its application to network flow problems; models and other models where the interarrival and service time distributions, or both, are nonexponential and other areas of Markov chain theory to develop useful statistics for networks of queues. Prereq: 5340, Statistics 5110, 5210.

5810 Special Topics in Management Science
5910 Management Science Problems
6000 Doctoral Research and Dissertation
6110-20-30 Models for Production Systems
6210-20-30 Management Science Seminar
6510-20-30 Doctoral Research and Dissertation
6610-20-30 Management Science Seminar
6710-20-30 Management Science Seminar
6810 Special Topics
6910 Special Topics
6910-20-30 Management Science Seminar

Marketing and Transportation
MAJORS
Marketing
Transportation and Logistics
DEGREES
M.B.A., D.B.A.
M.B.A., D.B.A.

G. N. Dicer (Head), D.B.A. Indiana
Marketing

Professors:
D. W. Craven, D.B.A. Indiana

Associate Professors:

Assistant Professors:

1	Alcoa Foundation Professor in Business Administration.

5000 Thesis
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 33.)

5200 Marketing Management (3) Management of the basic marketing functions. Case problems and marketing decision simulation. Prereq: 5050 or equivalent.

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

5300 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 (3) Investigation and solution of problems; application of research methods to functional areas of marketing. Research concepts, methods, and techniques. Prereq: Statistics 5110 or equivalent and 5200 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 processes with emphasis on the implications for marketing analysis and executive action. Marketing and the behavioral sciences. Prereq: 5200 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. Problems involved in marketing goods and services in foreign markets. Political, cultural, and economic conditions in different countries. Prereq: 5200 or equivalent.

5900 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) An examination of the behavior of individuals and groups in their roles as buyers of economic goods and services. Prereq: 5300 or Statistics 5312 or the equivalent, and Industrial Management 5610-20.

6210 Seminar in Marketing Models and Model Building (3) Examination of the nature, composition, construction, 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. Marketing topics vary with each course offering. Prereq: 9 hrs of graduate marketing, including 5300 and 6110.

Transportation and Logistics

Professors:
Office Administration

Professor:  G. A. Wagner (Head), M.S. Indiana.

                      Boston; D. R. Rehder, Ph.D. Iowa; E. R. Smith, Ph.D.
                      Ohio State.

Assistant Professors:  B. J. Brown, Ed.D. Tennessee; P. G. Campbell,
                      M.S. Austin Peay; D. Hampton, Ed.D. Northern Illinois;
                      H. G. Henry, M.S. Tennessee; H. Pattee, M.S., Tennessee;
                      J. Stallard, Ph.D. Ohio State.

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 legible copy; emphasis on skill necessary to meet occupational
        standards. 3 two-hour periods.

4430 Supervised Office Experience (3) Orientation to office position through actual office
        work; telephoning techniques, sources of information required by secretary, record
        keeping, office etiquette, interviews, and appropriate dress for office. 2 three-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 reduction;
        development of standards; use and preparation of office manuals. Prereq: Office Equipment
        Problems, 4320 or consent of instructor.

4551-69 Problems in Office Management (3, 3) Problems in the design of a large office
        or problems in the management of a small office. Prereq: Office Equipment Problems,
        4320, or consent of instructor.

4559-69 Work Measurement

4557-67 Work Simplification

4556-66 Supervision

4554-64 Mechanization

4553-63 Records

4552-62 Form Design

4551-61 System Analysis

4550-60-70 Statistical Analysis for the Business Decision Maker

5000 Thesis

5050-60-70 Statistical Analysis for the Behavior Sciences (3, 3, 3) 5050—Probability
        distributions, sampling distributions, estimation and hypothesis testing. Parametric and non-
        parametric tests.

5110 Introduction to Probability Theory (3) Classical probability and distribution theory. Prereq: Elementary Linear Algebra and Calculus of Several Variables.

5120-30 Theory of Statistical Inference (3, 3) Introductory theory underlying the common statistical procedures of hypothesis testing and estimation. Prereq: 5110.


5211 Elementary Statistics (3) Introductory statistics for graduate students. Probability, sampling distributions, estimation, and hypothesis testing. Emphasis on interpretation and decision making. Not counted toward a major or minor in statistics.


5312 Statistical Methods (3) Significance testing, applications of the Chi-square statistic, analysis of variance, least squares and linear regression. Prereq: 5311.

5420 Intermediate Analysis of Variance (3) Design Models; factorial, split-plot, and nested designs; covariance analysis. Prereq: 5312 or equivalent.

5610 Special Topics in Statistics (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6060 Applied Multivariate Analysis (3) Canonical correlation; discriminant analysis for several groups, and for equal and unequal covariance matrices; principal component analysis; Hotelling's $T^2$; multi-variate analysis of variance and covariance. Prereq: One year's course work in applied statistics, including analysis of variance and multiple regression analysis.

6070 Factor Analysis (3) Principal component analysis and principal factor analysis; estimates of communalities; methods of rotation; interpretation of factors; cluster analysis. Prereq: 6060.


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

Donald G. Hileman, Dean
B. Kelly Leiter, Assistant Dean
Jerry R. Lynn, Chairman, 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 Journalism. It is a member of the American Association of Schools and Departments of Journalism and the Association for Professional Broadcasting Education.

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 of the University Graduate School. Those lacking approved credits in communications (advertising, broadcasting, and journalism) must complete at least 15 prerequisite or supplemental hours of courses offered by the College of Communications and approved by the major advisor.

In addition, the following minimal requirements normally are 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. Applications for the graduate program, including all necessary materials that are not received at least two months before fall quarter registration and six weeks before registration for other quarters 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 post-baccalaureate 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, and 5140, at least nine 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 six 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 nine 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 six of which must be at the 5000 level;
- 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 committee.

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 of Communications.

* 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.
lege in the related social and behavioral sciences. The program is flexible and will accommodate a wide 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 minimal requirements are normally required 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 50th percentile in verbal and quantitative aptitude on the Graduate Record Examination; (c) completion of the California Psychological Inventory; (d) endorsement by at least three former teachers or professional colleagues chosen by the Graduate Studies Committee; (e) a statement of the applicant's goals and reasons for pursuing the doctorate. 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 coursework; (c) primary concentration in Communications: 15-18 hours of coursework; (d) secondary concentration in a cognate minor subject normally outside Communications: 12 hours of coursework; (e) technical competence area in either teaching, research, or administration: 15-18 hours of coursework and, for those who lack appropriate professional experience, an internship the equivalent of 9 credit hours; (f) research tool: 12 hours of coursework, e.g., statistics, foreign language, or the principles; (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 Communication; 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 5060. Continuing and Higher Education 4540, Instruction in Higher Education. Industrial Personnel Management 5110-520, Organization Theory I and II. Admission to candidacy must be obtained 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 following the course titles indicate quarter hours credit offered.

**Communications**

<table>
<thead>
<tr>
<th>MAJOR</th>
<th>DEGREES</th>
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<tr>
<td>Communications</td>
<td>M.S., Ph.D.</td>
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</table>

Professors:
- J. R. Lynn, Ph.D. Stanford
- D. G. Hileman, Ph.D. Michigan State
- J. B. 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:
- E. W. Dunn, Ph.D. Texas;
- E. F. Shaw, Ph.D. Stanford.

5000 Thesis

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. Stepwise process, bases for derivation and verification of hypotheses, and basic methods of designing research in communications.

5130 Advanced Principles of Mass Communications (3) A pro-seminar 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 of communication processes in interpersonal, intrapersonal, and mass communication's systems.

5970 Independent Study (3) Reading, research, or projects on special topics in Communications. 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: 5140. Recommended: 5100.

6200 Seminar in Communication Topics (3) Intensive analysis of special issues and problems in human communication. Repeated; each term will cover a 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, questionaire construction, data gathering (personnel, mail, and telephone), data processing and interpretation, attitude measurement and message pre-testing 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 multi-factor experiment designs. Laboratory and field experiment situations. Prereq: 5120 or instructor's permission. Basic statistics course either before or concurrent.


**Advertising**

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

Associate Professors:
- A. G. Ziegler, Ph.D. Illinois;
- S. K. Zeigler, Ph.D. Michigan State.

3630 Advertising Copy and Layout (4) Importance of advertising ideas and their translation into persuasive words and pictures. Principles and techniques of writing copy and preparing layouts. Lectures 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: 3630 or consent of instructor.

4360 Advertising Media (3) Study of media, markets, and audiences. Evaluation of media in relationship to communications needs of advertisers. Prereq: Advertising Principles, Marketing Communications II or consent.

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

4470 Advertising Campaigns (3) Practical application of advertising theory 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 ad-

5350 Advanced Advertising Research (3) Nature, scope, and application of research in advertising, including measurement of advertising effectiveness, and evaluation of advertising messages. Prereq: 4660 or consent of instructor.

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

5970 Independent Study (3)

Broadcasting

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


Assistant Professor: F. A. Lester, M.A. Tennessee.

3360 Television and Radio Advertising (3) Principles and practices underlying successful radio-television advertising; emphasis on media research, radio-television programming, creativity; instruction in television commercials.

3650 Radio-Television Writing (3) Theory and technique of writing all types of broadcasting scripts and related story writing. Prereq: Spanish, Italian, German, and French pronunciation. Prereq: Strongly recommended but not mandatory, Public Speaking.

4010 Speech for Broadcasting (3) Fundamentals of today's broadcast conditions as they affect the announcer; pronunciation and oral interpretation of General American Speech, English, Spanish, Italian, German, and French pronunciation. Prereq: Consent of instructor.

4810 Journalism in the High School (3) Functions and methods of high school publications. Staff organization, writing and editing techniques, editorial problems, and business management.


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 laws, regulations, and public pressures upon station policies. Particular emphasis upon the unique status of broadcasting among the media in terms of regulation. Prereq: Journalism 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; identification of trends in programming and current programming practices as related to audience requirements, governmental policies and conditions. Individual studies of program development on both the local station and network levels. Prereq: Intro to Broadcasting or consent of instructor.

5970 Independent Study (3)

School of Journalism

Professors: D. C. Cade (Director), Ph.D. Iowa; J. B. Haskins, Ph.D. Minnesota; J. E. Kalshoven, M.A. Louisiana State; J. M. Lain, M.A. Iowa; B. K. Leitner, Ph.D. Southern Illinois; W. C. Tucker, (Director Emeritus) M.A. West Virginia.

Associate Professors: J. A. Crook, Ph.D. Iowa State; S. S. Puett, M.S. Tennessee; E. F. Shaw, Ph.D. Stanford; F. B. Thornburg, M.A. Florida.

Assistant Professor: J. N. Adamson, M.A. Tennessee.

3120 Writing Feature Articles (3) Writing feature articles for news magazines, trade journals and magazines. Market analysis and free-lance selling. Prereq: Writing for Mass Media or consent of instructor.

3410 Communications Law (3) Statutory law and judicial precedents affecting mass communications media. Libel, contempt of court, invasion of privacy, copyright, Broadcasting, advertising, and postal regulations.

3800 Investigative and Specialized Reporting (3) Investigative and interpretive reporting of complex or specialized subjects to place news in perspective or to clarify existing situations. Emphasis on writing for publication. Prereq: Reporting.

3710 Public Relations Theories and Principles (3) Emphasis on persuasion and public opinion, the public relations process, public relations, techniques. Prereq: Consent of instructor. Not for graduate credit for communications majors.

3720 Public Relations Advanced (3) Application of public relations principles to business and industry, government, institutions and organizations, trades and professions. Prereq: 3710.

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 problems, practice in 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 agencies. Prereq: Editing for Mass Media.


4420 Newspaper Management (3) Daily and weekly newspaper operations. Prereq: Consent of instructor.

4590 National and International Communications (3) Communication of news and opinion among nations and under varying types of political and economic systems; world news organizations; the press as a factor in international affairs; internal and external barriers to the flow of information; comparison of world press systems.

4900 Problems in Research (3) An independent research course. Prereq: 4410 or 5210 or consent of instructor.

5210 Government and the Press (3) Functions 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 the influence of news and feature photographs, and picture stories. Prereq: Press photography or consent of instructor.

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.

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

5810 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.

5970 Independent Study (3)
College of Education

James D. McComas, Dean
William H. Coffield, Associate Dean for Graduate Studies and Administration
E. Dale Doak, Associate Dean for Undergraduate Programs
Madge M. Phillips, Director, School of Health, Physical Education, and Recreation
Charles M. Peccolo, Director, Bureau of Educational Research and Service

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 Master of Education degree, the Specialist in Education degree, and the Doctor of Education and Doctor of Philosophy degrees.

MASTER 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, the Research Coordinating Unit, 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-related needs by assisting with needs assessment and by helping develop plans to meet the needs. Staff follow through with in-service training of local district personnel, such training directed toward solutions of curricular, human relations, and other types of problems created or compounded by school desegregation. On-site evaluation of locally installed practices and continuing cooperative evaluation of the progress of local programs are additional major efforts. This program is funded by the U.S. Office of Education.

RESEARCH COORDINATING UNIT

The Research Coordinating Unit (RCU), located in Alumni Hall, is available for use by students, faculty, administrators, and vocational educators in the state. The primary objectives of the RCU are to collect and disseminate information, stimulate research, and conduct research in selected areas. The RCU has a library with the complete series of ERIC documents stored on microfiche. Microfiche reader-printers are available in the library. Computer searches of the ERIC files are also available at a nominal cost.

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. Coursework 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
Art Education

DEGREE
M.S.

Professor: J. W. Robertson, Ed.D. Columbia.

Assistant Professors: H. N. Hull, Ed.S. Peabody; P. K. McDowell, Ph.D. Iowa; J. P. Watkins, M.S. Tennessee.

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, stitching, 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.

4210 Art in Special Education (3) Techniques and materials for exceptional children. 1 hr and 2 labs.

4350-60-70 Problems in Art Teaching (3, 3, 3) Prereq: Consent of instructor.

5000 Thesis

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.

5850-60-70 Problems in Art Education (3, 3, 3) Prereq: Consent of instructor.

Music Education

MAJOR
Music Education

DEGREE
M.S.


Associate Professor: J. H. Jones, Ed.D. Columbia.


Thesis and non-thesis programs lead to the Master of Science degree in music education. Prerequisite preparation: undergraduate degree or equivalent in music education.

All graduate students in music education must pass proficiency examinations in music theory and applied music.

Requirements for Thesis Program:

45 quarter hours including thesis (9 hrs), the music education major (18 hrs), minor areas in music (9 hrs), and professional education (9 hrs). Required courses: Music Education 5000, 5210, 5220, 5230; Education 5710.

Requirements for Non-Thesis Option:

1. Minimum of 51 quarter hours of course work with a minimum of 26 hours of 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.
3. Satisfactory performance of research activities in required courses in music education listed below.
4. Specific course requirements:
   A. Music: 9 credit hours from the 3000-, 4000-, or 5000-levels. No courses required in the undergraduate curriculum may be included.
   B. Art: 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 evaluation 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 worked 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 rehabilitative programs of atypical children. Study of the uses and values of music 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

5159 Studies in Secondary School Music (3) Development of understandings regarding growth patterns and processes through music experiences; cultural and community influences on secondary school music, problems in the administration and teaching of music in the secondary school; and relationship of music with the humanities in the curriculum. Sequel to Teaching Music in Junior and Senior High Schools.

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 program of music in the school system. 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 Statistics.

5250 The Role of Music in Education (3) An exploratory course designed for school personnel, focusing 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 consent of instructor.

5270 Studies of Music for Children in the Primary Grades (3) Children's growth processes in music for Grades I-III, and 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 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 curricula. Survey of research, professional literature and development of bibliography, Laboratory activities. Projects. Prereq: Admission to M.S. program.

5850 Adult Education : A General Survey (3) Effective college teaching; testing and measurement; recent research in college instruction; major problems and issues in higher education. Required of candidates for the MACT degree. S/NC only.

5930 Theory and Research in Human Learning (3) (Same as Ed. Psy. 5330.)

5960-70 Problems in Continuing and Higher Education (3, 3) Independent study of problems and special institutes.

5980 American Higher Education (3) Purposes, functions, organization, and programs.

5980 Instruction in Higher Education (3) Problems, procedures, and techniques.

5980 Adult Development (3) Changes in characteristics of the adult over the life span and implications for adult education.

5950 Governance of Colleges and Universities (3) Study of the development, change, trends, process, and structure of collegiate governance.

5950 Fiscal Problems in Higher Education (3) A study of revenue sources and fiscal management in public and private colleges and universities.

5960 Program Planning in Continuing and Higher Education (3) Theory and method for planning adult education programs.

5960 The Community-Junior College (3) History and role of the two-year college, major functions, organization and administration, problems, and issues.

5955-55 Practicum in Continuing and Higher Education (3, 3, 3) Supervised practice in selected areas of instruction or administration of continuing or higher education programs.

5960-70 Seminar in Continuing and Higher Education (3, 3) Problems and issues confronting professionals in the fields of adult or higher education.

6450 Community Education for Adults (3) Contemporary programs; extension of secondary school opportunities for adults.

See also course listings under the Departments of Curriculum and Instruction, Educational Administration and Supervision, and Educational Psychology and Guidance.

### Continuing and Higher Education

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Professors:
- W. H. Cottfield (Head), Ph.D. Iowa;

Associate Professor:

Assistant Professors:

The Master of Science degree in Adult Education is offered for teachers, administrators, counselors, and community specialists. The degree program has two options: A thesis option requires a minimum of 45 hours, with 18 hours in the major field, 15 hours of electives, 3 hours of educational research, and 9 hours of thesis preparation. The non-thesis option requires a minimum of 51 hours, with 24 hours in the major field, 24 hours of electives, and 3 hours of research methods. For each option, 9 hours must be completed in the behavioral sciences. A minor may be developed from the hours allotted to electives. A thesis education requires satisfactory completion of a final oral examination, and the non-thesis option requires satisfactory completion of a final written examination.

5000 Thesis

5060 Adult Education: A General Survey (3)

Surveys the historical development of the field, philosophies of adult education, agencies, problems and issues, and the literature of adult education.

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

5330 Theory and Research in Human Learning (3) (Same as Ed. Psy. 5330.)

5360-70 Problems in Continuing and Higher Education (3, 3) Independent study of problems and special institutes.

5440 American Higher Education (3) Purposes, functions, organization, and programs.

5450 Instruction in Higher Education (3) Problems, procedures, and techniques.

5460 Adult Development (3) Changes in characteristics of the adult over the life span and implications for adult education.

5510 Governance of Colleges and Universities (3) Study of the development, change, trends, process, and structure of collegiate governance.

5550 Fiscal Problems in Higher Education (3) A study of revenue sources and fiscal management in public and private colleges and universities.

5660 Program Planning in Continuing and Higher Education (3) Theory and method for planning adult education programs.

5860 The Community-Junior College (3) History and role of the two-year college, major functions, organization and administration, problems, and issues.

5955-55 Practicum in Continuing and Higher Education (3, 3, 3) Supervised practice in selected areas of instruction or administration of continuing or higher education programs.

5960-70 Seminar in Continuing and Higher Education (3, 3) Problems and issues confronting professionals in the fields of adult or higher education.

6450 Community Education for Adults (3) Contemporary programs; extension of secondary school opportunities for adults.

See also course listings under the Departments of Curriculum and Instruction, Educational Administration and Supervision, and Educational Psychology and Guidance.

### Curriculum and Instruction

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Professors:
- J. B. Bellon (Head), Ed.D. California (Berkeley);
- P. T. Alexander, Ed.D. Kentucky;
- B. S. Burns, Ph.D. Iowa; I. N. Chiles (Emeritus), A.M. Missouri; M. A. Christiansen, Ph.D. Kansas; E. S. Christenbury (Emeritus), Ph.D. Georgia; C. T. Cox, Ed.D. Peabody; D. J. Dessart, Ph.D. Maryland; H. Frandsen, Ph.D. Illinois; L. O. Haab, Ed.D. Columbia;
- A. M. Johnston, Ph.D. Chicago; A. Malik, Ed.D. Columbia; E. E. Mauldin, M.S.L.S.
the College of Education in areas other than the student’s major area.
3. A minimum of 12 hours taken outside the College of Education.
4. A minimum of nine hours earned through the writing of a thesis.


Associate Professors:

Assistant Professors:

Instructors:

Lecturer:

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 in Curriculum and Instruction, or the Doctor of Education degree.

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 coursework.

SPECIALIST PROGRAM

The Educational Specialist degree programs 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 30 quarter hours of this Master’s work may be credited to the 90 hour Ed.D. 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.

4217 Teaching Elementary School Language Arts (3) Methods and materials used in teaching elementary school language arts. Development of functional relationships with other 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.

4260 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.

4288 Diagnostic 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. Includes 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.

4302 Teaching Reading to Linguistically Different Learner (3) Language characteristics and special reading problems attendant with the linguistically different learner. Prereq: An undergraduate reading course or 4300.

4340 The Junior High School and Middle School (3) To identify and analyze the distinguishing characteristics of the Junior High and Middle School Curriculums.

4350-60-70 Problems in Teaching English (3, 3, 3)

4351-61-71 Problems in Teaching Mathematics (3, 3, 3)

4352-62-72 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 Teaching Industrial Arts (3, 3, 3)

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

4359-69-79 Problems in Teaching Conservation (3, 3, 3)

4380-90-400 Problems in the Improvement of Instruction (2, 2, 2) Special conferences, workshops, or in-service programs.

4381 Problems in Early Childhood Education (3) May be repeated. Maximum 9 hrs. 6 hrs can be taken concurrently.

4410 Educational Sociology (3) Emphasis on examination of the school as a social system. (Same as Sociology 4410.)

4450 Teaching in Kindergarten: Overview (3) Relationship of kindergarden to total elementary program; goals; historical settings and current developments.

4451 Teaching in Kindergarten: Program Development (3) Curriculum planning and or-
ganization; classroom management. Prereq: 4450 or permission of instructor.

5410 Teaching Modern Languages in the Elementary School (3) Trends, content, methods, and materials. Prereq: Completion of a 3000-level sequence in one modern foreign language or consent of instructor.

5430 Home and School Relations (3) Study of need for and techniques which can develop closer relationship between the home and school at both elementary and secondary level.

4630 Current Educational Problems (3)

4654 Programs, Methods and Materials in Environmental and Science Education (3) Instructional materials and the use of curricular programs and issues in environmental and science education.

4750 Audiovisual Methods and Techniques (3) Selection, operation, and use of equipment and materials. (Same as Lib. and Inf. Sci. 4750 and Voc-Tech. Ed. 4750.)

4840 Introduction to Data Processing in Education (3) Analysis of current activities in the field of Educational Data Processing. The emphasis is placed on curricular, administrative, and research opportunities in education, using modern electronic data processing methods and machines.

4860 Programmed Learning (3) Theories of learning as related to technology of programmed instruction; techniques and applications of programming. 2 hrs and 1 lab. Prereq: Psychology 3210, Educational Psychology 3730, or consent of instructor. (Same as Psychology 4860.)

5000 Thesis

5040 Seminar in Elementary School Language Arts (3) A study of current curricular issues related to elementary school language arts education. Emphasis on individual student presentations, projects, and investigations. Prereq: At least one year of teaching experience (K-9), or consent of instructor.

5100 History of European Education (3) Ancient Greece to the development of national school systems.

5110 History of Education (3) Foundations for American education.


5140 Comparative Philosophies of Education (3) Educational differences in philosophy of the major philosophic schools of thought. Prereq: 4260 or equivalent.

5141 Pragmatism in Education (3) Consideration of the effects the American pragmatist tradition has had on educational policy and practice. Prereq: At least one course in History or Philosophy of Education.

5142 Existentialism in Education (3) An examination of the literature of existentialism as a source for understanding changing human diversity with a demand for social conformity in public education. Prereq: At least 1 course in History or Philosophy of Education.

5143 Supervised Readings in Philosophy of Education (3) Prereq: At least 9 hours in History of Philosophy of Education.

5150-60-70 Seminar (1, 1, 1) Educational literature.

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 Science (3) A critical analysis of new programs, materials, innovations, and developments in reading. Prereq: An undergraduate course in reading or consent of instructor.

5220 Seminar in Comparative Education: The Americas (3) Historical, philosophical, and sociological foundations; special reference to Canada, Brazil, Mexico, and Cuba.

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 language arts program, grades 1-8. Prereq: Undergraduate course Teaching Language Arts in the Elementary School or consent of instructor.

5281 Teaching Social Studies in the Elementary School (3) Recent trends, issues, and research findings. Credit cannot be received for both 5281 and 5970.

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) An 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 education. 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) Examination of programs and special instructional aids associated with the language arts program. Prereq: 5282 or equivalent, 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 program. Prereq: 5282 or equivalent, or consent of instructor.

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

5302 Psychology of Language (3) 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 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 of Reading in the Elementary School or 4300 or consent of instructor.

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

5330 Curriculum Development and Evaluation (3)

5340-70 Curriculum Development in the Local School (3, 3)

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 Practicum (3) Diagnosing and teaching children having developmental and corrective reading needs. Prereq: 4280.

5383 Remedial Reading Practicum (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, source units, and other materials.

5580 Curriculum Planning and Development (3)

5610 Educational Statistics (3)

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


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)

5691 Production and Use of Audiovisual Materials (3) Practical graphics, adapted to the needs of students. Projects: picture mounting, transparencies, slides, and lettering. Prereq: L.I.S. 4750 or equivalent. (Same as L.I.S. 5691.)

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

5720 Classroom Observation and Analysis (3) Classroom observation and analysis procedures; development of observational analysis skills, 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. Prereq: At least 1 yr. teaching experience (Math grades 7-12) or consent of instructor.

5825 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 mathematical concepts as well as strategies, methods, and materials for teaching. Materials suitable for four individualized instruction, mathematical laboratories, and independent study are considered. Opportunities for individual
projects. Prereq: Teaching Arithmetic in Elementary Schools or Teaching of Math, Grades 7-12, or equivalent.

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

5835 Teaching Mathematics in the Senior High School (Continuation of 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 (kindergarten-grade 3) with emphasis on application to programs and methods of instruction. Prereq: 5710 or 5830 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 the mathematical 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 the early childhood years. 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.

5850-60-70 Problems in Education: English (3, 3, 3)

5851-61-71 Problems in Education: Mathematics (3, 3, 3)

5852-62-72 Problems in Education: Social Studies (3, 3, 3)

5853-63-73 Problems in Education: Science (3, 3, 3)

5854-64-74 Problems in Education: Language Arts (3, 3, 3)

5855-65-75 Problems in Education: General Curriculum (3, 3, 3)

5856-66-76 Problems in Education: Instructional Materials (3, 3, 3)

5857-67-77 Problems in Education: Foreign Languages (3, 3, 3)

5858-68-79 Problems in Education: Conservation (3, 3, 3)

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 their importance to American education and life.

5903 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.

5908 Teaching Poetry in Grades 7-12 (3) A study of the materials and strategies for teaching poetry.

5909 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 Doctoral level who have interest in intensive study of the instructional process and its relationship to curriculum and learning.

5910-20-30 Problems in Lieux of Thesis (3, 3, 3)

5950 The Function of the Thinking Process in Education (3) Analysis of the thinking process for the purpose of tracing its implications for educational theory and practice.

5960 The Teaching of Natural Science (3) Emphasis on teaching strategies, testing and evaluation techniques, and professional guidelines for program planning and science.

5961 Seminar in Science and Environmental Education (3) Comprehensive studies of recent developments in science education of concern to classroom instruction. Particular emphasis on the interrelationships of environmental factors on science education.

5970 The Teaching of the Social Studies (3)

5960 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 research 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 areas of language arts. Two topics each term chosen by the 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) Prereq: Teaching of Language Arts in Grades 1-3, or equivalent. 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. Prereq: At least 2 courses in History or Philosophy of Education.

6210 Seminar in Elementary School Social Studies Research (3) Survey of current research in elementary social studies. Prereq: At least 2 courses in History or Philosophy of Education.

6220 Advanced Studies in Elementary School Science (3) A critical analysis of current research in the field of elementary school science. Prereq: An undergraduate course and one graduate course in science, 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 Science (3) A critical analysis of current research in the field of elementary school science. Prereq: An undergraduate course and one graduate course in science, or equivalent.

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 theory and 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 Language Arts (3) Critical research analysis of some selected issues in elementary school language arts. Prereq: 5280 or equivalent and consent of instructor.

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 discipline in secondary school. Prereq: 5270 or 5410 or equivalent.

6740 Curriculum Workshops in Instructional Improvement (3) Observation and participation in workshops sponsored by the College of Education. Prereq: 5640 or consent of instructor.
EDUCATIONAL ADMINISTRATION AND SUPERVISION

MAJOR DEGREES

Educational Administration M.S., Ed.S. and Supervision

Professors:
D. H. Stoliar (Head), Ph.D. Ohio State;

Associate Professors:

Assistant Professors:
G. W. Higginbotham, Ph.D. Michigan; P. M. Husen, Ed.D. Stanford.

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

5100 Internship in Educational Administration (3) May be repeated with consent of department. Maximum 6 hrs.

5130 Introduction to Educational Administration (3)

5180-99-200 Educational Specialist Research and Thesis (3, 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 Multi-Ethnic Society (3) Seminar offering opportunity to identify and explore educational problems arising from ethnic and racial diversity, tensions, and hostilities 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.

5530 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.

5751-61-71 Problems in Educational Administration and Supervision: Theory (3, 3, 3)

5752-62-72 Problems in Educational Administration and Supervision: Finance (3, 3, 3)

5753-63-73 Problems in Educational Administration and Supervision: Transportation (3, 3, 3)

5754-64-74 Problems in Educational Administration and Supervision: Business Management (3, 3, 3)

5755-65-75 Problems in Educational Administration and Supervision: Personnel (3, 3, 3)

5756-66-76 Problems in Educational Administration and Supervision: School Plant (3, 3, 3)

5757-67-77 Problems in Educational Administration and Supervision: Organization and Structure (3, 3, 3)

5758-68-78 Problems in Educational Administration and Supervision: School Law (3, 3, 3)

5759-69-79 Problems in Educational Administration and Supervision: Supervision (3, 3, 3)

5770 Maintenance of School Plants (3)

5780 Supervision (3) Supervisory activities of county and city school supervisors. Use of committees, effective techniques for working with groups, relationships with local and state administrative and supervisory personnel, and techniques for the evaluation of supervisory programs.

5790 School Board-Superintendent Relationships (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)

5930 Administration in Higher Education (3)

5981 Specialized Seminar: School Operation (3)

5982 Specialized Seminar: Higher Education (3)

5993 Specialized Seminar: State School Administration (3)

5994 Specialized Seminar: Preparation Programs (3)

5997 Specialized Seminar: Theory (3)

5998 Specialized Seminar: Finance (3)

5999 Specialized Seminar: Business Management (3)

6095 Specialized Seminar: Personnel (3)

6098 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 practicing 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 professional and supporting staff, in educational organizations. Topics will include recruitment, selection, placement, personnel policies, employee wage 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 in school personnel administration; staff planning, record systems, personnel policies, development; collective bargaining in education; and staff evaluation. May be repeated for a maximum of 12 hours.

6530 Futuristic Educational Planning Methods (3) Study of methods for describing alternative futures.

6550 State-Federal Relations in Education (3)

6560 Legal Foundations of Public Education (3)

6580 Seminar in Managing Conflict (3) Learning about and experiencing various forms of conflict.

6750-60-70 Independent Studies in Educational Administration and Supervision (3, 3, 3) Prereq: Consent of Instructor.

6800 Administration of Complex Educational Organizations (3)

6870 Advanced Study in School Facility Planning (3)

6990 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: 5290, 5810 or equivalent or consent of instructor.

6996 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)

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**Educational Psychology and Guidance**

**MAJORS**

College Student Personnel

M.S.

Educational Psychology

M.S.

Educational Psychology and Guidance

Ed.D., Ed.D.

Guidance

M.S.

**DEGREES**

**Professors:**

L. M. DelRitter (Head), Ph.D., Michigan; S. C. Dietz, Ed.D., Arizona State; W. M. Holbert, Ph.D., Texas; E. W. McClain, Ph.D., Texas; W. A. Popen, Ph.D., Ohio State; E. W. Schoch, Ed.D., Florida; C. L. Thompson, Ph.D., Northern Illinois; R. L. Williams, Ph.D., George Peabody.

**Associate Professors:**

K. L. Davis, Ed.D., Georgia; D. J. Dickinson, Ed.D., Oklahoma State; S. W. Huch, Ph.D., Northwestern; S. B. Lord, Ph.D., Indiana.

**Assistant Professors:**


**Graduate programs (thesis or nonthesis option)** lead to the Master of Science 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. Primary admission dates are February, May and July.

**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)**

**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.

**5054-55-56 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.

**5060 Standardized Testing (3)** Use and interpretation of standardized group instruments in the assessment of intelligence, aptitude, achievement, vocational interests and personality. Prereq: Appropriate course in measurement and research methods.

**5340 Group Dynamics (3)** Principles of group dynamics as they apply to a variety of educational practices in administrative, supervisory, and instructional aspects of the school program (Same as Psychology 5340.)

**5350 Educational Applications of Cognitive Theories (3)** Developmental theory of Jean Piaget and implications for education. Related theorists such as Bruner and Ausubel.

**5380 Student Appraisal (3)** Gathering, interpreting, and using data for development of guidance programs and individual counseling. Prereq: Ed. Psych. or Psych. 4640 or equivalent.

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College of Education 53

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**5100 Developmental Psychology (3)** (Same as Psychology 5100.)

**5110 Psychology of Women (3)** Examination of past and current educational and psychological theory and practice with special attention to assumptions and practice in regard to women; social context in which various theories were developed, current theories and research focusing on women and/or sex differences. Prereq: 4130 or basic course in personality theory.

**5111-12-13 Seminar in Current Issues in School Psychology (1, 1, 1)**

**5140-50-60 Psychosocial Assessment (3, 3, 3)** (Same as Psychology 5140-50-60.)

**5149-59-69 Practicum in School Psychology I (2, 2, 2)** (Same as Psychology 5149-59-69.) S/NC only.

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

**5210 Interpretation and Evaluation of Research Reports in Educational Psychology (3)** Emphasis on developing critical experimental research in educational psychology, guidance and counseling, and college student personnel. Prereq: Non-thesis option students only or consent of instructor.

**5220 Interpretation and Evaluation of Research Reports in Educational Psychology (3)** For students not conducting their own research projects; interpret and evaluate statistical tables and statistical tests as reported in journals. Prereq: 5210 or consent of instructor.

**5319 Field Work in School Psychology: Level I (2)**

**5320 Advanced Classroom Behavior Modification (3)** Current research in classroom behavior and its application to educational problems.

**5330 Theory and Research in Human Learning (3)** Influence upon school practice. Prereq: 5320. (Same as Cont. and Higher Educ. 5330.)

**5331 Current Developments in Human Learning (3)**

**5340 Group Dynamics (3)** Principles of group dynamics as they apply to a variety of educational practices in administrative, supervisory, and instructional aspects of the school program (Same as Psychology 5340.)

**5350 Educational Applications of Cognitive Theories (3)** Developmental theory of Jean Piaget and implications for education. Related theorists such as Bruner and Ausubel.

**5355 Student Personnel in Higher Education (3)** Philosophy and scope.

**5500 Therapy and Research in Human Learning (3)**

**5560 The College Student (3)** Nature, characteristics, and needs.

**5570 Case Studies in College Student Personnel (3)** Prereq: 5550 or consent of instructor.

**5720 Evaluation in Education (3)** Techniques and instruments for identifying and appraising social values, the thinking processes, social adjustment, emotional needs, personal interests and problems.

**5750 Verbal Behavior and Classroom Learning (3)** Overview of theories of verbal development, the role of verbal deficiencies in learning difficulties, diagnosis and counselling of the verbally deficient child. Prereq: Psychological and/or Educational Management.

**5780 Career Development: Theory and Research (3)**

**5840 Student Appraisal (3)** Gathering, interpreting, and using data for development of guidance programs and individual counseling. Prereq: Ed. Psych. or Psych. 4640 or equal-
Special Education and Rehabilitation

**MAJORS**

**DEGREES**

Special Education

M.S.

Vocational Rehabilitation Counseling

M.S.

**Professors:**


**Associate Professors:**

L. J. Coleman, Ph.D., Kent State; F. V. Essery, Ph.D., Michigan (Emeritus); C. G. Maisel, M.D., Texas; J. H. Miller, Ed.D., Auburn; J. M. Nadolny, Ed.D., Auburn; W. E. Woodrick, Ed.S., Mississippi State.

**Assistant Professors:**


**Lecturers:**

H. L. Byrd, Jr., M.S., Tennessee; S. W. Mulkey, M.S., Mississippi; O. E. Reese, B.S., Memphis State.

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 distributed 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) acoustically handicapped; (2) gifted; (3) disability evaluation; (4) learning disabilities; (5) mentally retarded; (6) multiple disabilities; (7) speech correction; (8) socially or emotionally maladjusted; (9) rehabilitation counselor 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 institution 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.

**MULTIPLE DISABILITIES**

4130 Education of the Brain-Injured Child (3) Nature, diagnosis, and management; skills for identifying educational, physical, and emotional characteristics; special educational techniques.

4150 Education of the Hospitalized and Homebound Child (3) School and home responsibility for physical care and social relationships, educational adjustment, vocational needs, and cooperation with related service resources.

4840 Education of the Cerebral Palsied Child at Home and School (3) Physical, social, and educational needs of cerebral palsied; evaluative techniques; related services.

4921 Student Teaching in Crippling and Special Health Conditions (3-15) S/NC only.

**DISABILITY EVALUATION**

5700 Disability Evaluation: Issues, Processes and Programs (4) Evolution of the philosophy and programs of disability insurance under Social Security; study of disability claims action and processing; principles of evidence. Prereq: Admission to program in Disability Evaluation or consent of instructor.

5710-20 Medical Aspects of Disability Evaluation (4, 4) Study of the nature and effect of impairments as a basis for determining whether they should be evaluated for disability insurance purposes; emphasis on the study of written medical reports for the determination of medical conditions, approximating the course of the medical condition, and deriving loss of function. Prereq: Admission to program in Disability Evaluation or consent of instructor.

5730 Vocational Assessment in Disability Evaluation (3) Theory and techniques of vocational assessment; use of resource materials; study of the criteria for vocational assessment of disability insurance claims under Social Security; on-site job analysis and case file vocational assessment experiences. Prereq: Admission to program in Disability Evaluation or consent of instructor.

5740 Problems/Practicum in Work Evaluation (3) Theory and techniques of work evaluation; application of principles of disability evaluation to disability claims evaluation criteria; practical experience in designing, conducting, and reporting work evaluation procedures in a workshop setting. Prereq: 5730 or consent of instructor.

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 Claims Evaluation (1-3, 1-3) Group 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/NC only.

**EDUCATION OF THE ACOUSTICALLY HANICAPPED**

4000 Rehabilitation Practicum (3) Evaluation...
Speech Pathology 4210. (Same as Audiology and Speech Pathology 4190.)

4200 Practicum in Speech Development of the Hearing Impaired (3) Applications of theories and techniques of speech development and improvement for hearing impaired children. Prereq: 4190 and consent of instructor. (Same as Audiology and Speech Pathology 4200.)

4210 Language Development of the Hearing Impaired I (3) Systems by which formal language 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. Prereq: 4190 or 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 for effective speech development; auditory training; speech-reading; manual language and its relation to other forms of communication; 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 physiology of the ear; duration and causes of hearing loss; methods and instrumentation for the assessment of hearing level; interpretation of audiological tests; speech 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 Deaf (3) (Same as Audiology and Speech Pathology 4250.)

4280 Curriculum Development in Elementary and Secondary Schools for the Deaf (3) Adaptation of curriculum development 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 activities, strategies, approaches, techniques, and specialized materials for curricula in teaching reading. Prereq: 4210 or consent of instructor.

4410 Instructional Media for the Deaf: Materials Preparation and Utilization (3) For in- stitute participants only. Introduction to basic skills and techniques for preparing and using visual displays, graphic materials, and projected media in classrooms for the deaf. Practical applications of media to the problems of educationally handicapped children. Prereq: Consent of instructor.

4470 Student Teaching of Acoustically Handicapped Children (9) S/NC only.

4471 Practicum with Acoustically Handicapped Children (6) S/NC only.

4439 Laboratory in Aural Rehabilitation (1) (Same as Audiology and Speech Pathology 4439.)

5040 Advanced Clinical Practice in Audiology (1-4) (Same as Audiology 5040.)

5220 Linguistics in the Education of the Auditoryly Impaired (3) Recent research and developments in linguistics related to audito- rially impaired.

5240 Seminar in Language Remediation for the Hearing Impaired (3) Projects and discussion will pertain to current and recent developments in educational methodologies and diagnostic and treatment approaches to the hearing impaired. The topics will include research and materials current in the use of the auditory-linguistic system and their adaptations. Emphasis will be placed on approaches which accommodate and assist the integration of hearing impaired children in the regular classroom.

5260 Seminar on Educational Implications of Language Development. Observations, discussion, and projects will pertain to the impact of language deficiency on educational programming for the hearing impaired. Prereq: Consent of instructor.

5310-20-30 Manual Communication (2, 2, 2) Acquisition of basic and advanced skills in fingerspelled and signed forms of communication. 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 Prototypical Curriculum Materials (3) Perception, communication, and learning theories; media design and advanced production techniques; evaluation processes. Emphasis on planning, designing, and producing prototypical media materials specifically designed to meet the needs of handicapped learners. Enrollment limited to persons holding major responsibilities for media in a program for the handicapped or similar setting. Prereq: 4410 or equivalent. (For Summer Media Institute only.)

5490 Educational and Psychological Guidance of the Deaf and the Hard of Hearing (3) Evaluation: test techniques for diagnosis and guidance; social and personality adjustment; occupational opportunities.

5540 Seminar in Language Pathology (3) (Same as Audiology and Speech Pathology 5540.)

5820 Curriculum Development Applied to Programs for the Hearing Impaired (3) Analysis of current curriculum trends in order to adapt them for hearing impaired individuals. Application of new curriculum options in the education of these children. Implementation of current and new methods of instruction and participation of the hearing impaired children. Prereq: C & I 5880 or the equivalent and consent of instructor.

EDUCATION OF THE EMOTIONALLY DISTURBED

4610 Nature and Characteristics of Learning and Behavior Disorders (3) Forms of academic and socially disturbing behavior, degrees of severity, possible causes, and relationships to each other. Relationships with respect to personality characteristics and developmental factors interpreted through behavorial and psychodynamic theory as well as practical situations in which learning and behavior disorders may occur.


4630 Practicum in Residential Settings Serv- ing Children with Disturbing Behavior (3) Practice in scientifically identifying, observing, and recording disturbing behaviors, initiating behavior changes regarding academic and social behaviors. Performance in a tutorial capacity within a residential classroom and within a mental training hospital. Prereq: Consent of instructor. In discussion and evaluation of relevant academic curriculum and reinforcement schedules. Prereq: 4610 and 4620 or consent of instructor.

4640 Practicum in Public School Systems Serving Children with Learning and Behavior Problems (6) Academic tutoring in a teacher/aide capacity within regular classrooms. Particular emphasis and practice in individualizing instruction for learning and behavior problem children within the regular classroom setting. Discussion and supervision of relevant methods and materials unique to each teaching situation. Prereq: 4610 and 4620 or consent of instructor.

4924 Student Teaching of the Emotionally Disturbed (9) Observation and practical experiences in child care work and classroom observation and teaching. Prereq or Coreq: Student Teaching Grades 1-12. S/NC only.

5110 The Nature and Concept of Mental Retardation (3) Identification, description, and study.

5120 Education of the Mentally Retarded Child (3) Philosophy and rationale underlying the teaching and education of the mentally retarded; methods and materials in special and regular classes. Prereq or Coreq: 4110.

5440 High School Programs for the Mentally Retarded (3) Trends, issues and research related to core and work study programs.

5480 Curriculum Development in Elementary Education of the Mentally Retarded (3) Philosophy and rationale underlying the education of the mentally retarded. S/NC only.

5481 Student Teaching Mental Retardation (3) Prereq: Knowledge in educable mentally re- tarded. S/NC only.

5482 Student Teaching of the Educable Mentally Retarded (3) Observation and supervised practicum. S/NC only.

5511 Psychology of Mental Retardation (3) Intellectual functioning, psychological theories and learning interrelations and their theoretical and educational implications emphasized. Prereq: 4110.

5512 Psychology of the Severely Mentally Retarded (3) Program and curriculum development for training/education of the severely retarded in the public schools, institutions and privately operated schools and workshops.

5513 Advanced Curriculum for the Mentally Retarded (3) Investigation and analysis of educational models, methodologies, and similar settings for the education of the mentally retarded children and adults. Emphasis on the varied curriculum alternatives to the retarded child's education.

EDUCATION OF THE VISUALLY HANDICAPPED

4150 Education of Partially Sighted Children (3) Curricular adjustments and materials; home visits for parents' cooperation in medical care and special needs.

4585 Eye Problems Encountered by the Teacher (3) Eye anatomy and hygiene; common diseases and defects; testing and treat- ment; educational adjustments for specific eye conditions; related service resources.

4923 Student Teaching of the Partially Seeing (3) S/NC only.

SCHOOL SPEECH AND HEARING THERAPY

4030 The Public School Speech and Hearing Program (3) Organization, administration, and procedures.

4040 Appraisal of Speech and Language Dis- orders (3) (Same as Audiology and Speech Pathology 4040.)

4049 Lab in Appraisal of Speech and Lan- guage Disorders (1) (Same as Audiology and Speech Pathology 4049.)
4310 Stuttering (3) (Same as Audiology and Speech Pathology 4310.)

4320-30-40 Clinical Practice in Speech Pathology (1-5, 1-6, 1-6) (Same as Audiology and Speech Pathology 4320-30-40.)

4341 Clinical Practice in Speech Correction in the Public Schools (3) S/NC only.


4400 Voice Disorders (3) (Same as Audiology and Speech Pathology 4400.)

4450-60-70 Clinical Practice in Audiology (1-4, 1-4, 1-4) (Same as Audiology and Speech Pathology 4450-60-70.)

4710 Introduction to Audiology (3) Same as Audiology and Speech Pathology 4710.

4720 Audimetry (3) (Same as Audiology and Speech Pathology 4720.)

4930 Aural Rehabilitation: Speechreading and Auditory Training (4) (Same as Audiology and Speech Pathology 4930.)

4959 Laboratory in Aural Rehabilitation (1) (Same as Audiology and Speech Pathology 4959.)

4940 Advanced Aural Rehabilitation (3) (Same as Audiology and Speech Pathology 4940.)

5040 Advanced Clinical Practice in Audiology (1-6) (Same as Audiology and Speech Pathology 5040.)

5380 Cerebral Palsy (3) (Same as Audiology and Speech Pathology 5380.)

5381 Cleft Palate (3) (Same as Audiology and Speech Pathology 5381.)

5540 Seminar in Language Pathology (3) (Same as Audiology and Speech Pathology 5540.)

REHABILITATION COUNSELOR EDUCATION

5100 Orientation to Rehabilitation (3) History, philosophy, and legal bases for the rehabilitation movement; case finding, intake, diagnosis, physical restoration, counseling, training, placement, and follow-up; relation to programs of allied agencies, rehabilitation teams; facilities and programs in hospitals, institutions, community agencies, and service groups. Attention to specialization in disability categories such as the mentally ill, the mentally retarded, and the blind.

5110 Medical Aspects of Rehabilitation Counseling (3) Structure, function and pathologies of the body systems including disease process and the residual function; other health problems in speech, vision, hearing, limbs and bracing, as well as psychiatric areas; medical terminology and the physician-counselor relationship. Special attention to the rehabilitation implication of disabilities.

5120 Psychosocial Aspects of Disability (3) Medical aspects and psychological impact of major disabilities; rehabilitation processes including implications of family and community.

5130-40 Seminar in Rehabilitation (3, 3)

5150-60 Internship in Rehabilitation (9, 9)

5170 Systematic Human Relations Training I (3) Structured training group utilizing Carkhuff model for instruction and practice in basic helping skills necessary for a rehabilitation counselor.


GENERAL COURSES

3333 Education of the Exceptional Child (3) Principles, characteristics, and special needs; local and state programs for diagnosis and care; educational provisions in regular and 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 and hearing.

4350-60-70 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 analysis of procedures and methods employed in the education and rehabilitation of exceptional persons. Emphasis on testing and implementation.

5000 Thesis

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: neurological and medical aspects, task analysis of cognitive, affective and psycho-motor skills and use of oral diagnostic testing material emphasizing cognitive development. Emphasis on 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 recommendation consistent with functional ability level. Emphasis on reading and mathematics skill development. Materials designed for ethnic population, high interest-low vocabulary, assessing sensory, linguistic, and motor development. Multiple handicapped or physically handicapped.

5403 Resource Teachers for the Handicapped (3) To help students acquire the skill to maintain mildly handicapped children in regular public education environments; includes job description, principles, techniques, assessment of learning, personnel management. Prereq: Training and experience in institutions for children, or consent of instructor.

5560 Experience in Teaching and Supervision of Exceptional Children (1-6, 1-6, 1-6) Physical and social development; business and personnel management. Prereq: Training and experience in institutions for children, or consent of instructor.

5560-70 Problems in the Education of Exceptional Children (3, 3, 3)

5620 Counseling Parents of Exceptional Children (3) Interpreting exceptionalities (handicapped and gifted) to parents and helping in the understanding and acceptance of the child in the school/home.


5830 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 the education, an analysis of current theories of integration as applied to the exceptional child. Review and discussion of current research concerning the education and rehabilitation of exceptional persons. Prereq: C & I 5800 or Ed. Psych. 5210 and consent of instructor.

5910-20-30 Problems in Lieus 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

DEGREES

Agricultural Education

M.S., M.A.C.T.

Business Education

M.S.

Distributive Education

M.S.

Home Economics Education

M.S.

Industrial Education

M.S.

Vocational-Technical Education

Ed.S., Ed.D.

Professors:

Agricultural Education: G. W. Wiegars, Jr. (Chairman), Ed.D. Missouri; G. A. Wagoner (Chairman), M.S. Indiana;

Home Economics: J. Brown, Ph.D. Ohio State; N. P. Logan (Chairman), Ed.D. Tennessee;

Distributive Education: C. B. Coakley (Chairman), Ph.D. Wisconsin;

Industrial Education: R. W. Haskell, Ph.D. Purdue; J. L. Reed (Chairman), M.S. Oklahoma; R. J. Woolin (Emeritus), Ph.D. Ohio State.

Associate Professors:

M. M. Miller (Head), Ed.D. Oregon State;

Agricultural Education: D. G. Craig, Ed.D. Cornell; J. D. Todd, Ed.D. Illinois;


J. D. Redcliff, M.S. West Virginia; E. R. Smith, Ph.D. Ohio State;

Home Economics Education: S. W. Miller, Ph.D. Ohio State;

Industrial Education: D. V. Brown, Ed.D. Utah; G. D. Cheek, Ph.D. Kansas State;

RCU: G. A. Bice, Ph.D. Ohio State.

Assistant Professors:


Distributive Education: D. E. McNelly, Ed.D. Missouri;

Home Economics Education: J. K. McInnis, Ph.D. Nebraska;

Industrial Education: G. K. LaBorde, Ed.D. Tennessee; T. L. Powell, M.S. Oklahoma;

RCU: W. A. Cameron, Ph.D. Ohio State.

Instructor:

J. A. Pearson, M.S. Tennessee.

MASTER'S PROGRAM

Each vocational service area (Agricultural Education, Business Education, Distributive Education, Home Economics Education and Industrial 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 M.A.C.T. is also available in the Business Education area.

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, Home Eco-
nomics, Distributive, and Industrial Education and in general Vocational-Technical Education.

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; area of concentration—basic, 3 hours; service area, 18 hours; VTE problems, 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.)

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.

5040 Guidance and Pupil Personnel Services in Education (3)
(Same as Educational Psychology 5040.)

5100-50-5200 Educational Specialist Research and Thesis (3, 3, 3) Selection, analysis and completion of a problem necessitating 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.

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 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.

5850-50-70 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 residence. S/NC only.

6210 Curriculum Planning in Vocational-Technical Education (3) Prereq: Curric. and Inst. 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) Prereq: Student teaching in Agric. Ed. or consent of department head.

5000 Thesis

5011-21-31 Problems in Lieu of Thesis (3, 3, 3)

5110-20-30 Current Literature (1, 1, 1)

5230-30 Agricultural Education in Off-Farm Agricultural Occupations (3, 3) Principles and procedures for developing occupational experience programs; course planning and teaching procedures. Prereq: Student Teaching in Agric. Ed. 9 hrs.

5340 Agricultural Education for First-Year Teachers (3) Assistance in adjustment to situation in which employed; group meetings in selected centers and visits by instructor. Prereq: Student teaching in Agric. Ed. 9 hrs.

5470 Adult Education in Agriculture (3)

5480 Supervision of Student Teaching in Agricultural Education (3)

5490 Supervised Occupational Experience in Agriculture (3) Prereq: Student Teaching in Agric. Ed. 9 hrs.

5620 Teaching Agricultural Mechanization in Vocational Agriculture (3) Prereq: Student Teaching in Agric. Ed. 9 hrs.

5700-60-70 Special Problems in Agricultural Education (3, 3, 3)

Business Education

4230 Curriculum Construction in Business Education (3) Aims, principles, practices and problems involved in the construction of business curricula for the various types of educational institutions in which business subjects are taught.

4610-20-30 Problems in Business Education (3, 3, 3)

5000 Thesis

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)

5614-24 Problems in Business Education: Clerical Practice (3, 3, 3)

5615-25-35 Problems in Business Education: General Business (3, 3, 3)

5617-27 Problems in Business Education: Business Law (3, 3, 3)

5618-28-38 Problems in Business Education: Administration (3, 3, 3)

5619-29 Problems in Business Education: Psychology and Skill Building (3, 3)

6110-20-30 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 post-secondary programs.

4140 Supervised Distributive Experience (3) Minimum 200 hours experience in approved distributive business; concurrent analytic project.

4310 Organization and Operation of Distributive Education (3) Background and development; needs: Federal and State Legislation; curriculum implications; establishing, evaluating, reporting, and improving the programs.

4320 Methods and Materials in Distributive Education (3) Prereq: 4310 or consent of instructor.

4410 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, 4520.

4510-20-30 Problems in Distributive Education (3, 3, 3) Selected research problems in teaching and coordinating distributive education programs.

5000 Thesis

5110 Administration and Supervision of Distributive Education (3) Operation of a distributive education program and the work of the city or county supervisor. Understanding and appreciation of problems from the high school principal's and the department head's point of view. Trends in distributive education, including community surveys, state plans, teacher-coordinator qualifications, the changing curriculum.

5120 Organizing and Teaching Adult Distributive Education (3) Planning, organizing, promoting, teaching, and evaluating continuing education programs in distributive education, utilization of local associations, employment agencies, business groups, and advisory committees in implementation.

5210-20-30 Special Problems in Distributive Education (3, 3, 3) Individual research, conferences, and/or workshops in teaching and supervising high school, post-secondary, and adult programs.
5610 Furthering Good Human Relationships (3, 3) 
5110 Advanced Methods of Teaching Home-Making Classes for Adults (3) 
5130 Furthering Good Human Relationships in the Classroom (3) 
5100 Thesis 
5000 Home Economics Education

College of Education

5800 Knowledgeable resource personnel. 
4520-21 New Developments in Industrial Education (3) 
4120-30 Job Analysis (3, 3) 
4110 Foremanship Training by the Conference Committees (3) 
3320-30 Materials and Methods for Shop and Related-Subjects Teachers (3) 
3340 School Shop Safety (3) 
3610 Development and Utilization of Advisory Committees (3) 
3210-20-30 Part-Time Programs in Cooperative Industrial Training (3, 3, 3) 
3310 Shop Organization and Management (3) 
3320-30 Materials and Methods for Shop and Related-Subjects Teachers (3) 
3340 School Shop Safety (3) 
4110 Foremanship Training by the Conference Method (3) 
4120-30 Job Analysis (3, 3) 
4100 Curriculum Building in Trade and Industrial Subjects (3) 
4510-11-12 Seminar in Industrial Education (3, 3, 3) 
4520-21-22 Recent Developments in Industrial Education (3, 3, 3) 
4621 Special Topics in Drafting (3) 
4662 Construction Processes (3) 
4670 Manufacturing Processes (3) 
4671 Materials and Processes (3) 
4682 Power and Energy (3) 
5110-20-30 Administration and Supervision of Industrial Education (3, 3, 3) 
5210-20-30 Special Problems in Industrial Education (3, 3, 3) 
5310-20 Methods of Research in Industrial Education (3, 3) 
5410 Improving Teachers in Service (3) 
5420 Advisory Committees and Apprentice Training (3) 
5430 Vocational School Administration and Management (3) 
5440 Advanced Methods of Teaching Skills and Technical Information (3) 
5510-20-30 Seminar in Industrial Technical Education (3, 3, 3) 
5610 Supervision of Home Economics in the Public Schools (3) 
5610-20-30 Seminar in Home Economics Education (3, 3, 3) 
5710 The Problem Method of Teaching Home Economics (3) 
5720 Teaching Home Economics in College (3) 
5730 Organization of the Homemaking Curriculum in Secondary Schools (3) 
5740 Organization and Operation of Area Vocational-Technical Schools (3) 
5750 Organization of the Homemaking Curriculum and Techniques of Laboratory Operations (3) 
5760 Organization and Development of Teaching in Home Economics (3, 3, 3) 
5770 Organization of the Homemaking Curriculum and Techniques of Laboratory Operations (3) 
5810-20-30 Problems in Home Economics Education (3, 3, 3) 
5810-20 Seminar in Home Economics Education (3, 3) 
5900 Thesis 
5910 Seminar in Home Economics Education (3, 3) 

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 leadership in community, churches, or agencies; and (4) public health positions in community health education, health planning and administration, and environmental health.

MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: Physical Education, Recreation, Safety Education, and School Health Education.

Programs leading to the Master of Public Health are also available in Community Health Education, Health Planning, and Environmental Health. Fifty-four quarter hours are required for the M.P.H. degree.

Approximately 23 quarter hours of work selected from courses numbered 5000 and above are included in the Master of Science degree requirement. Course selections 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 Physical Education, Recreation, Safety Education, and School Health Education. One full quarter of field practice is required for the Master of Public Health. During field practice, no student shall hold a full-time job except by special permission of the division chairman. Students will be placed in all parts of this country.

The non-thesis degree in Physical Education and in Recreation will consist of a minimum of 45 quarter hours of credit. At least one-half of the total number of quarter hours for the degree must be in courses numbered above 5000.

A three-quarter-hour course in research techniques or statistics or a three-quarter-hour seminar in research will be required.

Each non-thesis degree candidate will take a final comprehensive examination.

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 and two collateral areas of study. The curriculum to be pursued will be determined by the student and a doctoral committee. Selection of this curriculum will be based on the past training, experience, and interest of the student.

The basic requirements for admission are:

a. A minimum of 40 (physical education) or 50 (health education) quarter hours selected from the following sciences with each area represented: sociology, zoology, physiology, anatomy, psychology, and physical science; and microbiology and anthropology for health education.

b. Submission of satisfactory scores on the aptitude section of the Graduate
Record Examination is required for all doctoral and specialist programs.

c. A superior grade point average.

d. Submission of satisfactory references relating to training, employment, and character.

Health. Evidence of successful teaching or potential for success in the major area of study.

Graduate Assistantships

A variety of graduate assistantships are offered in Health Education, Physical Education, Safety Education, and Recreation to qualified women and men who are graduates of accredited colleges or universities. These assistantships are open to students in the Master's and Doctor's programs.

Assistantships are made available by local schools, agencies, and the School of Health, Physical Education, and Recreation in return for part-time services rendered. The services may consist of teaching physical education classes, teaching health classes, teaching safety classes, leading recreational activities, and/or directing or helping to manage extracurricular programs. Students interested in these opportunities should file their applications before February 1. Letters should be addressed to: The School of Health, Physical Education, and Recreation, The University of Tennessee, Knoxville, Tennessee 37916.

Public Health Traineeships

A few Public Health Traineeships are offered for Master of Public Health candidates. These are provided by the United Public Health Service. Letters should be addressed to: Health and Safety Division, The University of Tennessee, 1914 Andy Holt Avenue, Knoxville, Tennessee 37916.

Departments of Instruction

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

Division of Health and Safety

MAJORS

DEGREES

Health Education

Ed.D., Ph.D.

Public Health Education

M.P.H.

Safety Education and Service

M.S., Ed.S.

School Health Education

M.S.

Professors:

R. H. Kirk (Chairman), H.S.D. Indiana; W. J. Huffman, Ed.D. Illinois; R. Kent, Ph.D.


Associate Professors:


Assistant Professors:

I. A. Ahmad, Ph.D. Univ. of Oregon; A. J. Pickett, M.S. Columbia; A. F. Thompson, Ph.D. Michigan State.

Lecturers:


The Health and Safety Division offers the following degree programs:

Master of Public Health degree with a major in Public Health Education. (Major in Public Health Education accredited by American Public Health Association, Options with specialization in Health-Planning, Administration or Environmental-Occupational Health and Safety are 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 Philosophy degree in Health Education.

Doctor of Philosophy degree in Health Education.

Public Health

3000 Foundations of Health Science (3) In-depth study of content areas relating to personal health and contemporary health problems, i.e., mood modifying products, communicable and non-communicable 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 18 years of age for certification. Same as School Health 2510)

3310 Communicable and Non-communicable Diseases (3) Modern concepts of diseases; etiology of common communicable and chronic disease problems including prevention and control. Prereq: 1 year 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, restaurants, camps, and public bathing places. Healthful school living as affected by buildings and grounds, lighting, acoustics, thermal 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 health problem. Various types of educational programs to control the disease covered.

4130 Community Health Problems—Seduction (3) Explores problems of suicide regarding overall health of community. Emphasis placed on factors making suicide a serious health problem. Various types of educational programs to control the disease covered.

4140 Community Health Problems—Death 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 enterprise. Consideration in logical progression of the problems of transmitting current and new information to practitioners, communications among members of the modern health team, among health agencies, and the use of mass media for transmitting health information.

4410 Consumer Health and Safety Education (3) Survey of current 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 Certificate 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/NG only.

4730 Workshop in Public Health Education (3-1) For teachers, nurses, case workers, sanitarians, and other voluntary and public health agency personnel; emphasizes the problem solving approach, group interaction, case method and 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.

5010-20-30 Workshop in Public Health (3-6, 3-6, 3-6) 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 Education (5, 5, 5) On-the-job field practice under professional and academic guidance in public health or school health education. Seminars scheduled around experiences. S/N/C only.

5110 Environmental Health (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.


5140 Ergonomics and Work in Occupational Health and Safety (3) Study of elements of ergonomics and work as they relate to improvement of occupational health and safety. Lecture, demonstration, laboratory and field practice. Prereq: Consent of instructor.

5210 The Ecosystem of Public Health Education (5) Investigates living and non-living environments, groups and communities therein, and factors affecting human well being in health status. Understandings of human development, behavior, and learning in terms of health education are explored. 4 hrs and 2 labs.

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) Ad-
ministrative considerations of public health agencies including governmental aspects, legal bases, organizational principles, personnel factors, fiscal management, and public relations.

5430 Vital and Medical Statistics (4) 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 prepares exploration of conflicting theories and divergent styles of practice in community organization and development. 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 are included with special attention to roles and functions. May be repeated.

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.

5705 Health Planning I (3-5)

5710 Health Planning II (3-5)

5715 Health Planning III (3-5)

5730 Dental Health Education (3-5)

5735 Emergency Medical Services (3-5)

5745 Family Health Unit (3-5)

5750 Health and Medical Care Legislation and Law (3-5)

5755 Health Facilities Administration (3-5)

5760 Health Services Administration (3-5)

5785 Occupational Health Unit (3-5)

5790 Self-Care Unit (3-5)

5795 The Training of Paramedical Personnel (3-4)


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.


4430 Sports Safety (5) Accident prevention and injury control in sports activities; philosophy of sports safety and injury control; the relationship of sports safety and injury control; the 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, supervisors, and administrators. May be repeated.

5000 Thesis

5220 Behavioral Problems in Safety Education and Accident Prevention (3) Problems of behavior, causes of accidents, and the application of principles of psychology in the development of safe behavior in all segments of our environment.

5320 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 science as 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, instructional, and supervisory aspects. Basic emphasis on implementation of relevant programs.

5350 Civil and Defense Education (3) In-depth study of civil and defense problems; tornados, floods, fires, mass civil disorders, and nuclear and personnel attack by alien countries. 3 hrs and 2 labs.

5720-30-40 Graduate Workshop in Safety (3-6, 3-6, 3-6) Deals with special safety problems. Designed especially to explore special safety problems in a concentrated period of time.


5870-80-90 Current Issues in Safety Education (1, 1, 1)

6010-20-30 Internship and Research in Safety (3, 3, 3) Designed to allow the student opportunities for gaining in field experience to the end 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 curriculum.

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 curriculum problems in school health education. Extensive reading of literature required.

5000 Thesis

5100 Problems and Practices in School Health (3) Comprehensive study and analysis of the principles, problems, systems, and trends of and in school health.

5510 Curriculum Construction in School Health Instruction (3) An analysis of school health instruction programs in the elementary and secondary schools. Stresses the planning and construction of health curricula to meet the needs, interests, and abilities of pupils.

5520 Evaluation in School Health Instruction (3) Principles of objective tests construction; the place of behavior and attitude scales, check lists, questionnaires, surveys, and inventories in evaluation of health instruction. Includes criticism of several commercially prepared tests and construction and standardization of a test.

5530 School Health Program Surveys (3) Stresses the techniques and standards used in making a survey of a school health program; examines the relative contribution of health instruction, health services, and healthful environment as each contributes to the well being of individual students. Includes a survey of an existing school health program.

5620 School Health Administration and Supervision (3) Analysis of various types of administrative control; budgetary problems; the education-public health dilemma; responsibilities of school health personnel. Resource materials include case studies of on-going school health programs.

5630-40 Workshop in School Health Education (3, 3) Designed for graduate students, in-service teachers, and other health professionals. Emphasis in any workshop to be placed on one critical health issue.

5720-30-40 Graduate Workshop in Health Education (3-6, 3-6, 3-6) Deals with specific health problems. Designed especially to explore specific health problems in a concentrated period of time.


6000 Doctoral Research and Dissertation
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 art forms.

3151 History of Dance and the Related Arts II (1-1-2) Survey of dance and the arts related to it tracing their development in the twentieth century.

3310 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) Practical work, including student teaching, supplementing 4110.

3710 Camping (2) Theory and practice in leadership with practical experience in camp craft skills. Not for graduate credit for Physical Education majors.

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. (Same as Recreation 3880.)

4001 Stage Movement (3) Theory and practice in stage movement for actors and dancers. Styles of movement, character and moral movement and combat.

4010 Advanced Dance Technique (2) Development, integration, and synthesis of previous dance vocabulary; emphasis on analysis and practice of dance principles of solo and group work. Prereq: Intermediate Dance Techniques.

4020 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 classroom organization 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

5110 Administrative Problems in Health and Physical Education (3)

5120 Problems of the Curriculum in Health and Physical Education (3)

5130 Methods in Physical Education (3) Characteristics of different school age levels, and applications of learning procedures in physical activities at those 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. S/NC only.

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: 5550 or equivalent. May 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 exercise 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.)

5620 Applied Physiology (6) Principles of Physiology with special emphasis on the application of physiological findings to practical problems related to human function. Prereq: 1 year of 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: Zoology 4940 or equivalent. Recommended: 1 yr. of chemistry, physics, and mathematics. 3 hrs and 1 lab.

5620 Experimental Techniques in Applied Physiology (3) Laboratory course in experimental 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.

5810-20-30 Seminar in Physical Education (1, 2, 3) Study of current issues and problems in physical education with emphasis on outstanding studies and research in the field.

5910-20-30 Problems and Projects in Physical Education (3, 3, 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 Research Participation in Applied Physiology (1-6) Advanced research techniques are studied under supervision of a faculty member whose development of procedures and interests are in the area of study. Prereq: Consent of instructor. S/NC only.

6100 Seminar in Physical Education (1) Treatment of the topics involved in the major in physical education.

6220 Independent Research (3) Selection of a topic, development of a research proposal, and conduct of a study including the final writing of a research paper. S/NC only.

6320 Research Participation in Applied Physiology (1-6) Research problems and techniques are studied under the supervision of faculty members whose development of procedures and interests are in the area of study. Prereq: 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.

6610 Seminar in Exercise Physiology (2) Prereq: 5610. May be repeated with consent of the instructor. S/NC only.

6640 Research Participation in Applied Physiology (1-6) Advanced research techniques are studied under supervision of a faculty member whose development of procedures and interests are in the area of physical education. Prereq: Consent of instructor. S/NC only.

810-20 Practicum (2, 3) Intern experience in areas of major interest. S/NC only.
ship; 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, 3100, 3140, or consent of instructor.

4200 Survey of Recreation for Special Populations (3) 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

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, etc.—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.

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.

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, Assistant Dean

Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science 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 his 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, Memphis, 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 for allowing American engineering students to develop some understanding, both scientific and cultural, of Japan. It allows an M.S. candidate to obtain his degree from UTK while carrying out his 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 excepting 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 make a beginning at Japanese language study. At the option of the department, up to six 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 insofar 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

M.S.

Committee:

H. L. Loveless, Chairman
J. F. Bailey
F. A. Chamblin
D. W. Cravens
G. E. Nichols
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, manufacturing, etc. where both technical and non-technical factors exert significant influence on the success of a given activity.

The program does not provide the opportunity 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, 5100, 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 5810, Finance 5050, Marketing 5050, Industrial Management 5100 or Transportation 5210.

3. General Electives, nine 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.

Chemical and Metallurgical Engineering

MAJORS DEGREES

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

Professors:
H. F. Johnson (Head), D. Eng., Yale;
D. C. Bogue, Ph.D., Delaware;
B. S. Borle, Ph.D., Massachusetts Institute of Technology;
E. R. Brooks, Ph.D., Tennessee;
E. S. Clark, Ph.D., California (Berkeley);
L. V. Crawford,* J. W. H. Crawford, Ph.D., Pennsylvania;
O. L. Culberson, Ph.D., Texas;
H. W. Hsu, Ph.D., Wisconsin;
S. H. Jur, Ph.D., Cincinnati;
C. D. Lundin, Ph.D., Remsuller,
C. J. McHargue, Ph.D., Kentucky;
B. F. Oliver, Ph.D., Pennsylvania State;
J. L. Perona, Ph.D., Northwestern;
J. R. Roberts, Ph.D., Tennessee;
J. E. Spruiell, Ph.D., Tennessee;
E. E. Stansbury,* Ph.D., Cincinnati;
J. L. White, Ph.D., Delaware;
M. A. Wright, Ph.D., Wayne.*

Associate Professors:
W. T. Becker, Ph.D., Illinois;
J. F. Fellers, Ph.D., Akron;
G. C. Frazier, Ph.D., Johns Hopkins;
J. M. Holmes, Ph.D., Tennessee;
C. F. Moore, Ph.D., Louisiana State;
A. R. Vandermeer, Ph.D., Illinois Institute of Technology;
J. S. Watson, Ph.D., Pennsylvania.

Lecturers:
D. S. Billington, Ph.D., Iowa;
L. Dresser, Ph.D., Princeton;
H. W. Hoffman, D. Eng., Johns Hopkins;
R. N. Lyon, Ph.D., Michigan;
D. L. McCrory, Ph.D., Pennsylvania;
T. D. Parah, Ph.D., Rice;
P. B. Pilling, Ph.D., Leeds (England);
W. H. Seaton, Ph.D., Ohio State;
E. von Halle,
Ph.D., Tennessee.

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 or metallurgical engineering.

2. One or two minors, nine to 18 hours in total, either in chemical or metallurgical engineering, chemistry, mathematics, physics, engineering, or other related fields.


4. Active participation in graduate seminars in the department. Resident students must register for Chemet Engineering 5010 every quarter offered.

5. Final examination covering thesis, related fields, and graduate course work.

DOCTORAL PROGRAM

Students applying for entrance into the doctoral program must display concrete evidence of their competence and research experience, or 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 or metallurgical engineering amounting to approximately 36 quarter hours, at least 12 of which must be 6000 series courses.

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 civil, electrical, industrial, mechanical or nuclear engineering.

3. The preliminary examination, usually given in two parts, and covering such material as chemical and metallurgical engineering operations and processes, thermodynamics, fluid mechanics, heat transfer, technology, mathematics, physics, theoretical chemistry, and other related fields.

4. Active participation in graduate seminars conducted by the department. Resident students must register for Chemet Engineering 5010 every quarter offered.

5. Reading knowledge of a foreign language relevant to the candidate's research program; selection of language to be made in consultation with the faculty committee.

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 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 Ch.E. 4910, 4920, 5640, 5660 and either 5650 or 5680 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 Ch.E. 4910 and 4920, 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.

Chemet Engineering

5010 Graduate Seminar (1) May be repeated. Prereq: Admission to graduate program.

Chemical Engineering

3410 Flow of Fluids (4) Differential and overall momentum balances, mechanical energy balances: flow in tubes, piping systems, and pumps; meters; pumps; Prereq: Elementary Linear Algebra and Calculus of Several Variables, and Mass and Energy Relations. 3 hrs and 1 lab.

3420 Heat Transfer (4) Differential and overall...
energy balances; steady and unsteady state heat conduction in simple geometries; heat transfer in tubes and heat exchangers; condensation of fluids; boiling; radiation. Prereq: 3410. Introduction to Differential Equations. 3 hrs and 1 lab.


3440 Stagewise Operations (3) Analytical and graphical methods applied to stagewise separa-

3450 Diffusional Operations (3) Diffusion, simultaneous heat and mass transfer; applications of mass balances, gas absorption, extraction. Prereq: 3420.

3610 Process Dynamics (3) Quantitative treatment of dynamic nature of physical processes. Linear systems and differential equations. Laplace transform techniques. Block diagrams, algebra, and transfer functions of systems, process simulation. Mathematical models for several chemical processes will be developed and analyzed in detail. Prereq: Introduction to Differential Equations.

3620 Chemical Process Control (3) Basic control theory applied to chemical processes; feedback control systems, cascade control, feed forward control, stability analysis, root locus and Bode analysis. Modern industrial control hardware and instrumentation. Prereq: 3610.

4110 Chemical Engineering Data Analysis (3) Analytical and experimental identification of system extremals; statistical properties of samples and source systems; empirical modeling of processes; statistical process control. Prereq: Math 3150.

4120 Probabilistic Chemical Engineering Sys-
tems (3) Experiment designs, simulation of stochastic systems, predictive techniques, and analysis of networks in the process industries. Prereq: 4110.

4130 Introduction to Optimization (3) Principles and applications of various optimization techniques to chemical process design; unconstrained optimization, equality constrained optimization, inequality constrained optimization, and dynamic programming. Prereq: 4110.


4420 Process Design and Economic Analysis (3) Development of basic information on a process into an integrated plant design considering mass and energy balances, product specifications, equipment characteristics, capital investment, operating costs and economic merit. Prereq: 4410, 4530.

4430 Special Problems in Design and Economics (3) Extension of 4420 for student participation in the A.I. Ch.E. annual contest problem; other advanced design projects. Prereq: 4420.

4530 Chemical Engineering Reaction Kinetics (3) Chemical reaction rates in closed and flow systems; interpretation of laboratory and pilot plant data; reactor design. Prereq: 3420-30, Chemistry 3430.

4540 Fluid-Solid Operations (3) Heat and mass transfer in aerated and liquidized beds--applications include adsorption, ion exchange, crystallization. Prereq: 3440-50.

4620 Control of Complex Chemical Processes (3) Analysis of nonlinear systems, stability considerations, design of an integrated control system for a complete chemical process. Prereq: 3620.

4680 Hydrocarbon Processing (3) Study of specialized characterization of physical prop-
erties of fossil fuel raw materials and products, and of processes for conversion of fossil fuel raw materials into products needed in industrial energy, material and consumer markets. Prereq: 3440.

4710 Advanced Transport Phenomena (3) An introduction to molecular theories for predicting transport properties; development of mass, energy, and momentum balances; heat transfer; and selected applications in laminar flow; generalized correlation methods. Prereq: 3450.


4740 Introduction to Transport Phenomena in Biological Systems (3) Application of principles of transport phenomena to biological systems. Transfer of chemical energy and various cellular active transports: structure and rheology of physiological fluids, membrane and interfacial phenomena; analysis and design of artificial organs. Prereq: 3440, 3450 or consent of instructor.

4750 Microbiological Process Engineering (3) Application of chemical engineering principles and design concepts to microbiological processes; continuous culture of microorganisms, food processing and pharmaceutical processes. Prereq: 3440, 3450 or consent of instructor.

4760 Principles of Biochemical Separation (3) Physical aspects and similarities of modern biochemical separations: classroom demonstrations, design of production and analytical systems.

4770 Chemical Bioengineering Laboratory (3) Laboratory investigations of controlling factors in biochemical engineering operations: Liquid chromatography, continuous microbial growth and handling, preparatory zonal centrifuge and electrophoresis, etc. Prereq: 4740, 4750, and 4760 or consent of instructor.

4781-B2-33 Topics in Biochemical Engineering (3, 3, 3) Problems of current interest in biochemical engineering. Prereq: Consent of instructor.

4810-20-30 Special Problems in Chemical En-
gineering (3, 3, 3) Chemical engineering problems related to recent developments in industrial practice. Prereq: Consent of instructor.

4910 Applied Polymer Science (3) A first course in the physical properties of polymers. Polymer structure, crystalline and glass transitions, physical properties of amorphous and crystalline polymers, crystallization kinetics and mechanical properties are discussed. Prereq: Process Principles and Materials III.

4920 Polymer Processing (3) Rheological properties of polymer melts and solutions, viscometry, unit operations of fiber, plastics and rubber industries: analysis and scale-up, flow through dies and pipelines, screw extrusion, spinning of fibers, injection molding. Prereq: 3420. Process Principles and Materials III or equivalent.

4930 Principles of Fiber and Textile Engineer-
ing (3) Chemical and crystalline structure of important fibers; melt, wet and dry spinning of non-cellulosic fibers: preparation of yarn; dyeing, weaving and knitting. Emphasis on qualitative aspects. Prereq: Met. Engr. 3110 or equivalent.

4940 Plastics Fabrication Operations (3) Lec-
ture and laboratory course treating unit opera-
tions in the plastics industry, with emphasis on the types of mechanisms of operation of machinery used and the structure and properties of fabricated parts.

Operations to include: extrusion, co-extrusion, injection molding including structural foam, thermoforming, blow molding, rotational molding, etc. Prereq: 3420 or equivalent.

5000 Thesis

5111 Chemical Engineering Analysis (3) Mathematical formulation and solution of differen-
tial equations--application to chemical engi-
neering, especially those of heat and mass diffusions; transform methods, classical solution techniques, and digital computer. Prereq: Dif-
ferential Equations.

5112 Numerical Methods in Chemical Engin-
eering (3) Modeling of typical chemical engi-
neering systems in a form suitable for numeri-
cal solution; use of high-speed digital computer. Treatment includes consideration of conver-
gence, stability, and truncation error, and appli-
cation of vector and matrix algebra. Prereq: 5111.

5120 Heat Convection (3) Analysis of heat convection in fluids under viscous and turbulent flows, emphasizing analytical approach; simultaneous diffusion of momentum and heat. Prereq: 5111.

5130 Methods of Optimization (3) Principles and applications of various mathematical pro-
gramming techniques to chemical process design and control; variational method, maxi-
mum principle, dynamic programming, and geo-
metric programming. Prereq: 4130.

5210 Process Dynamics (3) Generalized analy-
sis of recycle operations, steady state simula-
tion and optimization of typical processes.

5250 Chemical Process Industry Economics (3) Analysis of the economic components of chemical processes, of the internal economics of the chemical enterprise, and of decision making for investment in capital facilities. Prereq: 4120-30, 4420.

5310 Thermodynamics of Heterogeneous Equilibrium (3) Phase rule; equilibrium between phases; composition relationship between phases; ideal and non-ideal solutions. Prereq: 3430 or equivalent.

5320 Statistical Thermodynamics (3) Basic concept of statistical mechanics and applica-
tion to evaluation of thermophysical properties. Prereq: 5310.

5410-20-30 Research and Design in Chemical Engineering (3, 3, 3) Design of laboratory opera-
tions; interpretation of laboratory data and design of experiments in chemical engineer-
ng research.

5510 Chemical Reactor Design (3) Non-ideal flow patterns in chemical reactors: diffusion and reaction in two phase systems; introduc-
tion to heterogeneous catalysis and reactor stability. Prereq: 4530.

5610 Stagewise Mass Transfer Operations (3) Equilibrium stage, concepts applied to mass transfer operations, emphasizing non-isother-
mal andmulticomponent systems.

5620 Differential Mass Transfer Operations (3) Differential mass transfer operations: falling film, packed tower and bubble contactong de-
vices; non-isothermal andmulticomponent sys-
tems; current theories of mass transfer; mass heat and momentum transfer analyses. Prereq: Differential Equations.

5640 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, etc., including x-ray diffraction, nuclear magnetic resonance, and electron microscopy. Prereq: 4910 or equival-
ent.

5650 Mechanical Behavior of Solid Polymers
66 College of Engineering

(3) Application of linear viscoelasticity and large deformation elasticity to solid polymer (especially vulcanized rubber and crystalline polymer) properties. Topics include dynamic modulus and loss tangent, wave propagation, friction, tearing, tensile failure, abrasion, bulk polymer solutions and bulk polymers, lattice theory of polymer solutions and prediction of phase equilibrium, phase transitions, kinetic theory of rubber elasticity. Prereq: 4910, 5320 or equivalent.

5680 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, measurement of polymer properties, calorimetry, and dynamic mechanical measurements. Coreq: Undergraduate physical chemistry.


5810 Mechanics of Viscous Flow (3) (Same as Engr. Mech. 5220.)

5820 Non-Newtonian Fluid Mechanics (3) Tensor analysis; generalized equations of motion; survey of non-Newtonian technology. Prereq: 5810 or equivalent. (Same as Engr. Mech. 5230.)

5910-20-30 Selected Topics in Polymer Science (3, 3, 3) Advanced problems in modern polymer science dealing with current interest to engineers. Prereq: 4910, 4920 or equivalent. (Same as Chem. 5150-60-70.)

5940 Industrial Chemistry of Polymers (3) Mechanisms and reactions of polymers including oxidation and degradation. Modifications of polymer systems. Prereq: Chemistry 5531 or equivalent.

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 Diffusion Processes (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 investment decision in the face of external competition. Prereq: 5250.

6310 Thermodynamics of Irreversible Processes (3) Thermodynamic treatment of irreversible chemical processes, transport processes, coupling of phenomena, etc., with special emphasis on topics and methods of interest to engineering and bioengineering students. Prereq: 5310.

6520 Catalytic Reactor Design (3) Principles of kinetic, heat and mass transfer for the design and analysis of heterogeneous catalytic reactors. Prereq: 5610.

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.

6810 Advanced Methods in Polymer Processing (3) Application of theories of rheological properties and structures formation to analysis of polymer process operations. Prereq: 5820.

6920-30-40 Recent Advances in Polymer Science and Engineering (3, 3, 3) Treatment of latest developments in science and technology of polymers. May include topics of morphology, structure, characterization, etc. Prereq: Consent of instructor.

6950 Advanced Industrial Polymer Chemistry (3) In-depth treatment of chemistry and properties of new polymeric engineering materials; highly integrated engineering and chemical approach is used. Prereq: 5940 or consent of instructor.

6960 Polymerization Methods Using Organometallic Catalysts (3) The syntheses, reactions, mechanism studies, and modifications of highly controlled polymeric structures will be presented. Organometallic catalysts such as Grubbs' and Grignard, etc., will be discussed. Prereq: 5940.

6990 Polymerization Methods Using Organometallic Catalysts (3) The syntheses, reactions, mechanism studies, and modifications of highly controlled polymeric structures will be presented. Organometallic catalysts such as Grubbs' and Grignard, etc., will be discussed. Prereq: 5940.

Metallurgical Engineering

3110 Engineering Materials I (4) Introductory course correlating the atomic, crystal, and micro-structure of solids with mechanical, physical, electrical and chemical properties of engineering significance. 3 hrs and 1 lab.

3120 Engineering Materials II (3) Extension of Engineering Materials with emphasis on the control of mechanical properties of materials by phase transformation, thermal, and mechanical treatment; correlation of resultant properties with service performance. Suggested for mechanical, civil, and industrial engineering students.


3150 Engineering Materials V (3) Extension of 3110 with emphasis on the mechanisms and control of reactions of engineering materials with aqueous, non-aqueous, and gaseous environments. Prereq: 3110.


3210 Plastic Deformation (4) Phenomena and thermomechanical properties of metals, ceramics and polymeric systems. Applicable concepts of crystallography and x-ray diffraction; use of stereographic projections. Prereq: 3110. 3 hrs and 1 lab.

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) Thermodynamical and structural factors governing binary equilibrium. Ternary systems. Kinetics and morphology of precipitation and phase transformations in simple and complex systems. Prereq: 3220. 3 hrs and 1 lab.

3310 Biomedical Applications of Materials for Life Scientists (3) Principles of engineering materials and the control of reactions of engineering materials with biological systems. Coreq: General Chemistry or equivalent.

3520 Materials Behavior and Chemical Process Equipment Design (3) Mechanical, metallurgical and chemical considerations in design of chemical process equipment. Prereq: Principles and Materials III or equivalent; 3150; and Chemical Engineering 3420. (Same as Engineering Mechanics 3520.)

3710 Metallurgical Applications in Manufacturing Technology (3) Fabrication methods and principles of mechanical/thermal processing for finished and semi-finished articles; casting; powder metallurgy; plastic forming; joining; and 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 for applications of polymeric engineering structures and components. Coreq: 4740. 3 labs.

4510-20 X-Ray Diffraction and Crystallography (3, 3) Lecture and laboratory work in crystallography, x-ray diffraction, and examination of polycrystalline materials, including significance of line and peak intensities, line breadth, and texture. Prereq: 4530.

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
4710 Production Metallurgy (3) Thermodynamic and kinetic principles of roasting, smelting, refining.

4730 Mechanical Metallurgy I (3) Elastic behavior. Description of stress, strain, and elastic constitutive relations. Effects of composition, impurities, and temperature on mechanical behavior. Failure by yielding. Prereq: Elementary Linear Algebra, Calculus of Several Variables, and Infinite Series, and Fluid Mechanics, Mechanics of Materials, or consent of instructor. 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 3230, and 4730 or M.E. 3650 or consent of instructor. Also suggested for mechanical engineering, engineering mechanics, or engineering science students. 3 hrs or 2 hrs and 1 lab.

4780 Casting and Welding (3) Principles and processes of casting and welding: Heat transfer, solidification, segregation, gas-metal and slag-metal interactions, thermal treatments, associated stresses. Prereq: 3230, 3 hrs or 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, engineering mechanics, and engineering science majors. 3 hrs or 2 hrs and 1 lab.

5000 Thesis

5110 Point Defects and Dislocations (3) Theoretical and experimental analysis of point, line, and planar imperfections in solids. Prereq: 4730 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 involving 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 phase transformations by nucleation and growth; solidification, precipitation, spinodal decomposition. Prereq: 5140.

5160 Phase Transformations II (3) Analysis of systems involving the complete transformation of solid solutions; pearlitics, bainitic, massive, and maritensitic transformations. Prereq: 5150.


5210-20-30 Welding Metallurgy (3, 3, 3) Welding processes and the physical metallurgy of welding, including power supplies, heat flow, residual stresses, solidification, and solid state reactions of welds and parent material. Current theories of cold cracking, hot cracking, and porosity formation are developed. Prereq: Physical Metallurgy.

5310 Solidification and Crystal Growth I (3) Solute redistribution, thermodynamic considerations, kinetic, convection and fluid flow effects on the solid to liquid transition. Prereq: Math 4550.

5410-20-30 Advanced X-Ray Diffraction (3, 3, 3) Review of mathematical techniques; generalization of diffraction theory, analysis of scattered intensity in reciprocal space; relationship between scattering intensity to electronic and magnetic order-disorder, particle size and lattice faults. Introduction to crystal symmetry, space group theory, and crystal structure problems; some laboratory work. Prereq: Math 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, and practical applications such as plastic deformation, fracture, precipitation, and phase transformations. Prereq: 4510-20.


5640 Structural Characterization of Polymers (3) (Same as Chem. Engr. 5640).

5850 Mechanical Behavior of Solid Polymers (3) (Same as Chem. Engr. 5650).

5750 Corrosion (3) Analysis of corrosion processes in terms of polarization measurements and the Pourbaix diagram. Influence of stress, temperature, and localized conditions contributing to pitting, crevice, and stress corrosion cracking.

5910-20-30 Special Topics in Metallurgy (3, 3, 3) Lec-tures and reading on more recent advances in metallurgy and related fields.

5840-50-60 Metallurgy of Deformation and Fracture (3, 3, 3) Theoretical and engineering analysis of the effect of stress state, strain rate, radiation, deformation-induced changes and metallurgical structure on mechanical behavior in service, testing, and fabrication.

5910-20-30 Metallurgical Thermodynamics (3, 3, 3) Application of thermodynamic and physical chemical methods to metal and metallurgical 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 Theoretical Metallurgy (3, 3, 3) Study of the phases of solid state physics applied to elasticity, introduction to quantum theory, specific heats, electron theory, electrical and thermal conductivity, magnetic properties, theory of alloy formation. Prereq: 5100 or Physics 3730; Math. 4550 and consent of instructor.

6210-20-30 Rate Process in Metallurgy (3, 3, 3) Theoretical and practical considerations of rate processes in solids such as diffusion, recrystallization, grain growth, and phase transformations.

6320 Solidification and Crystal Growth II (3, 3) Fluid flow, magnetohydrodynamic effects in incompressible liquid conductors, morphology, structure stability, heat and mass transfer processes in liquid to solid transition, multi-phase solidification, compositional, non-steady state dendritic phenomena, some nucleation phenomena. Prereq: 5310.

6410-20 Thermodynamics of Solids (3, 3) Classical and statistical thermodynamic analysis of the stability of solid solutions, compounds, and crystalline phases. Prereq: 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. Prereq: classification according to transformation behavior. Prereq: Core curricu-lum in Met. Engr. and Math. 4050 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 irreversible thermodynamics. Prereq: 6810 or 6820, 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. Prereq: 6810 or 6820, or consent of instructor.

Civil Engineering MAJORS

DEGREES

Civil Engineering M.E., M.S., Ph.D. Civil and Environmental Engineering M.E., M.S.


MASTER OF SCIENCE PROGRAM Graduate programs in Civil Engineering and in Environmental 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 certain undergraduate prerequisite courses must be taken before admission as a candidate for the Master of Science in Civil Engineering.

**CIVIL ENGINEERING**

The Department of Civil Engineering offers two options for the Master of Science degree in Civil Engineering.

**Option I:**

A minimum of 45 quarter hours, including at least nine hours of thesis, is required.

**Option II:**

A minimum of 48 quarter hours, including a three-quarter-hour special problem, is required. The special problem will culminate in a written report which must be approved by the student's major professor.

**ENVIRONMENTAL ENGINEERING**

For a major in Environmental Engineering the Bachelor's degree may be in fields other than Civil Engineering. In some cases prerequisite undergraduate courses may be indicated, and in general these must be completed before courses for graduate credit can be taken.

The Department of Civil Engineering offers both Thesis and Non-Thesis Options for work toward the Master of Science degree in Environmental Engineering.

**Option I:**

The student must present a minimum of 45 quarter hours of approved graduate courses. The major shall include a minimum of nine quarter hours of thesis and 18 quarter hours credit of approved Environmental Engineering course work. A minor may be selected but is not necessarily required.

**Option II:**

The student must present a minimum of 48 quarter hours of approved graduate courses. The major shall include a minimum of 27 quarter hours of approved Environmental Engineering course work. A minor may be selected but is not necessarily required.

Option I or II must be approved by the department.

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

**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 nine 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. These related fields will normally include subjects such as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 12 quarter hours of mathematics will be required beyond the Civil Engineering undergraduate requirements.
4. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.
5. Upon completion of at least one-half of all 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.

**Civil Engineering**

4120 Concrete Design (3) Reinforced concrete continuous beams and floor slabs; footings, and retaining walls. Prereq: Concrete Design and Defections and Statistically Indeterminate Structures.


4230 Legal and Ethical Aspects of Engineering (3) Legal principles underlying engineering work; laws of contracts, torts, agency, real property; problems of professional registration and ethics.


4250 Photogrammetry (3) Methods of plotting maps from aerial photographs; stereoscopic plotting instruments; applications. Prereq: Engr. Surveys, or Forestry Summer Camp for forestry majors.

4260 Analysis of Framed Structures (3) Maximum stresses for moving loads; use of influence lines; lateral forces due to earthquake and wind; analysis of portals, building frames and space frames.

4330 Construction Methods and Equipment (3) Fundamental operations in construction and selection of equipment; production rates, balancing of equipment, and cost estimates.

4510-20 Advanced Structural Design (3, 3) Plastic design in steel in 4510; design of typical highway bridges in 4520. Prereq: Design of Framed Structures for 4510; and Concrete Design for 4520.

4530 Cost Comparison in Design and Construction (3) Theories of engineering and construction. The cost comparison of alternate designs with emphasis on applications to civil engineering problems. Prereq: Concrete Design, Design of Framed Structures.

4540 Computer Utilization (3) Computer use, the economic justification, and the extent of its use by industry. The utilization of computers for the solution of civil engineering problems. Prereq: Design of Framed Structures.

4550 Engineering Behavior of Soils (3) Plastic and elastic behavior of soils, determination and use of properties of engineering soils. Prereq: 5220 or consent of instructor. 2 hrs and 1 lab.

4560 Stabilization of Soils (3) Mechanical stabilization of soils by compaction, drainage, and blending; chemical stabilization of soils with admixtures; waterproofing and modifying soils and additives. Prereq: Physical Properties of Soils. 2 hrs and 1 lab.

4620 Airport Planning and Design I (3) Emphasis on airport master planning. Included for consideration on the air side; runway configuration, capacity, geometrics and lighting; and on the land side are included terminal layout and design, and ground access systems and parking. Prereq: 4620. 2 hrs and 1 lab.

4680 Traffic Engineering (3) Study of the characteristics of the driver, vehicle, and roadway and their interaction; traffic studies; basic considerations of traffic circulation and control; elements of urban transportation planning studies.

4690 Airport Planning and Design II (3) Integration and application of the principles of airport master planning for the purpose of site selection and design of an airport facility through a comprehensive team project, also includes environmental evaluation of design. Prereq: 4620. 1 hr and 2 labs.

4710 Portland Cement Concrete Mix Design (3) Properties and tests of portland cement concrete, methods of concrete mix design, nondestructive concrete evaluation testing, use of concrete admixtures. Prereq: Materials of Construction. 2 hrs and 1 lab.

4720 Asphalt and Bituminous Concrete (3) Properties and tests of asphalt and asphaltic mixes, mix design of bituminous concrete. Emphasis on use of asphalt in transportation construction projects. Prereq: Materials of Construction. 2 hrs and 1 lab.

4850 Elementary Structural Matrix Methods (3) (Same as Engr. Mech. 4850 and Arch. 4890.)

5000 Thesis

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 (3) Analysis of complex planar and space frames. Prereq: 5110 and 5120.

5150 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, stability considerations; stiffness and flexibility analysis of plane trusses, general members and structures composed of general members. Prereq: 4540 or consent of instructor.

5155 Analysis and Design of Plate Structures (3) Fundamental theories of bending and buckling of plates; practical application of previous theories in 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; elastic-plastic behavior considered for structural systems; approximate design methods developed. Prereq: 5120, 5150.
Application of the finite element method to structural analysis; plane stress, plane strain, axisymmetric, and three-dimensional elements; use of typical computer programs. Prereq: 5180 or 5820 and 5860. (Same as Engr. Mech. 5180.)

Pavement Design (3) Characteristics of pavement loads; theory of pavement design; design practices; construction and maintenance. Prereq: Engr. Properties of Soils.


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.

Planning and Transportation (3) Methods for preparation of transportation elements of comprehensive development plans. Analysis of relationships between various transportation modes, transportation and other community features. (Same as Planning 5270.)

Engineering Practice (3) Valuation and feasibility studies; depreciation and useful life; engineering economics.

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.

Structural Model Analysis (3) Experimental methods of shear, moment, and stress analysis.

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.

Soil Mechanics—Elastic Behavior (3) Stress-deformation characteristics, theory of consolidation, theories of settlement analysis. Prereq: Physical Properties of Soils or consent of instructor.

Soil Mechanics—Seepage (3) Saturated flow through embankments, filter design criteria, seepage forces and velocities, subdrains, and drainage structures. Prereq: Physical Properties of Soils or consent of instructor.

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

Pre-stressed Concrete (3) Properties of prestressing materials and anchorages systems; methods of pre-tensioning and post-tensioning; analysis and design of members and continuous structures.

Behavior of Reinforced Concrete Members (3) Ultimate strength and behavior of re-inforced concrete members; relation between research results and current specifications for design. Prereq: 4120.

Urban Systems: Engineering and Management (3) The management and engineering of urban systems. Interaction of transportation, utilities, environment, government, and economic cycles. Prereq: Graduate standing or consent of instructor.

Traffic Engineering—Characteristics (3) Theoretical and practical considerations of the characteristics of the driver-vehicle-roadway system; level-of-service concept of capacity.

Traffic Engineering—Operations (3) Fixed-time and volume-density controllers; progressional systems; one-way operations; reversible flows; system operation, including computerized networks; legal aspects of operational controls. Prereq: 5810. 2 hrs and one 2-hr lab.

Geometric Design (3) Advanced theory and practice in the design of highways. Prereq: Highway Engineering I.

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 crossing, intersections, utility considerations, parking, effect of mass transportation; channelization; marketing; lighting; the freeway, frontage road, surface street system. Prereq: Consent of instructor.

Urban Transportation Planning (3) The use of various models for the prediction of traffic demands and vehicular flows; land use planning; parking needs. Prereq: 5810.

Public Transit Planning (3) The planning process and methods for the study of personal movement by bus, rapid rail and taxicab transit. Also includes the nature of public transit; its various forms, its impact on the community's needs; user preferences; modal split models; and the total social, political, economic, and technical impacts of public transit. Prereq: Highway Engineering I or Graduate Standing.

Special Problems in Civil Engineering (1-9) Study of a civil engineering topic to fulfill the special problem requirement in the non-thesis program. Enrollment limited to civil engineering students in non-thesis program. May be repeated. Maximum 9 hours. S/NC only. Prereq: Consent of instructor.

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, complicated trusses, etc.

Doctoral Research and Dissertation


Advanced Matrix Formulation of Structural Problems (3) Analysis of complex structures including space frames containing non-prismatic curved members; finite element methods of analysis; methods of solution utilizing digital computers. Prereq: 5120 and 5150.

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: 5170 and 5610.

Behavior of Reinforced Concrete Beams and Frames (3) Ultimate strength and behavior of statically indeterminate reinforced concrete structures subjected to static and dynamic loading. Prereq: 5170 and 5610.

Behavior of Reinforced Concrete Slabs (3) Behavior, analysis, and design of reinforced concrete slabs; finite element solutions; ACI Code methods; yield-line theory. Prereq: 5740, 5160 or ES 6310.

Traffic Flow Theory (3) Special problems in traffic engineering, using queueing theory, Markov processes, Monte Carlo methods, and simulations of various conditions and/or design. Prereq: 4540 or Math 3150 or 5820.

Statewide Passenger Transportation Planning (3) Preparation of comprehensive multi-modal, multi-use traffic flow models, functional classification, programming and scheduling. Emphasis on governmental policies, decisions, especially as they affect air and highway investments. Prereq: 5660.

Future Transit Technology and Research (3) New transit systems and new technology are identified and evaluated. Also considered is the planning of possible research areas in both technology and the planning process and possible research designs. Prereq: 5870.

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 techniques are integrated into the urban transportation planning process. State-of-the-art and new modeling techniques are investigated. Prereq: 5860 or 6827, Math 3150 and Stat. 3450.

Planning Models for Transportation Systems II (3) An analytical analysis of modal split, trip distribution, and assignment. Mathematical, statistical, and computer science techniques are used in the modeling process. These models are integrated for use in the urban transportation planning process. Prereq: 6880.

Special Topics in Civil Engineering (3, 3, 3) Selected advanced problems of current interest in Civil Engineering. Prereq: Consent of instructor.

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 control.

Unit Operations of Environmental Pollution Control (3) Physical unit operations and chemical unit processes employed in air, land, and water pollution control activities. Theoretical development of design models and evaluation of performance. Topics include mixing, sedimentation, filtration, mass transfer, and adsorption. Prereq: 3000.

Environmental Engineering Chemistry (3) Fundamentals of chemistry related to generation, formation, movement, and fate of environmental contaminants. Analytical techniques for evaluation of specific air, water, and solid waste pollutants. Prereq: 3000 and general chemistry.

Urban Water Management (3) Introduction to urban water modelling; evaluation of optimum urban water policies; formulation of system constraints and analysis of decision-making processes; management of stormwater, and treatment of urban point, non-point water for beneficial use. Prereq: 3000 and Elementary Hydrology.

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.

Water Resources Engineering Development (3) Water resources development and management and single or multipurpose planning; economics in alternative decisions; principal water uses; multiobjective evaluation procedures for water and resource projects; Tennessee's water law principles; special topics of current interest. Prereq: Consent of instructor.

Hydrologic Design (3) Application of frequency and regression analysis to hydro-
logic 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.

4500 Water Quality Management (3) Water quality control objectives, methods, and philosophies; water quality criteria; effect of various uses of water quality; receiving water characteristics and waste assimilation capacity; regulatory standards; economic considerations. Prereq: Introduction to Environmental Engineering.

4510 Elements of Water and Wastewater Transport Systems (3) An introduction to theory and design of water transportation and distribution systems and wastewater collection systems. Prereq: Introduction to Environmental Engineering.

4520 Elements of Water and Wastewater Treatment Systems Design (3) An introduction to the unique properties employed in the physical, chemical, and biological treatment of water and wastewater. Application of unit operations and processes as design for water and wastewater treatment plants. Prereq: 4000.

4530 Sanitary Engineering Laboratory (3) Physical, chemical, and bacteriological analysis of water and wastewater. Prereq: 4000. 3 labs.

4600 Solid Waste Management (3) Quantities and characteristics of solid wastes; collection methods and equipment; disposal and recycle techniques; economics; planning and management. Prereq: 3000.

4700 Air Pollution-Air Resources Management (3) An introductory course on the concepts of air pollution; analysis of the relationship among emission sources, topography, and atmospheric stability; and adverse effects on receptors; engineering approaches for air pollution control.

4810 Water Law (3) Survey study in water law, including case studies and water law doctrines. (Same as Water Res. Development 4810.)

5000 Thesis


5160 Planning and Utilities (3) Planning for adequate water supply and sewage waste disposal in the urban community; impact of utility patterns on area development, and the problems of utility service policies. Not for Civil Engineering majors. (Same as Planning 5160 and Water Res. Development 5160.)

5200 Water Resources Systems (3) Control, utilization and management of water in water resources engineering. (Same as Water Res. Development 5500.)

5210 Advanced Water Resources Engineering (3) Complex problems encountered in water resources engineering such as water hammer, surges, wave action, unsteady motion, etc. Analysis of such problems preliminary to design of complex water resources structures.

5230 Surface Water Transport Processes (3) Dynamics of flow in catchments, streams, lakes and estuaries; Hydrodynamic dispersion, diffusion, boundary layer effects, unsteadiness, kinematic wave approximation. Consideration given to geometric and hydraulic nonuniformities. Prereq: Fluid Mechanics or consent of instructor.

5232 Sediment Transportation (3) Sediment properties and their measurements; bed loads and suspended load movement; erosion, scour, transport and deposition of sediments by flowing water, siltation of reservoirs and related topics. Prereq: 5230.

5234 Flood Damage Reduction (3) Survey of national, regional, local flood problems; hydrologic design; flood control measures; land-use controls and adjustments; floodproofing, flood insurance, and other flood damage reduction 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, and the interaction of radiation and matter; current data handling technology. Prereq: Consent of Instructor.

5262 Remote Sensing Data Acquisition (3) Theory of active and passive sensors, their areas of specialty, an introduction to the description of remote sensing platforms, including the Earth Resources Satellite Communications System; mission planning. Prereq: 5260 or consent of instructor.

5263 Remote Sensing Data Analysis and Interpretation (3) A traditional and automatic methods of data analysis and interpretation, formatting and display, pattern recognition techniques; use of automated data processing equipment for data storage, retrieval, analysis and classification. Prereq: Math 3150, Stat 3450.

5301 Advanced Hydrologic Analysis 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 with illustrative examples. Prereq: Consent of instructor.

5302 Advanced Hydrologic Analysis II (3) Continuous streamflow records are interpreted using methods of stochastic hydrology, including flood frequency analysis. Hydrologic design of water resources systems using streamflow simulation techniques including autoregressive and moving average noise models. Prereq: Consent of Instructor.

5310 Groundwater Transport Processes (3) Dynamics of flow in porous media with emphasis on physical processes important in subsurface hydrology. Hydrodynamic dispersion, advection, layered soils, and unsaturated flow phenomena. Analytical solutions of flow equations, Dupuit approximation, analog and numerical methods, and graphical solutions. Prereq: Fluid Mechanics or consent of instructor.

5311 Groundwater Flow (3) Water well design, quantitative evaluation of aquifers; artificial recharge; surveying techniques, fundamentals of groundwater investigations. Prereq: 5310.

5330 Descriptive Hydrology (3) Occurrence and description of elements of the hydrologic cycle, its effects on earth and its relation to man. Not for Civil Engineering majors. (Same as Water Res. Development 5330.)

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.


5543 Industrial Wastes (3) Sources, characteristics, treatment, and plant design. Prereq: 5502.

5561 Aquatic Environment Pollution (3) A study of the effects resulting from agricultural, municipal, and industrial pollution upon the physical, chemical, and biological characteristics of natural waters. Prereq: 4500.

5582 Microbiology for Sanitary Engineers (3) A study of microorganisms and microbial processes which are significant in sanitary engineering, including biochemical reaction, identification, enzymes, metabolic reactions, energy transfer, synthesis and growth; aerobic and anaerobic biological treatment processes. Prereq: Graduate standing.

5593 Advanced Sanitary Engineering Laboratory (3) Advanced laboratory techniques used in the analysis of water and wastewater. Application of modern instrumental procedures for chemical, physical, and biological analysis. Prereq: 4530. 3 labs.


5700 Planning and Air Pollution Control (3) The relationship between 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 monitoring, dispersion of pollutants, fluid mechanics. Prereq: 4700 and Fluid Mechanics.

5720 Air Pollution Particle Collection Theory (3) The mechanics of particles suspended in a gaseous medium including particle motion, collection, and aggregation of gaseous particles. Prereq: 4700 and Fluid Mechanics.

5730 Air Pollution Control Device Design (3) Design and evaluation of systems used to control the emission of gaseous and particle air pollutants. Computation of performance of specific devices and systems. Prereq: 5720.

5740 Dynamical and Physical Meteorology (3) Fundamental physical principles of the atmospheric sciences are developed. Specific topics include atmospheric energetics, general circulation, perturbation theory, vorticity theory, the equation of motion, solar and terrestrial radiation, and the thermodynamics of dry and moist air. Prereq: Math 4550 and Fluid Mechanics or equivalent.

5750 Turbulence in the Atmosphere (3) Present state of our knowledge of turbulence in the atmosphere. Theoretical boundary layer mean wind and temperature profiles are derived and related to observations. Methods of estimating surface fluxes, energy spectra, and convective cloudiness are outlined. Discussion of how the theories can be applied to describe changes in turbulence in air flow over urban areas. Mechanisms of formation of clearance 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 relation between Eulerian and Lagrangian spectra, the differences between instantaneous and continuous sources, diffusion in a zone of wind shear and diffusion from urban area sources. Prereq: 5740.

5900 Special Problems in Environmental Engineering
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.

Specific departmental requirements include:
1. Electrical Engineering 5070-80 and 5090 or 5100.
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 and nine quarter hours of another approved area.
4. Master's thesis, totaling nine quarter hours or more.
5. A final oral examination covering the thesis and related course work.

DOCTORAL PROGRAM
The Ph.D. degree with a major in Electrical Engineering may be pursued in the areas of circuit theory, computers, quantum electronics, electromagnetic theory, plasma engineering, 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 minimum of 36 quarter hours of work in electrical engineering at the 5000- and 6000-levels.
- A minimum of 12 quarter hours of 6000-level course work. At least three quarter hours must be in an area other than the student's major area.
- A minimum of 18 hours of mathematics at the 4000-level or above.
- Mathematics (or Physics) 5610-20-30 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.

Many of the electrical engineering courses are offered in the evening. Engineers working in industry are encouraged to participate in the department's graduate program.

Dissertations and research 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.


3050 Basic Field Theory (3) Forces between charges, electric and magnetic fields, Gaussian 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 of induction motors and d.c. machines. Prereq: 3040. 4 labs.

3090 Energy System Operation (3) Synchronous machines, transmission-lines, and transformers as power system elements; power system representations, unit calculations, 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.

3150 Basic Control Systems (3) Systems differential equations, solution by classical methods; Laplace transform methods; design of control and computer systems. For non-electricals only. Prereq: 3120, Math 4610.

3160 Logic Design of Digital Systems (3) Introduction to boolean algebra and design...
of combinational circuits. Presents gate and flip-flop theory. Design of clocked sequential circuits and other systems containing memory. Introduction to minicomputer architecture and system components. Includes basic concepts, architecture of arithmetic, storage, input/output, and control systems. Instruction set capabilities and machine language programming. Prereq: 3010, Computer Science 3150, 4 labs.

3190 Plasma I (3) Engineering applications of physical electronics, plasma effects and devices. Topics include electrostatic precipitators and plasma engineering, characteristics of diodes, rectifiers, and diode switches. Prereq: Circuits III, 3040 concurrently. 4 labs.

3290 Plasma 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.

3390 Plasma III—Basic Electronic Amplifiers (3) Vacuum tube and transistor R-C coupled amplifiers, power amplifiers, bias stability, feedback. Prereq: 3010 and 3820, Coreq: 3720. 4 labs.

4020 Direct Electrical Energy Conversion (3) Basic principles, devices and applications of electrical power systems. Energy conversion through thermonic effects, thermionic conversion, magnetohydrodynamics, solars cells, and fuel cells. Lab: Laboratory demonstrations. Prereq: 3050, 3190, 3810, and ME 3530.

4090 Microwave Circuits and Electronics (3) Circuits represented by wave-shattering, isolators, gyrators, couplers, microwave vacuum diodes, and magnetic-field devices. parametric amplifiers, power generator semiconductors, varactor semiconductors. Prereq: 3060. 4 labs.

4090 Propagation II (3) Free space and guided wave propagation. Obliquely incident waves, metallic tube and dielectric rod waveguides, short wire radiators, tropospheric and ionospheric propagation, flat and spherical earth propagation multipath waves. Prereq: 3060. 4 labs.


4200 Electromagnetic Field Transients (3) Pulse propagation on lines, reflection of pulses, wave theory, voltage and current variation of pulses from antennas. Prereq: 3060. 4 labs.

4340 Two-Port Networks (3) Two-port parameters. Passivity, activity, and reciprocity, image parameter, generalization of the filter theory; frequency transformation, two-port models, modern filter theory. Maximally flat and equivalence approximations to the ideal filter and the delay. ideal delay. 4 labs.


4370 Introduction to Feedback System Design (3) Mathematical formulation of control system behavior; steady-state error and error constants; root-locus methods; optimum gain adjustments; compensation networks; introduction to compensation. Prereq: 3720, Lab optional.

4400 Introduction to State Variable Methods (3) Analysis of continuous and discrete systems in the time domain including both manual and computer-aided methods: basic tools for the computer-aided design of circuits and systems. Prereq: 3720.

4410 Power System Components and Control (3) Analysis of power system components and their interconnection. Studies in control of power and frequency as well as voltage and reactive power. Prereq: 3060.

4420 Power Systems Analysis (3) System studies including load flow, faults, and stability. Prereq: 3060.

4430 Transmission, Distribution, and Protection (3) Studies in underground and d.c. transmission lines with special emphasis on power-voltage and insulation requirements; system protection against faults. Prereq: 3090.

4460 Lasers and Masers (3) Introduction to the principles of laser and maser operation based on classical concepts of electric and electronics engineering analogies. Consideration of practical devices and applications.


4600 Opto-Electronic Detection and Instrumentation (3) Sensitivity, resolution (frequency response) and noise concepts of practical devices. Device characteristics and fundamentals of optical engineering. Prereq: 3180.


4850 Optical-Electronic Detection and Instrumentation (3) Sensitivity, resolution (frequency response) and noise concepts of practical devices. Device characteristics and fundamentals of optical engineering. Prereq: 3180.

4860 Electromagnetic Power Amplifiers (3) Transistor and vacuum-tube power amplifiers; distortion, thermal considerations; r.f. power amplifiers; regulators. Prereq: 3830. 4 labs.

4900 Communications Electronics (3) Oscillator modulation and demodulation: basic communication systems. Prereq: 3830. 4 labs.

4700 Switching Circuits (3) Pulse amplification, amplifiers, multihole, wave shaping circuits, trigger circuits. Prereq: 3010 and 3830. 4 labs.

4740 Integrated Circuits (3) Processing and fabrication of active and passive components for monolithic and hybrid circuits. The design of linear and digital monolithic and hybrid circuits packaging, reliability, and large scale integration. Prereq: 3820.


4800 Hardware—Software Interface in Mini-computers and Microprocessor System Design (3) Presents minicomputer and microprocessor interface design. Hardware—software interaction and trade-off. Priorityinterrupt structures are discussed and utilized. Telecommunication devices are developed. Project-oriented, contract course. Completion of two projects, one utilizing a minicomputer and the other a microcomputer, are minimal course requirements. Prereq: 3180.

4810 Digital Integrated Circuits (3) Introduction to the analysis and design of discrete data control systems using frequency domain techniques. Digital filter design techniques. Application of digital computers to closed-loop feedback systems.

4820 Introduction to Pattern Recognition (3)
Role of pattern recognition within the framework of artificial intelligence. Principal topics include: learning, perception, and adaptative machines. Typical applications of pattern recognition to problems of practical significance - computer simulation and elementary pattern recognition problems. Prereq: 3100, Elementary Linear Algebra, Calculus of Several Variables and Infinite Series and Math 3150, or consent of instructor.

4830 Image Processing by Computer (3) Principal methods for coding, storing, and processing images by means of digital computers. Computational algorithms for image operations. Prereq: 3100, or consent of instructor.

4850 Small Computer Systems (3) Basic structure of small computer systems, input-output techniques, interrupt structures, peripheral devices, system software and assembly language programming. Course is project-oriented. Prereq: 3100. Engineering Computations, Computer Science 3150 or equivalent or consent of instructor. (Same as Computer Science 4850.)

4910-20-30 Special Electrical Engineering Problems (3, 3, 3) Problems in electrical engineering involving library or laboratory research.

5000 Thesis

5040-50-60 Electrical Engineering Research (3, 3, 3)

5070-80 Modern Transform Methods (3, 3) Laplace transform and complex variable theory. Z-transform, difference equations and distributed parameter systems. Coreq: Math 4510 or 4540.


5180 Bioengineering Systems II Bioelectric Phenomena (3) A study of the electrical phenomena associated with biological systems both as stimuli and responses. Quantitative theories of conduction, resistance, impedance, and electromechanical properties of bioelectrical systems are investigated. Prereq: 4600 or consent of instructor.

5190 Bioengineering Systems III Instrumentation and Analysis (3) An investigation of the process by which information is gathered and transmitted from a biological system under test and the manner in which this information is treated, as to signal analysis and modeling, in order to maximize the yield of meaningful information from the biological system. Prereq: 4600 or consent of instructor.

5210-20 Advanced Electrical Machinery (3, 3) Fundamental processes of electromechanical energy conversion; application in conventional devices; stability and control for rotating machinery. Park's transformations and the two-axis model, with emphasis on the transient behavior of isolated and interconnected rotating machinery. Prereq: Math 4150 or equivalent.

5230 Advanced Electrical Machinery Applications (3) Linear motors; pole amplitude modulation and other speed control techniques; variable frequency operation. Prereq: 5210.

5240-50 Linear Control System Theory (3, 3) Mathematical theory of feedback; analysis and design of linear control systems using frequency response and root-locus techniques; stability criteria; state-space representation; pole-zero synthesis; multivariable systems; characteristics of typical control elements. Sampled-data as well as continuous-data systems are studied. Coreq: Math 5070-80.

5260 Microwave Theory and Practice (3) Analysis and design of microwave control circuit systems including: construction of linear models describing function and phase characteristics; techniques of state-space, root-locus and pole-zero techniques. Modern developments in microwave signal detection and processing. Coreq: Math 5070-80.


5360 Application of Quantum Electronic Devices (3, 3) Quantum coherence properties of laser radiation and "beat-frequency" experiments. Use of lasers in communication and instrumentation systems. Specific application examples: photo-optical and laser emission spectroscopy, optical harmonic generation, holography, metal-working, and biological and medical applications. Prereq: 5340 and Math 4710 or equivalent.

5370 Advanced Direct Electrical Energy Conversion I (3) Theory, latest devices and applications for production of electrical energy by the gaseous means of thermal, magnetohydrodynamic, and electrolytic means. Possible topics: direct method. Prereq: 5260 or Math 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 the gaseous means of thermal, magnetohydrodynamic, and electrolytic means. Possible topics: direct method. Prereq: 5370 or Math 4150, or equivalent.

5410 Power System Networks (3) Sequence impedances for transmission lines, machines, and the transformer. Representation of system network characteristics such as Z_{bus}, Y_{bus}, and others. Computer methods are emphasized. Graduate standing or consent of instructor.

5420 Fault and Load Flow Studies (3) Analysis of a power system under both shunt and series fault conditions. Computer methods for fault studies are included. The load flow problem is formulated with computer involvement. Emphasized. Prereq: 5410 or consent of instructor.


5510-30 Linear Active Circuits (3, 3, 3) Analysis and design of linear active control circuits. Includes a mathematical treatment of active devices and their equivalent circuits, sources of distortion, wide-band and pulse amplifiers, and a detailed treatment of feedback amplifiers and using pole-zero and root-locus techniques; types include audio, video, pulse, driver, operational, and distributed amplifiers. Coreq: Math 4510 or 4710.

5520-90 Electronic Switching Circuits (3, 3, 3) Emphasis on active devices; includes clipping circuits, clamping circuits, comparators, multivibrators, flip-flops, bistable circuits, and negative-resistance circuits, time-base generators, blocking oscillators, gates, counting and timing circuits, synchronizing circuits, and circuits for frequency division. Emphasis is placed on the transient response and high-speed operation. Coreq: Math 4510 or 4710.


5610-20-30 Analog Computers (3, 3, 3) Analog computer simulation of linear and nonlinear differential equations; problem set-up; scaling and computer errors. For non-engineering majors only. Prereq: Introduction to Differential Equations and Elementary Linear Algebra, and Calculus of Several Variables. 4 labs.

5625 Introduction to Switching Theory (3) Number system and codes; error-detection and error-correction techniques; finite state machines; Boolean algebra; functional blocks. For non-engineering majors only. Prereq: Introduction to Differential Equations and
5535 Introduction to Digital Computer Design (3) General organization of digital data processor; computer architecture; memory unit; arithmetic unit; control unit; input-output. For non-engineering majors only. Prereq: 4625. 4 labs.

5560-60 Electronic Communication Systems (3, 3) Theory of information transmission in communications systems; mathematical treatment of modulation and demodulation in analog and digital systems; bandwidth requirements, noise, system performance in noise. All modern systems are considered and compared with emphasis on digital data systems. Prereq: 4625. 4 labs.

5670-90 Introduction to Pattern Recognition (3, 3) (Same as Computer Science 5640-50.)

5690 Introduction to Artificial Intelligence (3) (Same as Computer Science 5610.)

5710 Random Process Theory for Engineers (3) Probability and random variables as approaches by set theory. Statistical averages and transformations; random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral analysis applied to response of systems to random signals.


5740 Digital Processing of Signals (3) Analysis of discrete-time signals; sampling theorem and its implication; frequency domain design of digital filters; time domain design of digital filters; quantization effects; processing of digital signals using Fourier transform. Prereq: 4100 or equivalent.


5770 System Identification (3) Presentation of various identification schemes including deterministic, stochastic and time-frequency methods. This course has particular applications in all areas of engineering and science. Prereq: Consent of instructor.

5800 Power Transmission Lines (3) New and unconventional power transmission systems. Transmission line parameters for overhead and underground lines. Corona and radio interference of high voltage transmission. Insulation coordination and protection. Design procedures for high voltage transmission. Prereq: 4410-20-30 or equivalent.

5810-20 Electromagnetic Fields (3, 3) Vector analysis; electric circuits; static electricity and magnetism; the behavior of electromagnetic waves, traveling waves, Klystron, magnetrons, traveling wave amplifiers and backward wave oscillators. Prereq: 5820.

5860 Electromagnetic Wave Propagation (3) Supplementary studies in wave propagation in isotropic, anisotropic, and layered media. Traveling waves, power, stored energies, propagating and non-propagating modes, orthogonality properties, boundaries 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 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 peripherals. The structure and operation of a computer system is 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

6240 Advanced Systems Theory (3) Advanced analytical methods for systems with deterministic inputs; treatment of discrete-data, non-stationary, and linear systems. Prereq: 5070-80 or equivalent.


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: 5240-50-60 and consent of instructor.


6500-10 Electrical Conduction in Gases and Plasma Physics (3, 3) (Same as Physics 6500-10.)


6660 Electromagnetic Diffraction and Scattering (3) Diffraction of electromagnetic waves by antennas and other structures; the multipath propagation problem, introduction to modern approximate methods, creeping waves. Prereq: 5810-20 and Math 4250 and 4550.


6780 Coding Theory (3) Presentation of the mathematical structure of algebraic 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.


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.

Professors:


Associate Professors:


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 in-
clude 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 or 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 and acquiring 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 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 or 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 36 quarter hours is required. The requirements include the following:

<table>
<thead>
<tr>
<th>Hours Credit</th>
<th>Plan I</th>
<th>Plan II</th>
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<tbody>
<tr>
<td>Mathematics</td>
<td></td>
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<tr>
<td>Engineering Courses (Major option)</td>
<td>18</td>
<td>27*</td>
</tr>
<tr>
<td>Related Courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses)</td>
<td>9</td>
<td>12</td>
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<tr>
<td>Thesis</td>
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*Engineering courses under Plan II may include advanced laboratory work or special problem work, for example E.S. & M. 5910 or analogous courses in other departments.

A final examination is required under both plans, covering graduate course work and the thesis (if any).

THE DOCTORAL PROGRAM

General policies and requirements of the Graduate School relating to admission, residence, languages, 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 108 quarter hours credit beyond the undergraduate degree exclusive of credit for the Master's thesis. These shall include a minimum of 36 quarter hours credit in Doctoral Research and Dissertation and a minimum of 72 quarter hours credit in other courses.

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 or her advisory committee.

3. A minimum of 18 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 nine 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 students at the completion 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.


3410 Introduction to Biomedical Engineering (4) Designed to introduce the facets and opportunities of Biomedical Engineering and to provide basic terminology and background knowledge for further courses in the field. Subjects include anatomy, physiology, biomechanics, mathematical models of body systems, etc. Coreq: Multivariable calculus and linear algebra or consent of instructor.

3420 Introduction to Clinical Engineering (3) Designed to train students in life sciences, health professions, and the use and applications of medical instruments. Body systems are introduced, and instruments used in control of these systems are explained and demonstrated. Prereq: 3410 or consent of instructor.

3430 Perspectives on Medical Ceramics (3) Details development of implant material from both an engineering and a medical viewpoint. Demonstrates results of combined efforts of physician and biomedical engineer. Audiovisual aids and models are used to reinforce lecture topics. Prereq: 3410 and Engineering Materials I.

3439 Medical Ceramics Laboratory (1) Surgical and observations and laboratory experiments to illustrate design and application parameters. Design project or paper required. Coreq: 3430.

3520 Materials Behavior and Chemical Process Equipment Design (3) (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; work-energy; impulse-momentum. Not for departmental graduate credit. Prereq: Elementary Statics and Dynamics or Basic Mechanics II. Coreq: Math-Multi-Variable Calculus and Linear Algebra.

3710 Intermediate Dynamics (3) Introduction to three dimensional dynamics of particles and rigid bodies; dynamics of bodies with varying mass; kinematics of rotating coordinate systems; LaGrange's equations. Prereq: Dynamics and 2nd quarter 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 activities. Fluid flow phenomenon, pressure measurement methods, and basic bacteriological and mycological tests will be demonstrated. Course identifies new and critical role for biomedical engineering in health care systems, and includes analysis of hospital facilities and monitoring systems. Prereq: 3410 or consent of instructor.

4430 Orthopaedic Biomechanics (3) Introduction to engineering principles and applications in orthopaedics and rehabilitation. Topics include statics, Newton's laws of motion, stresses in simple sections, engineering materials, and biological materials. Prereq: Consent of instructor.

4500 Applied Mechanics for Life Scientists (4) Concise and broad coverage of basic principles and concepts of mechanics. Fundamental concepts, statics, vibrations, continuum mechanics and properties of materials. Applications in engineering and medicine. Prereq: Analytic Geometry and Calculus of a Single Variable or consent of instructor.

4520 Biomedical Fluid Mechanics (3) Discusses objectives, review foundations and present developments in biomedical fluid mechanics. Properties of human blood and blood vessels, determinants of cardiac performance, analysis and measurement of blood flow and flow characteristics in biological systems. Project and/or term paper required. Coreq: 4520.

4529 Biomedical Fluid Mechanics Laboratory (2) Measurement of blood flow characteristics in biological systems. Project and/or term paper required. Coreq: 4520.

4530 Biomechanics (3) Discusses objectives, review foundations and present developments in areas of mechanical properties of living tis-
Mechanics of Viscous Flow (3) Role of viscous forces in flow phenomena; application of the Navier-Stokes equations; emphasis on numerical methods of solutions; Introduction to streamline methods of laminar flow analysis. Prereq: Math 4610. (Same as Chem. Engr. 5610.)

5230 Non-Newtonian Fluid Mechanics (3) (Same as Chem. Engr. 5620.)

5270 Hydrodynamic Stability (3) Stability of flow systems; Karman vortex street, linearized equations of motion for small disturbances and methods of solution for real boundary conditions; emphasis on characteristics of the solutions to the disturbance equations and modes of instability manifested in jets, plane interfaces accelerated normally, flow between rotating cylinders, superposed fluids moving relative to each other, boundary layers on concave surfaces, vortex streets and unidirectional flows. Prereq: 5110-20-30. Coreq: Math 5610.


5410 Theory of Elasticity (3, 3, 3) Strain, strain in three dimensions; torsion and bending of prismatic bars; axisymmetric stress distribution; stress concentration; plane stress, plane strain. Prereq: Math 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 of solids; quasi-static problems; vibrations problems; stability problems; fourth-order and dimensional linear viscoelasticity. Prereq: Math 5800.


5640: 2 hrs and 3 labs.

5710-20 Advanced Dynamics (3, 3) Physical laws relative to translating and rotating reference frames; rigid body dynamics; variational methods; Lagrange's equations; Hamilton's principle. Prereq: 3710 or 4710. Math 4610.

5730 Advanced Vibrations (3) Vibrations of multiple degree of freedom lumped parameter systems. Iterative and approximate solutions. Introduction to random vibrations. Prereq: 4710 and 4850.

5740 Vibrations of Continuous Media (3) Equations of motion for strings, rods, beams, membranes, plates, and shells; natural modes and frequencies; response of damped and undamped components to applied dynamic loads; approximate methods of solution. Prereq: 5410 and Math 4550.

5750 Orbital Mechanics (3) Planetary, satellite, and restricted three-body problems; orbital perturbations; classical principles of minimization. Prereq: 3710 and 4710.


5820 Structural Mechanics (3) Linear analysis of structures by use of elementary methods; linear elastic structures; Introduction to structural vibrations and stability. Prereq: 5840.


6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) Critical survey of literature on advanced convective motion; heat, mass and transfer; boundary layer theory based on the Navier-Stokes equations; boundary layer flow; introduction to nonuniformity concepts; turbulence; turbulent boundary layer flow; high speed flow of phenomena in nonreacting and reacting systems. Prereq: 5110-20-30 (or equivalent); Math 4610, 4540-50, 4710. (Same as Environmental Engr. and Mech. Engr. 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.


6340 Theory of Plasticity (3) Yield conditions; strain hardening; general constitutive equations; plastic potential; uniqueness theorems; extremal and variational principles; problems in plasticity, plasticity effects; Kolmogorov's hypothesis; large and small eddy structure by turbulent flows; turbulent diffusion by continuous movement; applications to turbulent jets, wakes, pipe flow, and boundary layers. Prereq: 5110-20-30. Coreq: Math 5610-20-30.

6610 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, photothermoelasticity, photoplasticity and photoviscoelasticity, recent developments in photoelasticity. Prereq: 5640, 5420 and consent of instructor. Prereq: Math 4610.

6710 Impact and Stress Waves in Solids (3) Mechanical impact; wave propagation in elastic solids; impact and waves in elastic rods, beams, and plates; contact problems in impact of elastic bodies; inter, dynamic interaction; linear and nonlinear elastic structures; linear viscoelastic and plastic materials; dynamic
properties and materials. Prereq: Math 5630.

6800 Advanced Continuum Mechanics (3) Prereq: Math 5620 or M.E. 5410, or Met. Engr. 5640 or equivalent. (Same as Chem. Engr. 6800.)


8840 Nonlinear Mechanics (3) Development and solution of governing equations for nonlinear mechanical systems; free, forced and self-sustained vibrations; large deflections of strings, bars, and membranes; nonlinear particle dynamics. Prereq: 5800 and Math 4500.

6919 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:**

- D. C. Doulet (Head), M.S., Tennessee, P.E.
- H. P. Emerson (Emeritus), B.S. Massachusetts Institute of Technology, P.E.; R. M. LaForge, M.S., Georgia Institute of Technology, P.E.; H. L. Loveless, M.S., North Carolina State, P.E.

**Associate Professors:**

- D. H. Hutchinson, Ph.D., Georgia Institute of Technology, P.E.; D. H. Pike, Ph.D., Florida; J. N. Snyder, Ph.D., Ohio State, P.E.; W. G. Sullivan, Ph.D., Georgia Institute of Technology, P.E.

**Assistant Professors:**

- W. W. Claycombe, Ph.D., Virginia Polytechnic Institute, P.E.; J. D. Duncan, Ph.D., Kansas State; M. L. Carnall, P.E.; K. M. Goodman, M.S., Tennessee, P.E.; T. M. West, M.S., Tennessee, P.E.

**MASTER OF SCIENCE 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 three-hour design project is available.

Graduate work in industrial engineering provides for concentrations in operations research, human factors, systems engineering, reliability, work measurement, facilities planning and engineering economy. Either one or two minors can be elected in engineering, mathematics, psychology, business, computer science, statistics or economics.

**4060 Production and Inventory Systems (3)** Fundamentals and applications of statistical forecasting for production planning, inventory analysis and control techniques, production planning, scheduling, capacity planning, analysis and production scheduling and control models. The overall production process as an integrated system. Prereq: Industrial Operations Research I and Industrial Operations Research II. Not available for graduate credit for Industrial Engineering students.

**4080 Forecasting Methods in Industrial Engineering (3)** Application of technological forecasting 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 industrial forecasting techniques. Prereq: 4060.

**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 analysis, multi-project control, and computer programs. Prereq: Statistics 3450.


**4170 Automatic Process Control (3)** Characteristics of automatic processes and controllers; elementary open and closed loop control systems; feedback to industrial control system. Prereq: Introduction to Differential Equations, and Dynamics.

**4230 Scheduling Systems (3)** Performance measures for job shop and flow shop scheduling, including both static and dynamic conditions. Techniques for generating production schedules. Deterministic and probabilistic dispatching conditions. Prereq: Industrial Operations Research II.

**4240 Pre-determined Time Systems (3)** Work design and measuring using a predetermined time system such as methods time measurement, work measurement, and no-time-factor methods. 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.

**4260 Engineering Economy (3)** Methods and problems in the selection or replacement of equipment. Depreciation, investment, engineering economics, profitability, capital recovery, monthly rate of return on investment. Not available for graduate credit for Industrial Engineering students.

**4350 Case Studies in Engineering Economy (3)** Extension of basic engineering economy principles to actual problems faced by competitive firms and regulated industries. Case studies taken from literature form basis of course 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: 4260.

**4540 Industrial Development (3)** Factors other than mechanical or chemical which enter into the successful establishment of manufacturing enterprises. Cost studies and market analysis to determine the commercial feasibility of new plants or projects.

**4590 Simulation (3)** Generation of output of a complex random process by computer. Models to be applied include Markov chain, simulation languages. Simulation as a design tool in industrial systems. Prereq: Computer Science 3150.

**4810 Human Factors in Work Design II (3)** Human factors and limitations affecting work place layout, working environment, design of tools and equipment, and communications and response in man-machine systems.

**Prereq:** Work Measurement, General Psychology. Not available for graduate credit for Industrial Engineering students.

**4830 Health Systems Engineering (3)** A study of hospital management, in the means by which they may be improved through the application of modern health systems engineering principles and techniques. Prereq: Work Methods and Design.

**4860 Systems Analysis (3)** Matrices and linear vector spaces for systems models. Laplace and Z-transform techniques and applications. Description and modeling for system processes and systems. Prereq: Introduction to Differential Equations, linear algebra. Not available for graduate credit for Industrial Engineering students.

**4910-20-30 Special Industrial Engineering Topics (3, 3, 3)** Open with consent of instructor. May be repeated.

**4950 Safety Analysis (3)** Development of organization and programs for prevention and control of accidents with emphasis on OSHA Rules and Regulations.

**5000 Thesis**

**5110 Work Design (3)** Advanced methods analysis embodying the design and improvement of work systems, human factors, workers' responses and individual participation. Prereq: Motion and Time Study or Work Methods and Design.

**5210 Advanced Work Measurement (3)** Characteristics of some of the better known predetermined time systems, application to formula construction, and practice in application. Prereq: Motion and Time Study or Work Methods and Design.

**5240 Facilities Planning and Design (3)** Modern materials handling techniques, computer-aided layout techniques, applications of operations research models, and the use of these to design a manufacturing facility. Prereq: Production Facilities Planning.


**5260 Information Systems Design (3)** Systems engineering approach to 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 decision making under conditions of incomplete information. Bayesian and Neyman-Pearson statistical decision models, utility functions, value of information, and quadratic loss analysis and parallel and sequential decision processes. Prereq: 4520 and 5520.


**5520 Advanced Engineering Economy (3)** Modification of engineering economy techniques for decisions under risk and uncertainty. Solutions to problems requiring evalu-
4520

78 College of Engineering

5600 Human Factors Engineering (3) Study of the characteristics of man with emphasis on the design of work environments and products. Particular attention given to the modeling of man as a process or system controller. Prereq: Introduction to Engineering.

5610 Human Factors Engineering (3) The human operator, his performance characteristics, and his environmental requirements. Emphasis is given to the formal description of human operator transfer characteristics through both quasi-linear models and models describing the operator as an information-processing system. Prereq: 4510.

5700 Optimization Methods in Industrial Engineering (3) An introductory course in optimization research. Analytical techniques required in 5710, 5720, and 5730 are presented. Applications of classical optimization theory, N-dimensional geometry and the calculus of variations, to selected areas of operations research. Prereq: Math 4050.

5710 Linear, Quadratic and Dynamic Programming (3) An introduction to mathematical programming. Topic includes linear programming, quadratic programming, and dynamic programming. Applications include computer solutions to programming problems. Prereq: 5700.


5730 Game Theory and Random Processes (3) Additional topics in operations research including game theory with applications to decision making in a competitive environment, and random processes with applications to queueing, inventory models and decision making. Prereq: 5700, Statistics 3450.


5830 Health Systems Engineering II (3) Specific functions of health systems are analyzed for integration of health systems (DSS). The student's advisor will assist in planning the program of study to ensure that it meets the DSS content requirement. Prereq: 5830.


5860 Industrial Systems Engineering (3) State variable methods for analysis and design of continuous and discrete systems. Computer methods for systems analysis. Introduction to system optimization with emphasis on 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 non-thesis 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 (3) Study of operations research models to analyze and design productive systems. Emphasis will be given to the statistical analysis of systems and the development of models for analysis and decision making. Prereq: 5520, 5710.

6700 Nonlinear Programming (3) Development of optimization techniques for static and dynamic nonlinear systems subject to various constraints. Emphasis will be given to nonlinear optimization theory to solve nonlinear optimization problems. Prereq: 5710.

6730 Dynamic Programming (3) Techniques for solving multistage optimization problems as a consequence of time. Prereq: 5710. Emphasis will be given to the computational problems. Prereq: 5710.

6740 Advanced Topics in Optimization of Dynamic Systems (3) Advanced topics in multistage optimization. Topics include state dependent dynamic programming, adaptive control, and selected topics. Prereq: 6730.

6910 Advanced Topics in Industrial Engineering (3) Selected topics of current interest. Topics may cover those not covered in other graduate courses. The course will provide a forum for advanced graduate students to study individually or in group as appropriate. Prereq: Graduate standing and consent of instructor. May be repeated with consent of department.

Mechanical and Aerospace Engineering

MAJORS

Aerospace Engineering

M.E., M.S., Ph.D.

Mechanical Engineering

M.E., M.S., Ph.D.


GRADUATE STUDY PROGRAMS

Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy with specialization in mechanical engineering or aerospace engineering are available to graduates of recognized undergraduate curricula in mechanical or aerospace engineering and to graduates of other curricula who satisfy the necessary prerequisites. The general policies and requirements of the Graduate School apply to these programs. Departmental graduate programs are also available at the Space Institute, Tullahoma.

MASTER OF SCIENCE PROGRAMS

The student must satisfactorily complete a program of study which has been approved by the student's advisory committee. At least one-half of the program of study must be engineering courses in mechanical or aerospace engineering and normally nine quarter hours of course work (4000-level or above) in mathematics.

1. The Thesis Program. The requirements are:

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 nine quarter hours of course work (4000-level or above) in mathematics.

2. A minimum of nine quarter hours of credit in thesis.

3. Participate in the departmental seminar program.

4. Submit and defend a written thesis which demonstrates the ability to conduct and report research on an independent investigation.

5. Pass a final examination on all work submitted for the degree.

II. The Course Program.

Normally, this program is restricted to those students who have had significant engineering work experience. The evaluation of the work experience and the final selection of the student's program of study are left to the student's advisory committee. The requirements are:

1. A minimum of 45 quarter hours of course work which includes at least 27 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally nine quarter hours of course work (4000-level or above) in mathematics.

2. Participate in the departmental seminar program.

3. Pass comprehensive written and oral final examinations on all
course work submitted for the degree. The student's committee will be of sufficient size to include at least one faculty member from a study area not reflected in the course program.

III. The Problems Program. The requirements are:
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 include prior quarter hours of course work (4000-level or above) in mathematics.
2. A minimum of nine quarter hours credit in Selected Engineering Problems (5900).
3. Participate in the departmental seminar program.
4. Pass a comprehensive written final examination on all course work submitted for the degree and an oral examination on all work (including problems) submitted for the degree.

DOCTORAL PROGRAM

Students applying for entrance into the doctoral program must display evidence of ability to perform and report independent study. The Master's thesis may be offered as such evidence. 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.
2. A minimum of 36 quarter hours of credit is 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 or aerospace engineering courses numbered 3000 and above, with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.
5. The student's doctoral committee determines if a reading knowledge of one or two languages is required.
6. Participate in the departmental seminar program.

GRADUATE CREDIT FOR NON-MAJORS

Junior (3000-level) and senior (4000-level) mechanical and aerospace engineering courses may be taken for graduate credit by non-mechanical or non-aerospace engineering majors, if approved by the student's major department. Mechanical or aerospace engineering majors may not normally use more than one 4000-level engineering course to meet their advanced degree requirements. Graduate students should consult with instructors regarding prerequisites for undergraduate courses.

Mechanical Engineering

3000 Energy—An Overview (4) Introduction to available energy resources, recovery and utilization; power generation techniques including conservation schemes; emphasis on the resources-environment-man interaction associated with energy; primarily for non-engineering students.
3110-20 Applied Engineering Thermodynamics (3, 3) Energy and laws governing energy transformations; thermodynamic properties; applications of engineering problems. Prereq: College physics and calculus.
3311 Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties. Prereq: College physics and calculus.
3320-30 Engineering Thermodynamics (3, 3) Properties of gases and gas mixtures; chemical reactions; equilibrium; applications to mechanical and aerospace engineering problems. Prereq: College physics and calculus.
3410 Fluid Flow (3) Development of continuity, momentum and energy principles for fluid systems; applications to mechanical and aerospace engineering problems. Prereq: College physics and calculus.
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. Prereq: College physics and calculus.
3510 Mechanics of Machinery (3) Machine motions, graphical methods; instantaneous centers; velocities; accelerations. Prereq: Dynamics and calculus.
3620 Mechanics of Machinery (3) Newton's laws; work, energy, impact; single degree vibrating systems. Prereq: 3311.
3630 Mechanics of Machinery (3) Multiple degree vibrating systems; static and dynamic forces; balancing; vibration isolation. Prereq: 3620, 3910.
4150 Energy Conversion Systems (3) Direct and indirect methods of electricity operating and design characteristics of selected direct conversion systems. Prereq: 3330, 3440, and 4510.
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. Prereq: 4140 and 4420.
4170 Turbo-Machinery (3) Basic principles of turbo-machinery; systematic methods of analysis, design, and evaluation. Prereq: 3530 or Aerospace Engineering 3510.
4180 Energy Production and Utilization (3) Thermodynamic constraints on energy production; comparison of power generation methods; evaluation of new energy sources and concepts; energy conservation schemes.
4450 Lubrication (3) Hydrodynamic theory of lubrication of sliding bearings; application of Navier-Stokes equations to infinite and finite bearings; analytical and numerical solutions; applications to design. Prereq: 3440. Coreq: Aerospace Engineering 3510.
4471-81-91 Experimental Mechanical Engineering (3, 3, 3) Experimental methods and measurements including instrumentation, controls, analog devices, flow measurement, physical property measurement, testing standards and the planning, conducting, analyzing and reporting of experimental tests. Prereq. for 4471: 3330, 3410, 3440, and 3850; for 4481: 4471, 3630 or 4420.
4510 System Dynamics (4) Analytical models of physical systems, linearization, Laplace transforms, dynamic characteristics and stability of systems, numerical simulations, and analog computer solutions. Not for departmental graduate credit. Prereq: 3630 or Aerospace Engineering 3620.
4520-30 Creative Design (3, 3) Application of engineering principles to the solution of current problems with emphasis on design innovation.
4621 Manufacturing Processes (3) Comparison of machining methods; plastics production; metallography. Prereq: 3650 or Manufacturing Materials and Processes; Met. Engr. 3110.
4622 Tool Design (3) Principles underlying tool and die design, design of high-volume production tools and molds, work holding fixtures. Prereq: 4621.
4624 Manufacturing Engineering Systems Design (3) Design of manufacturing system for a particular product: Manufacturing planning, tool and fixture design, selection of manufacturing operations, redesign of product to reduce cost.
4625 Manufacturing Process Engineering I (3) Product Specification: dimensional analysis of size and form; true position tolerance theory; tolerance analysis; and workpiece control for production to tolerance. Prereq: Materials and Manufacturing Process or Manufacturing Materials and Processes.
4633 Matrix Analysis (3) Application of matrices to solution of complex structures and lumped parameter vibrating systems. Prereq: 4632.
4660 Materials and Manufacturing Processes (3) Selection of materials and processes; relationship to design and manufacture. Prereq: 3650.

4730 Thermal Environmental Systems (3) Design of refrigeration and air conditioning systems. Prereq: 4720.

4810 Internal Combustion Engines (3) Thermochemical phenomena in internal combustion and propulsion engines. Combustion, detonation; equilibrium; dissociation. Analysis of internal combustion engines using ideal and real fluids. Prereq: 3350, 3440.


4910-20-30 Selected Topics in Mechanical Engineering (3, 3, 3) Problems related to developments and practice in mechanical engineering.

5000 Thesis


5120 Convection Heat Transfer (3) Equations of viscous fluid flow, energy equation, convection analysis of fluid mechanics and internal 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 analyses, 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 description in fluid mechanics; derivation of basic equations; two-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.

5640 Advanced Fluid Mechanics (3, 3, 3) Advanced topics in fluid mechanics. Prereq: Consent of instructor.

5660 Advanced Material Design (3, 3) Design of bearings, gears, shafting, lubrication.

5760-80-90 Dynamics of Machinery (3, 3, 3) Dynamics of machinery; vibrations; balancing; fly-wheels and governors.

5710 Metal Machining (3) Analytical approach to the mechanics of machining. Detailed treatment of basic phenomena-plastic flow, fracture, form change, and wear. Prereq: Undergraduate metallurgy and materials behavior, and heat transfer.


5840-50-60 Turbo-machinery Systems (3, 3, 3) Theory and practice of design, development and systems integration of turbo-engine 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 electro-mechanical systems. Techniques for experimentally determining system parameters. Analog and digital computer simulation techniques. Prereq: Undergraduate dynamics, heat transfer, and fluid mechanics.

9000 Selected Engineering Problems (3-9) Selected problems in mechanical engineering to fulfill the requirement of the Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.

9500 Seminars (1) Discussions on all phases of mechanical engineering, including reports on current research at The University of Tennessee, Knoxville. S/NC only. May be repeated.

9990 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 Engr. Mech. 6110-20.)

6130-40 Advanced Radiation Heat Transfer (3, 3) Radiation heat transfer in absorbing, emitting and scattering media; the interaction of thermal radiation with convection and convection heat transfer; radiation heat transfer in hyper sonic flow; radiative characteristics of luminous flames and non-uniform gases; scattering by planetary atmosphere. Prereq: 5110-20-30, Math 4550.

6420 Selected Topics in Thermodynamics (3) Compressible flow analysis; equilibrium of the pure substance; metastable states. Prereq: Consent of instructor.

6430 Selected Topics in Thermodynamics (3)

6610 Engineering Vibrations (3) Mechanical transients. Linear and nonlinear single degree of freedom systems. Prereq: Consent of instructor.

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 physical elements; linearization and superposition. Elementary natural and forced motions. Dynamic characteristics and stability of systems.


4110 Aerodynamic Fundamentals (3) Atmospheric, dynamic and thermodynamics 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. Prereq: 4110.

4120 Compressible Flow (3) One-dimensional internal flow; shock wave and expansion waves; friction and non-adiabatic flow. Prereq: 3510, Mech. Engr. 3320.


4230 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow; compressibility effects; numerical solution methods. Prereq: 3510, Mech. Engr. 3320, 4420.


4250 Propulsion (3) Principles of propulsion devices; turbo-jet, ram-jet, and rocket engines. Prereq: 4110 or Mech Engr 3130.


4510 Airplane Performance (3) Introduction to airfoil and wing characteristics, drag; propellers; static performance and maneuvers; theory and design of control surfaces; stability. Prereq: 3510.

4510 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

5110 Fundamentals of Aerodynamics (3) Kinematics and dynamics of perfect fluids; potential flow about a body; conformal mapping, hodographs. Prereq: 4220 or ME 5310, Math 4250.

5120 Experimental Methods in Fluid Mechanics (3) A study of experimental techniques with laboratory exercises on fluid mechanics; flow visualization, wind tunnel tests (supersonic and subsonic), water table experiments, tabular flow measurements, boundary-layer measurements. Prereq: 4210-20-30 or ME 5310.

5150-60-70 Air Vehicle Aerodynamics and Performances (3, 3, 3) Application of aerody-
Aircraft (3) Analysis of performance and in-
5560 Vertical or Short Take-Off and Landing
Automatic stability and control . Application to
speed range. Prereq : 4230 and 5530.
surfaces, and empennages over a wide flight
operators. Stability criteria for airfoils operat-
missiles. Prereq : 4230 and 5530.
surfaces throughout the flight speed range.
Prereq: Math 4710.
multibody problems, and trajectory analysis.
Free molecule flows, accommodation coeffi-
cients. Viscous slip and temperature jump chen-
pertinent to the present status and future
Consideration of parameters significant for air
vehicle type selection . Integration of the air
selected experimental
results and test facilities. Prereq: 5220 and
ME 5220.
4220. Introduction to Hypersonic Flow (3)
Blender body flow; similitude; Newtonian theory of
interaction; free molecule and rarefied gas flow. Prereq:
5240.
5260. Selected Topics in Aerodynamics (3)
Further study of transonic, supersonic and
hypersonic flow theories.
5270-80-90 Aerospace Ground Test Facilities
(3, 3) Atmospheric models and similarity
considerations. Aerodynamic test facility
involving wind tunnels, shock tubes, hotheads
and static pressure tubes, and rocket engine
facilities for air breathing and rocket engines.
Space environment. Theoretical and practical con-
siderations of space environmental test
5240. Magneto-hydrodynamics (3) Review
of electromagnetic field theory; chemical kinetics,
thermodynamic and thermophysical properties of
gases, including equations and applications.
Prereq: 4220 and Math 4710.
5340-50 Atmospheric Entry (3, 3) Motion
and heating along ballistic and lifting trajectories;
dynamic stability; heat protection systems.
Prereq: 5220. Recommended: 5240.
5510-20-30 Aerospace Mechanics (3, 3, 3)
Principles of mechanics applicable to aerospace
vehicles including equations of motion, multibody problems,
and trajectory analysis. Prereq: Math 4710.
5540-50 Aerospace Vehicle Stability and Control
(3, 3) Introduction to aircraft stability and
control. Static and dynamic longitudinal, direc-
tional, 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: 4220 and 5530.
5560. Vertical or Short Take-Off and Landing
(3) Introduction to the design of vertical flight
aircraft. Development of the structural and aerodynamic
operators. Stability criteria for airfoils operat-
ing at high subsonic speeds. Prereq: 5550.
5570. Aircraft Propulsion & Performance
Engineering (3) Analysis of performance and in-
aircraft throughout the flight speed range.
Prereq: 4220 and 5530.
and chemical basis of rate equations; flow
with vibrational and chemical nonequilibrium.
Prereq: 6410.
5810. Advanced Boundary Layer Theory (3)
Derivation and critical review of the governing
equations. Asymptotic solutions; similarity
methods; boundary layer transformations. Approx-
nimate integral methods to include com-
pressible, incompressible, and transition to attached and separated flows; shock-wave
boundary layer interaction. Prereq: 5220, ME
5120, and Physics 5630.
5910. Advanced Topics in Gasdynamics (3)
Selected advanced topics in gas dynamics.
The selection of topics will be based on the
special interests and the students registering
for the course. Representative topics may in-
clude non-equilibrium transport phenomena,
radiation gas dynamics, non-equilibrium gasdy-
namics, advanced acoustics, and perturba-
tion techniques. Prereq: Consent of instructor.

Nuclear Engineering

MAJOR: Nuclear Engineering

DEGREES

M.S., Ph.D.

Professors:


Associate Professors:

T. Hoffman, Ph.D. Tennessee; H. C. Roland, Ph.D. Tennessee; O. L. Smith, Ph.D. Missouri.

MASTER OF SCIENCE PROGRAM

A graduate program leading to a degree of Master of Science is available to gradu-
ates of recognized undergraduate cur-
ricula in engineering and physics. Each
applicant will be advised as to the neces-
sary prerequisite courses before he 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 follow-
ing:

1. A major consisting of a minimum of
18 quarter hours of graduate courses in
nuclear engineering.
2. A minor of nine quarter hours in
mathematics.
3. Nuclear Engineering 5000, Master's
thesis.
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 follow-
ing:

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
six hours of Nuclear Engineering 5980 each
quarter and investigates problems as
signed by a member of the faculty. At the
deadline of each quarter the student submits a
written report and makes an oral presentation of his work.

3. Final examination covering graduate course work and practice school problems.

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 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 special competence in nuclear science.

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 Project.
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 5000-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 nine 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 knowledge in a given field.
6. A reading knowledge of one foreign language.

4110-20-30 Introduction to Nuclear Reactor Theory (3, 3, 3) Nuclear structure; radioactive decay laws; neutron interaction; fission process; chain-reacting systems; diffusion equations; coupled-group diffusion theory; neutron moderation; reaction coefficients; perturbation theory. Prereq: Physics 3730 or consent of instructor.

4140-50 Theronuclear Systems (3, 3) Fusion reactions; plasma stability; plasma containment; plasma diagnostics; thermonuclear devices. Prereq: Physics 3730; Math 4550.

4210-20-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation; neutron scattering 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 adjoint flux. Prereq or Coreq: 4110 or equivalent.

4530 Reactor Simulation Laboratory (3) Simulation of reactor design and operation with analog computer; reactor kinetics; single and multigroup transport coefficients; poloning, control rod calibration; power reactor; subcritical assembly. Prereq: 4120.

4610-20-30 Reactor Power Systems (3, 3, 3) Nuclear structure, decay laws, neutron diffusion, time behavior of reactors, heat removal, analysis of reactor power plants; economic, safety, and environmental aspects of nuclear power. Prereq: Math 4610, non-nuclear engineering students only.

4710 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.

4720 Reactor Thermal Design (3) Hydrodynamics and heat transfer in boiling systems; boiling crises; reactor thermal design, steam generator design. Prereq: 4710.

4730 Nuclear Reactor Design (3) First-order reactor design, intergration with non-nuclear heat transfer and power conversion system, economic evaluation; optimization procedures, description of typical systems. Coreq: 4130.

4810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation; shield design. Prereq: Physics 3730, Math 4550.

4820 Reactor Kinetics and Controls (3) Derivation of kinetic equations; basic kinetic parameters; transient response with feedback; control and protective systems. Prereq: 4110.

4840 Nuclear Reactor Safety (3) Presentation of reactor safety concepts and criteria; credible accident analysis; fission product release and transport; containment systems; accident analysis; engineering safeguards. Prereq: 4120, Coreq: 4730 or consent of instructor.

4930 Nuclear Fuel Management (3) Discussion of problems associated with processing of nuclear materials fuel cycle analysis; burn-up calculation. Prereq: 4120.

5000 Thesis

5110-20-30 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 conduits; conduction; radiation; reactor core thermal analysis. Prereq: 4720 or equivalent, Math 4710, 4550.

5210 System Dynamics (3) Transient analysis, Laplace transforms, frequency response, stability (linear and nonlinear), and sensitivity analysis by state variable methods. Dynamic analysis of distributed systems. Prereq: Consent of instructor.

5220 Reactor System Dynamics (3) Application of methods of general system dynamics to reactor systems. Modeling of neutronic and non-neutronic processes. Dynamics, stability, and control of zero power reactors and power reactor systems. Prereq: 5210, 4130 or equivalent.


5240 Reactor Instrumentation (3) Principles and applications of instrument components 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: 4820, or consent of instructor.

5710-20-30 Nuclear Design (3, 3, 3) Development and application of analytical techniques for the neutronic aspect of nuclear reactor core design. Techniques considered are multigroup discrete ordinate theory, multigroup Pn theory, integral transport theory, perturbation theory, and others. The generation of the required multigroup constants is formulated starting with the available point data and using the Nordheim treatment in the slowing down region and gas kernel in the thermal region.

5740 Reactor Shielding (3) Application of analytic solutions of Boltzman transport equation to shield design problems. Spherical harmonics, moments methods, numerical solutions, dimensional calculations, and Consistent Imbedding cases studied. Prereq: 4810.


5840-50 Fast Breeder Reactors (3, 3) Special characteristics of fast breeder reactors, with emphasis on the LMFBR. The need for breders; neutron physics and thermal characteristics of the reactor core; development status of engineering components; fuel cycle cost analysis; safety; coolants other than sodium; world status of development.

5910-20 Advanced Nuclear Reactor Design (3, 3) Factors affecting nuclear reactor design, and optimization with respect to performance criteria. Prereq: Consent of instructor. May be repeated with consent of department.

5980 Nuclear Engineering Practice (3-12) Experiences in solving and reporting on engineering problems. Prereq: Approval of the Nuclear Engineering Department. May be repeated. Only the Alternate Plan students may take this course. S/NC only.

6600 Doctoral Research and Dissertation

6110-20-30 Selected Topics in Reactor Theory (3, 3, 3) Special topics related to reactor theory such as transport theory, control rod theory, and perturbation theory. Selected topics from the literature. Prereq: Consent of instructor.

6140 Radiation Shielding (3) Advanced topics in radiation shielding. Monte Carlo techniques and space radiation problems. Natural space radiators, energy-source radiators, dose conversion, probability, etc. Selected neutron, gamma, and space-radiation shielding problems. Prereq: Consent of Instructor.

6150 Reactor Dynamics (3) Special topics in reactor dynamics and control. Prereq: Math 5630.

6710 Two-Phase Flow and Heat Transfer (3) Pool boiling and flow boiling; hydrodynamics of two-phase flow, boiling crisis, two-phase instabilities. Prereq: 5130 or equivalent.
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. 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 chairman 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*
Crafts, Interior Design, and Housing
Food Science
Food Systems Administration
Nutrition
Textiles and Clothing
Major (includes minimum of nine hours of 5000 courses) 18 hours
Thesis .................................................. 9 hours
Collateral area(s) of study (includes minimum of six hours of 5000 courses) ..................................... 18 hours
(Minimum of 18 hours of 5000-level courses exclusive of thesis.)
Total 45 hours

*Requirements include Crafts, Interior Design, and Housing 5615 or Child and Family Studies 5170, Child and Family Studies 5700 or Planning 5100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5600.

Three-hour course in Research Methods or Statistics.

Twelve hours in Consumer Studies or Housing to include nine hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5000.

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 4340, 5050-60; Finance 5210-20; Political Science 5641, 5670-80, 5710; Library and Information Science 5250.

Housing courses to be selected from Agricultural Mechanization 5110, 5610; Crafts, Interior Design, and Housing 4320, 5615, 5510-20-30; Planning 5360-80, 5450; Geography 5520.

Twelve hours in an area of Home Economics other than the area (Consumer Studies or Housing) chosen above.

Minimum 27 hours in and nine hours outside College of Home Economics.
Minimum of 27 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.

In some instances two related collateral areas may be selected with nine hours in each area and a minimum of three hours of a 5000 course in each.

Collateral area(s) of study may be chosen in an area other than in home economics with the approval of the appropriate professors.

An oral examination is required.

Note: Nine hours is the maximum credit allowed for special problems work and
community services and planning to meet development needs of individuals and families. \textit{Physiological Development and Well-Being} in man throughout the life cycle. Emphasis for particular age groups may be on: physiological response to nutrient intake; improvement of nutritional status through informed community action; cultural, economic and technological influences on food selection. \textit{Environmental Factors}—design, housing, food service systems, clothing, textiles, and crafts as they relate to human needs. Emphasis may be on the impact of: cultural, sociological, psychological, and economic change; technological developments; esthetics in improving the quality of the environment. \textit{Consumers’ Economic and Social Well-Being} throughout the life cycle. Emphasis may be on: the relationship between family structure and decision-making processes in the use of human resources; the effects of social, macro- and micro-economics and political development on consumption patterns and other behavior; community programs to meet the socioeconomic needs of consumers.

(3) Fifteen to 24 hours in cognitive or supporting courses (mainly from departments in other colleges in the University) including courses to give sufficient competence in statistics or research methods needed for dissertation research. Additional courses will complement the option emphasis and dissertation research area.

(4) 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 5520 or Food Systems Administration 5210; six hours from Food Science 5610-20-30-40, 6110, Food Systems Administration 6110, 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 nine hours may be substituted for 5000 and 6000 courses in Nutrition.

(3) Minimum of four 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 Arrowmount School of Crafts. The program provides advanced instruction in designer-created crafts through classes taught by nationally known craftsmen. Cooperation with national and local craft organizations has so stimulated the work of craftsmen throughout the area that their work has gained national recognition. See also page 86.

**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 level, programs of study may be planned in the Interdisciplinary or in the Food Science or the Nutrition options. At the master’s degree level, the 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. Students 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**

<table>
<thead>
<tr>
<th>MAJORS</th>
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<tr>
<td>Child and Family Studies</td>
<td>M.S.</td>
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<tr>
<td>Consumer Studies and Housing: Public Policy</td>
<td>M.S.</td>
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<tr>
<td>Home Economics</td>
<td>Ph.D.</td>
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4210 Family Financial Problems (3) Analysis of alternate ways of meeting financial problems encountered during the family life cycle. Prereq: 9 hrs in social sciences. Recommended as prerequisite to beginning thesis work in this area. May be repeated with consent of instructor. 1 hr lab. Maximum 9 hrs.

4220 Converting Time and Energy in the Home, School, and Community (3) Evaluation of management principles to homemaking activities; evaluation of equipment, work centers and work procedures in terms of time and energy demands. Adaptation of the handicapped for school and home. 3 hrs energy and 3 hrs sociological equivalent.

4230 Development in Infancy (3) Development during the prenatal period and first fifteen months of life. Interaction between infant and environment. Review of research relating to infant crying and prediction of later behavior. Prereq: Human Socialization and Human Physiology, or equivalent.

4250 Development in Late Stages of Life Cycle (3) Adult life in our society. Adjustment to internal and environmental changes through middle and aged ages. Prereq: Human Socialization, 3 hrs psychology, and 3 hrs sociological equivalent.

4350 Advanced Child Development (3) Survey of selected theories relevant to child development with emphasis on research literature and research methodology. Prereq: 5410 and 5530 or consent of instructor. 6 hrs child development or equivalent.

4420 Learning Experiences with Parents (3) Dynamics of parent-child interaction. Emphasis on a variety of techniques for developing communication and working relationships between parents and teachers 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.

4610 The Child in the Community (3) Needs of child; community agencies meeting these needs; visits to agencies contributing to the welfare of children. Prereq: Human Socialization 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 deprived preschool children. Prereq: 4110 or equivalent.

4630 Field Work in Child, Family and Consumer Studies (3-15) Opportunity for students to work in schools, child 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 and contemporary 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; development of goods; grading, branding, labeling; advertising; consumer practices affecting costs; specific household commodity information. Prereq: Principles of Economics.

4840 Generational Relations and Family Life Styles (3) The historical, economic, and social experiences of different generations, their influence on relations within and across generational groups, and implications for family life.

5000 Thesis

5060 Practicum (1-12) Field experience in selected agencies and organizations that focus 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 standard of living. Review of major consumption studies. Prereq: CIDH 4320 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 the instructor.


5170 Consumer Economics (3) Consumer functions in the economy; structure of consumer markets; government action relating to consumer affairs; factors affecting prices of consumer goods.

5180 Management of Family Finances (3) Financial problems of families; adjustments necessary in family financial plans under changing conditions.

5210 Theories of Child Development (3) Major theories of child development. Prereq: 4350 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 Sexualities and Sex Roles (3) Examination of multidimensional aspects of human sexuality. Review of major contributions from anthropological, sociological, and personality theory and research.

5410 Advanced Family Relationships (3) Problems in family life; individual adjustments, group relationships.

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 Interaction in Emotionally Disturbed Families (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.


5540 Teaching-Learning Process in Preschool Programs (3) Multidimensional aspects of teacher's role in nursery school and day care programs. Emphasis on guiding children in groups. Prereq: Previous experience in a laboratory nursery school and consent of instructor. 3 hrs and 1 lab (2 hrs).

5550 Supervision in Preschool Programs (3) Emphasis on guidance of students working in nursery schools and day care centers. 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 Nursery School Administration (3) Organizing and operating schools and play groups for preschool children. Housing, staff, schedules, programs, financing, etc. 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 an understanding of child development and family relationships. Prereq: Consent of instructor. S/NC only.


5800 Problems in Child, Family and Consumer Studies (1-3) Advanced study selected from the field of child development and family variables in family planning programs. Internship in planned parenthood programs and clinics. May be repeated. Maximum 9 hrs.

5840 Family Planning Programs (3) Community and family planning programs. Internship in planned parenthood programs and clinics. 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.


6310 History of Child Development (3) History of the development of the field. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6310 Individual and Family Development. Physiological Determinants (3) Selected aspects of ...
of family members' 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, 4 hrs physiology, or equivalents.

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, 5630, or equivalents.

6330 Individual and Family Development: Socialization (3) Processes of socialization throughout the life cycle. Focus on the family as a primary socializing agent. Prereq: 5210, 5410, or equivalents.

6410 Theories of Family Interaction (3) Review of theories of the family's social interaction. Emphasis on critical evaluation of theoretical formulations of contemporary research on family behavior. Prereq: 5410 or equivalent.

6450 Conceptual Frameworks for the Family (3) Theoretical and research models for understanding families. Exploration and applications of frameworks on both theoretical and research levels. Historical and contemporary development of family studies. Prereq: 5410 or consent of instructor.

6540 Seminar in Programs for Infants and Preschool Children (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.

6610-20 Contingency Management Programs for Disadvantaged Children (6, 6) Direct application and evaluation of methods designed to modify variant behavior exhibited by children from disadvantaged families. Students will receive supervision in organizing and training agents in the child's social community. Both students' and agents' behavior will be guided by principles derived from operant reinforcement theory. Prereq: 5420. May be repeated.

Crafts, Interior Design, and Housing

MAJORS DEGREES
Crafts, Interior Design, and Housing M.S.

Consumer Studies and Housing: M.S.

Public Policy Ph.D.

Home Economics


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 integrated only in so far as the experimentation with these contributes to the philosophical and creative orientation of the designer-craftsman. 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 his 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).

ARROWMONT SCHOOL OF CRAFTS
Graduate students in the area of crafts have a unique opportunity to participate in the summer program at the 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-craftsmen who offer, in many instances, approaches different from those of the resident faculty; this further enriches the student's program of study. Therefore, students are required to attend the Arrowmont School of Crafts during the summer term(s) and to pay the additional registration, tuition, and laboratory materials fees required by that School.

ACQUISITIONS AND EXHIBITIONS

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 undergraduate studio work to the department. This portfolio may include slides or original work.

4110 Home Wiring and Lighting Requirements (3) Service of electricity in modern homes; evaluation of materials and wiring plans in terms of family desires and need for equipment. 1 hr and 2 labs.

4130 Contemporary Design (3) Furnishings and interiors: economic, technological and sociological influence on the development of design; changing living conditions; interrelation of architecture and furnishings. Significant designers and their work.

4140 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 as they relate to promotion, design construction, display and evaluation for two and three dimensional displays. Annual Student Craft and Interior Design exhibit curates quarter. Prereq: Introduction to Related Arts or equivalent.

4155 Interior Space Planning I (6) Analysis, planning and design of the office environment; includes contract specifications.

4156 Interior Space Planning II (6) Studio problems involving large scale non-residential interior spaces such as restaurants, transportation facilities, stores, institutions, etc. Prereq: 4155. Consists of instruction and experience planned to explore strengths, structural and formal characteristics.

4310 Crafts in America (3) Craft movement; factors that contributed to growth and development. Educational, social, economic, recreational and therapeutic values of crafts. Place of craftsman in society as producer, teacher, designer for industry.

4320 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.

4330 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.

4410 Craft Media (4) Possibilities and limitations of craft media; understanding educational and social values of craft work. Designing and executing craft program by using inexpensive materials and tools. 3 labs.

4420 Leather Design (4) Relationship of design to function, techniques, and materials. Creating leather objects of original design. 1 hr and 2 labs.

4430 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

5040 Seminar in Design (3) Intensive reading, discussion and critical evaluation of 20th century design concepts, the men, the motivation and the creative components leading to visual innovation.

5050 Advanced Design Studio (3) Studio experience planned to explore strengths, structural variability, and form potentials of design materials, searching for aesthetic potential in depth.

5060 Practicum (1-12) Field experience in selected agencies and organizations that focus on solutions to problems in housing.

5120 Historic Interior Design (3) Emphasis is placed on research studies of historic design developments. A variable content course with emphasis on interior design, furniture and/or accessories for England, Scandinavia, Mediterranean area and/or America, May be repeated. Maximum 18 hrs.

5210 Furniture Appreciation (3) Aesthetic qualities of past and present styles. Study of significant structural and formal characteristics.

5310 Interior Design (3) Advanced problems in the planning and design of interior space; includes application of research information in making design decisions. Prereq: Consent of instructor.

5330 Craft Design (3) Fine design in international crafts; designing in basic craft media. 1 hr and 2 labs.
cepts in the development of two and three-dimensional forms in fiber constructions. 5352—Advanced experimentation using aesthetic concepts in the development of two and three-dimensional forms in weaving. 5362—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in textile design and consent of department head. Each course may be repeated one time.

5343-53-63 Textile Design I, II, III (4, 4, 4)
5343—Initial development of theory for investigation of aesthetic concepts for the surface decoration of textiles. 5353—Advanced experimentation using aesthetic concepts in the surface decoration of textiles. 5363—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in textile design and consent of department head. Each course may be repeated one time.

5344-54-64 Wood Design I, II, III (4, 4, 4)
5344—Initial development of theory for investigation of aesthetic concepts in two and three-dimensional forms in wood. 5354—Advanced experimentation using aesthetic concepts in the development of two and three-dimensional forms in wood design. 5364—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in wood design and consent of department head. Each course may be repeated one time.

5345-55-65 Enameling I, II, III (4, 4, 4)
5345—Initial development of theory for investigation of aesthetic concepts in two and three-dimensional forms in enameling. 5355—Advanced experimentation using aesthetic concepts in the development of two and three-dimensional forms in enameling. 5365—Experimentation in unifying 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.

5346-56-66 Plastics I, II, III (4, 4, 4)
5346—Initial development of theory for investigation of aesthetic concepts in two and three-dimensional forms in plastics. 5356—Advanced experimentation using aesthetic concepts in the development of two and three-dimensional forms in plastics. 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.

5368 Ceramics—Glaze Calculation (4)
Experimentation with various types of clay bodies and glazes for reaction and oxidation firing atmospheres. Prereq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5369 Ceramics—Kiln Construction (4)
Investigation of designs for and construction of various sizes and types of kilns and burner systems which promote 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 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 derivation of design implications from anatomy, physiology, anthropology, 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 development of micro-environments 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 and scientific design methodology applied to the analysis, synthesis and evaluation of research oriented interior design projects. Comprehensive design research project to be carried out by 2 or 3 member teams. 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 furniture pieces and systems; emphasis on the production of construction drawings and scale models. Prereq: Consent of instructor.

5615 Housing Programs and Policies (3) Analysis of private and public programs and policies designed to promote realization of suitable homes and living environments for families. Economic and social problems related to national housing objectives. Prereq: 4320 or consent of instructor.

5620 Experimental Methods in Household Equipment (3) Research methods and techniques used in determining performance of household equipment. Prereq: Equipment in the Home or consent of instructor. 1 hr and 2 labs.

5630 Environmental Requirements for Family Work Centers (3) Trends in planning work center areas such as for kitchens and laundries; evaluation in terms of adequacy, convenience, safety, facility for development of home economics facilities; costs; problems of installation and remodeling.

5810-20-30 Problems in Related Art, Crafts and Interior Design (1-3, 1-3, 1-3) Advanced study selected from any field of RACID. Prereq: Consent of departmental head and professor in charge of investigation.

5910-20-30 Seminar in Related Art, Crafts and Interior Design (1-3, 1-3, 1-3) Prereq: Consent of instructor.

Courses offered periodically only at the Arrowmount School of Crafts, Gatlinburg, Tennessee. Courses may be repeated.

3311 Metal Design (1-4)
3321 Metal Design (1-4)
3331 Metal Design (1-4)
3411 Weaving (1-4)
3421 Weaving (1-4)
3431 Weaving (1-4)
3511 Textile Design (1-4)
3521 Textile Design (1-4)
3611 Wood Design (1-4)
3621 Wood Design (1-4)
3711 Enameling (1-4)
3721 Enameling (1-4)

3411 Crafts in America (1-4) (Same as 4310.)
4411 Craft Media (1-4) (Same as 4410.)
4421 Leather Design (1-4) (Same as 4420.)
4431 Plastics (1-4) (Same as 4430.)
4511 Ceramics (1-4)
4521 Ceramics (1-4)
4531 Ceramics (1-4)
4621 Studio Problems in Leather Design (1-4)
4631 Studio Problems in Metal Design (1-4)
4641 Studio Problems in Weaving (1-4)
4651 Studio Problems in Textile Design (1-4)
4661 Studio Problems in Wood Design (1-4)
4671 Studio Problems in Enameling (1-4)
4681 Studio Problems in Plastics (1-4)
4691 Studio Problems in Ceramics (1-4)
5331 Craft Design (1-4) (Same as 5330.)
5411 Advanced Problems (1-4) (Same as 5410.)
5441-51-61 Metal Design (1-4, 1-4, 1-4) (Same as 5341-51-61.)
5442-52-62 Weaving (1-4, 1-4, 1-4) (Same as 5342-52-62.)
5443-53-63 Textile Design (1-4, 1-4, 1-4) (Same as 5343-53-63.)
5444-54-64 Wood Design (1-4, 1-4, 1-4) (Same as 5344-54-64.)
5445-55-65 Enameling (1-4, 1-4, 1-4) (Same as 5345-55-65.)
5446-56-66 Plastic (1-4, 1-4, 1-4) (Same as 5346-56-66.)
5447-57-67 Ceramics (1-4, 1-4, 1-4) (Same as 5347-57-67.)
5811-21-31 Problems in Related Art, Crafts and Interior Design (1-4, 1-4, 1-4) (Same as 5810-20-30.)
5911-21-31 Seminar in Related Art, Crafts and Interior Design (1-4, 1-4, 1-4) (Same as 5910-20-30.)

Food Science, Nutrition, and Food Systems Administration

MAJORS
Food Science
Nutrition
Food Systems Administration
Home Economics

DEGREES
M.S.
M.S.
Ph.D.

Professors:
M. R. Gram (Head), Ph.D. California (Berkeley); R. E. Beauchene, Ph.D. Kansas State; A. M. Campbell, Ph.D. Cornell; G. E. Goertz, Ph.D. Kansas State; M. J. Hitchcock, Ph.D. Wisconsin; L. M. Odland, Ph.D. Wisconsin, D.Sc. Rhode Island; J. R. Savage, Ph.D. Wisconsin; J. T. Smith, Ph.D. Missouri.

Associate Professors:
B. L. Beach, Ph.D. Wisconsin; D. W. Hubbard, Dr.P.H. Tulane; D. E. Lyon, M.S. Cornell; M. A. Smith, Ph.D. Tennessee; M. N. Traylor, M.P.H. California (Berkeley).
Food Science

4000 Origin of Food and Foodways (3) Tracing of food and the development of individual and group foodways. Prereq: 6 hrs social science or humanities.

4010 Introductory Experimental Food Science (3) Use of physical and sensory evaluation in experimentation with fats, high protein foods, and batter and dough systems. Prereq: Nature of Foods 1.


4040 Food in Contemporary Society (3) Consumer’s options, responsibility and potential influence with respect to food supply.

5000 Thesis

5140 Foods and Nutrition: Physicochemical Principles (3) Introduction to thermodynamics; physical characteristics and properties of proteins, carbohydrates and lipids; chemistry of the colloid state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: Nutrition 3330 and College Algebra or equivalent.

5510 Food Structure (3) Classification of foods according to textural parameters: use of instrumentation in the evaluation of textures. Prereq: 4010 or Food Technology 4920; statistics or consent of instructor.

5520 Food Sensory Testing Methods (3) Principles and methodology of sensory evaluation of food; application of the methods; analysis of sensory data. Prereq: 4010; statistics; or consent of instructor.

5530 Advanced Experimental Food Science (3) Application of research methods to individual problems. Prereq: 5510-20 or consent of instructor.

5550 Food Behavior of the Individual (3) Development of and changes in the choices of food and in food habits of the individual. Prereq: 4000, 3 hrs of Nutrition, or consent of instructor.

5560 Foodways in the United States (3) Current foodways of selected sub-cultures in the United States and the historical basis for their development. Prereq: 4000, 3 hrs of Nutrition, or consent of instructor.

5580 Foodways in the United States (3) Current foodways of selected sub-cultures in the United States and the historical basis for their development. Prereq: 4000, 3 hrs of Nutrition, or consent of instructor.

5590 Field Experience (3-9) Experience in a state or regional community nutrition program. Prereq: 5310 and consent of instructor. 3 labs.

5620 Field Study in Community Nutrition (1-12) Personal participation in and analysis of a state or regional community nutrition program. Prereq: 5320 and consent of instructor. 3 labs.

5630 Carbohydrates and Fats in Relation to Food Science (3) Physical and chemical characteristics of sugars, starches and fats with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5640 Proteins in Relation to Food Science (3) Physical and chemical characteristics of the proteins of milk, eggs, flour and meat with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5700 Current Programs and Trends in Food Science (1-3) Recent advances in food science, their impact on curricular considerations, and their implications for teachers, extension workers, and dietitians. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Science (1-3) Advanced study from the field of food science. Prereq: Consent of department head and professor in charge of investigation. May be repeated.

5850 Field Experience (3-9) Experience in a food-related industry or agency under the supervision of a faculty member. Prereq: Consent of instructor. May be repeated.

6000 Doctoral Research and Dissertation

6110 Advanced Topics in Food Science (3) Comprehensive individual study and group discussion of topics related to current problems in food science. Prereq: Consent of instructor. May be repeated.

6120 Food Dispersions (3) Physical characteristics of solutions, colloidal dispersions, and emulsions in relation to treatments applied. Prereq: 5530.

6310-20 Structure of Food Plants and Animal Tissues (3, 3) Histological structure of food plants and animal tissues as related to physical characteristics and chemical properties of food components. Prereq: 5630-40.

6510-20 Food and Socio-Cultural Change (3, 3) Critical evaluation of and participation in experiences affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5560 or 5560; or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

Nutrition

3310 Organic Chemistry (4) Emphasis on subjects leading to 3320-30 and Text and Cling. Prereq: General Chemistry. 3 hrs and 1 lab. Not for graduate credit for Food Science, Nutrition and Food Systems Administration majors.

3320 Food Analysis (4) Elementary quantitative analysis; typical food analyses. Prereq: 3310 or equivalent. 3 hrs and 1 lab. Not for graduate credit for Food Science, Nutrition and Food Systems Administration majors.

3330 Physiological Chemistry (2) Digestion and metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in nutrition. Prereq: 4010 or equivalent. Not for graduate credit for Food Science, Nutrition and Food Systems Administration majors.

3399 Physiological Chemistry Laboratory (1) Prereq: 3320, Coreq: 3330, 1 lab. Not for graduate credit for Food Science, Nutrition and Food Systems Administration majors.

3410 Reproductive and Developmental Nutrition (3) Nutritional requirements for expectant mothers, infants, and preschool children. Prereq: 6 hrs of nutrition. 2 hrs and 1 lab.

3420 Nutrition for Children, Adolescents and Adults (3) Application of basic principles and research findings to good nutrition for children, adolescents and adults. Prereq: 6 hrs of nutrition. 2 hrs and 1 lab.

3430 Community Nutrition (3) Introduction to nutrition; problems and services in the community; supervised field experiences are an integral part of the course. Prereq: 6 hrs of nutrition.

4110 Introduction to Nutrition Research (3) Discussion of principles and laboratory experiences. Prereq: 6 hours of nutrition. 2 hrs and 1 lab.

4230 Nutrition in Disease (4) Nutrition problems in diseases influenced by diet. Prereq: 5 hrs Science of Nutrition. 3 hrs and 1 lab.

4231 Clinical Experience in Dietetics (2) Planned educational experiences in selected health care facilities applying principles of nutrition in disease. Coreq: 4230.

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

5110 Advanced Physiological Chemistry (4) Biochemistry 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, growth 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; supervised field work. Prereq: 5 hrs Science of Nutrition; consent of instructor. 3 labs.

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. 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: 5210 or equivalent.


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 Food Survey and Food 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 changes, dietary intakes and the effect of nutrition on the rate of biological aging. Prereq: 5210 or consent of instructor.

5610 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 duties at the Child Development Center, Center for the Health Sciences, Memphis. Prereq: Consent of department head.

5700 Current Programs and Trends in Nutrition (1-3) Discussion of selected recent developments in field of nutrition and their implications for teachers, extension workers, dietitians, public health nutritionists, and others in related fields. May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

5800 Problems in Nutrition (1-3) Advanced study selected from the field of nutrition. Prereq: Consent of department head and professor charge investigation. May be repeated. Maximum 9 hrs.

5950-60 Seminar (1, 1) 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: Quality 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 plant, equipment and food service systems based on needs of the system. Procedures for purchasing equipment. Prereq: Quality Food Procurement, Production and Service, or consent of instructor.


4260 Food and Lodging Physical Plant, Planning and Maintenance (4) Feasibility, planning, development and construction of food and lodging physical plant and maintenance. Electrical, heating, plumbing, air conditioning and ventilation and illumination 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 service and lodging operations. Prereq: Food Systems Administration; Electronic Data Processing.

5000 Thesis

5110-20 Experimental Food Quantity Food Study (3) Analysis of food production, holding environment, and service problems related to quality of food served in volume. Use of management resources. Prereq: 4130, Quality 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: 4150.

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 (1) The role and responsibilities of the administrator in maintaining desired qualitative and quantitative standards in a food service delivery system. Prereq: Quality 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 Programs and Trends in Food Systems Administration (1-3) Recent advances in food systems administration and their implications for dietitians, school food service directors and others in related fields. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Systems Administration (1-3) May be repeated.

5850 Field Experience (3-9) Planned administration experience in a food service system. Prereq: Consent of instructor.

5900 Seminar in Food Systems Administration (1-3) May be repeated.

6110 Advanced Topics in Food Systems Administration (3) Comprehensive individual study and group discussion of topics related to current problems in food systems administration. Prereq: Consent of instructor.

6210 Manpower Planning and Training for the Food Service Industry (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 Resources in Food Service Systems (3, 3) Interrelationships of resources and evaluation of their efficiency and effectiveness in food service systems. Prereq: 5230 or consent of instructor. Taken in sequence. Credit for 6310 contingent upon completion of 6320.

6900 Seminar (1-3) May be repeated. S/NC only.

Home Economics

MAJOR

Home Economics

DEGREE

Ph.D.

Professors:

L. M. Oland (Dean), Ph.D., Wisconsin, D.Sc.
Rhode Island; G. E. Goertz (Associate Dean), Ph.D., Kansas State.

Associate Professor:

J. L. Cunningham (Assistant Dean), Ph.D., Michigan State.

Assistant Professor:

V. S. Amagnost (Assistant Dean), M.S., Tennessee.

5060 Practicum (1-12) Field experience in selected organizations that focus on interdisciplinary solutions to problems associated with human nutrition and well-being. Prereq: Consent of instructor. 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 component disciplines and analysis of current programs; emphasis on projection of future developments. Prereq: 12 hrs of 5000-level Survey of the Social Sciences, Memphis.

5220 Development of Community Services Programs (3) Same as Agricultural Extension 5210.

5500 Field Experience in Selected Organizations for Study in the Foreign Country of a Student or Staff Initiated Course for Study in a foreign country of a topic(s) pertinent to field. Topic to be determined by student and instructor with department and college approval. May be repeated. Maximum 12 hrs.

5600 Study of a Foreign Culture (3) Historical study of a foreign culture. Prereq: Consent of department head and college approval. May be repeated. Maximum 15 hrs.

5610 Current Programs and Trends in Human Resource Development (1-3) Current developments and problems related to human resource development and their impact on the quality of life. Prereq: Agricultural Economics 4320 or Economics 5340 or Planning 5100 or Child and Family Studies 5700 or consent of instructor.

5700 Current Programs and Trends in Human Resource Development (1-3) Current developments and problems related to human resource development and their impact on the quality of life. Prereq: Agricultural Economics 4320 or Economics 5340 or Planning 5100 or Child and Family Studies 5700 or consent of instructor.

5800 Problems in Community Services (1-3) Prereq: Consent of the professor in charge of investigation. Hrs and credit to be arranged. May be repeated. Maximum 9 hrs.

5910 Seminar in Human Resource Development (1-3) May be repeated. S/NC only.

6110-20 Theoretical Issues in Human Resource Development (3) Interdisciplinary approach to the development and use of human resources in the solution of family and consumer problems. Prereq: 12 hrs of 5000-level courses representing 2 areas of Home Economics.

6210 Professional Issues in Human Resource Development (3) Role and philosophy, and administrative procedures for human resource development. Prereq: 12 hrs of 5000-level courses representing 2 areas of Home Economics.

6310 Advanced Topics (3) Comprehensive individual study and group discussion of individual and family behavior, physiological de-
Development and well-being, environmental factors, and economic and social well-being. Prereq: 6110. May be repeated.

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 58 for staff and course offerings.)

**Textiles and Clothing**

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<thead>
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<th>MAJORS</th>
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<tbody>
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<td>Textiles and Clothing</td>
<td>M.S.</td>
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<tr>
<td>Home Economics</td>
<td>Ph.D.</td>
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<td>Professor:</td>
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<td>A. J. Treece (Head), Ph.D.</td>
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<td>Ohio State.</td>
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<td>Associate Professor:</td>
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<td>J. M. Ford, Ph.D. Pennsylvania State;</td>
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<td>B. C. Goswami, Ph.D. Manchester (England);</td>
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<td>C. J. Noel, Ph.D. Notre Dame.</td>
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<td>Assistant Professors:</td>
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<td>R. P. Dowlen, M.S. Tennessee;</td>
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<tr>
<td>M. F. Miller, Ph.D. Pennsylvania State.</td>
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<td>Lecturer:</td>
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<td>A. L. Bullock, B.S. Mississippi College.</td>
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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 dress design terminating in finished garments developed through the use of draping, 1 hr and 2 labs.

5000 Thesis

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 trade methods used 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 each 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 textile fibers including polymerization, reactions, dyeing, 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—Emphasis on fabric finishes. 5270—Emphasis on dyes and dyeing. 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 theories 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: 3480 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/or clothing and their implications for new types of programs, techniques, TV, and/or curricula approaches. 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 9 hrs.

6910 Seminar in Textiles and Clothing (1-3) May be repeated. Maximum 6 hrs.
Aviation Systems

MAJOR
Aviation Systems

DEGREE
M.S.

Professors:
B. H. Goethart, 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.

Assistant Professor:
S. J. Miley, Ph.D. Mississippi State.

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, six 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 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 Computer Science 3150 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.

Both thesis and non-thesis programs are available for fulfilling the requirements of the program. The thesis program is the usual program 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, six quarter hours in I.E. 5700 and I.E. 5710 and for the administration area, six 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 A.S. 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, nine quarter hours in I.E. 5700, I.E. 5710, and I.E. 5720 and for the administration area, nine 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 three quarter hours in A.S. 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.

Courses suitable for credit in the major field include:
- A.E. 5810, Aviation Systems—An Overview
- A.E. 5820, Air Vehicles
- I.E. 5840, Air Traffic Control Systems
- A.S. 5070, Airports and The Community
- A.S. 5080, Collection and Distribution
- A.S. 5090, Government Policies for Aviation
- A.S. 5100, Experimental Flight Mechanics, Performance
- A.S. 5220, Experimental Flight Mechanics, Stability and Control
- A.S. 5870, Special Topics in Aviation Systems
- Electives typical of those suitable for credit in the area of Aviation Systems, Research and Development Include: A.E. 5150-60-70; Computer Science 4410-20-30 and 5110-20; 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 5820; 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 community, collection and distribution, demand requirement analyses, types of developments and their projections. Prereq: A.E. 5810.
demonstrating the acquisition of flight test performance and emphasizes stability and control characteristics. In addition to the data, tests will be conducted covering a broad range of aircraft performance, stability and control characteristics. In addition to the development of the MANU系统, we 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: A.E. 5120.

5210-20 Experimental Flight Mechanics (3, 3) Consideration of flight mechanics with emphasis on experimental techniques. Special equipment 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 MANU system, we 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: A.E. 5120.

5970 Special Topics in Aviation Systems (3) Current problems of an aviation systems topic, normally performed during the last quarter of work toward degree in non-thesis program. For Aviation Systems degree candidates only.

Cybernetics 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 of the theories of cybernetics, bionics, information, and general systems are presented with a review of the theories of cybernetics, information, automatic control, 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 their interaction with 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. Special covariant 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)

* Space Institute, Tullahoma.
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 quarter hours 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.

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
4700 Air Pollution-Air Resources Management (3)

Forestry
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)

Geography
5610 Selected Topics in Climatology (4)

Geology
5290 Quaternary Problems (4)
4320 Soil Formation, Morphology and Classification (4)
5240 Soil Productivity and Management (3)
5250 Pedology (4)
5810 Crop Climatology (4)
5820 Advanced Crop Physiology and Ecology (4)

Psychology
5750 Ethological Psychology (3)

Zoology and Entomology
4240 Animal Ecology (4)
4660-70 Limnology (4, 4)

5570 Animal Populations (3)
5850 Insect Autecology (4)
5860 Geographic Distribution of Animals (4)
5870 Insect Synecology (4)

Industrial and Organizational Psychology

MAJOR DEGREES
Organizational Psychology
M.S., Ph.D.
Committee:
J. M. Larsen, Jr. (Chairman); R. D. Arvey; E. E. Cureton (Emeritus); R. L. Dibbey; M. E. Gordon; E. D. Sundstrum; C. Travis; 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 5350-60-70).

ADMISSION PROCEDURE

Applicants for admission should request forms and materials from both the Graduate Office and the Chairman, 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 assistance consideration.

Standards: At least nine 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.

PH.D. PROGRAM

I. Course Requirements

A. Minimum course requirements

1. I.M. or Psych. 5170, 5180, 5190 (Proseminar in Industrial and Organizational Psychology)

2. Statistics 5500-60-70 (Behavioral Statistics). Exemption by petition

3. Psych. 5070 (Academic Prac-icum)

4. Minimum of three 6000-level seminars to be selected from Psych. or I.M. 6250, 6260, 6270, and I.M. or Psych. 6380*

5. 36 hours of Psych. or I.M. 6000 (Doctoral Dissertation)

B. Recommended electives

1. For students who require preparation in statistics: Behavioral Statistics Sequence (Statistics Department)

2. For preparation for advanced section (81) G.R.E.: Psych. Proseminar

3. For students who require preparation in psychometrics: Applied Psychometrics

4. For students who require preparation in management: I.M. 5110, 5120, 5230 (the latter is the same as Psych. 5450)

5. For students who wish to pursue special research interests aside from their dissertation: I.M. 5250, 5260, 5270 (Readings in Organizational Psychology) I.M. or Psych. 6900 (Supervised Field Research)

6. Courses available in areas related to Industrial and Organizational Psychology:

a. Through College of Business Administration: Wage and Salary Administration, Seminar in Personnel Research (I.M. 5240)

b. Through College of Liberal Arts: Psych. 6450, 6460, 6470

II. Program Requirements

A. Attainment of a B average in the Proseminar in Industrial and Organizational Psychology.

B. Completion of a comprehensive exam in general psychology

* May be repeated for additional credit.

** 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 his qualifications for pursuing a Ph.D. are required.
within no more than two years of entry. This examination covers the following specific areas of psychology:
- History and Systems
- Testing and Individual Differences
- Sensation, Perception, and Psychophysics
- Learning
- Motivation
- Social

C. Completion of a general preliminary examination in scientific methodology within no more than two years of entry. 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. This examination must be attempted no later than nine months following completion of the general preliminary examination. 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. 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 two weeks prior to the awarding of the degree.

F. Maintenance of at least a 3.0 grade point average.

M.S. PROGRAM

I. Course Requirements

A. I.M. or Psych. 5170, 5180, 5190
- Proseminar in Industrial and Organizational Psychology

B. Statistics 5050, 60, 70 (Behavioral Statistics) and applied psychometrics, 3 hrs.

C. 18 hours of additional course work to be selected primarily from among the 5000-level course offerings in Industrial Management and Psychology (e.g., I.M. 5110, 5120, 5230; Psych. 5080 [Current Topics in Applied Psychology])

D. 9 hours of Psych. or I.M. 5000
- (Master's Thesis)

E. Recommended: Psychology Proseminar.

II. Program Requirements

The Ph.D. program requirements described above in sections II A, II B, and II F comprise the major requirements for a Master's degree. An oral examination covering the thesis and related topics must also be completed.

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

Floyd C. Larson, Director,
Water Resources Research Center

MAJOR

DEGREE

Water Resources Development

M.S.

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 nine hours of thesis work. The exact curriculum of each student is decided in consultation with his faculty committee, depending on his background and field of interest. If in his undergraduate work the student has, in the opinion of his faculty committee, sufficient training and education in one or more of the required courses, he 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)
- (Same 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 Engr. 4810)

5000 Thesis

5130 Planning Research Methods I (3)
- (Same as Planning 5130)

5160 Planning and Utilities (3)
- (Same as Environmental Engr. 5160 and Planning 5160)

5200 Water Resources Systems (3)
- (Same as Environmental Engr. 5200)

5330 Descriptive Hydrology (3)
- (Same as Environmental Engr. 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.
Anthropology

MAJOR

DEGREE

Anthropology

M.A., Ph.D.

Professors:

W. M. Bass (Head), Ph.D. Pennsylvania;
A. K. Guthe, Ph.D. Michigan; P. W. Parmalee,
Ph.D. Texas A. & M.

Associate Professors:

C. H. Faulkner, Ph.D. Indiana; J. E. Harrison,
Ph.D. Syracuse; R. L. Jantz, Ph.D. Kansas;
H. M. Lindquist, Ph.D. Kansas;
M. C. R. McCullough, Ph.D. Pennsylvania.

Assistant Professors:

A. M. Henderson, Ph.D. Colorado;
F. H. Smith, Ph.D. Michigan.

M ASTER'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, nine hours may be taken in closely related disciplines (at least one-half of the
courses must be at the 6000 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.

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 non-literate 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.

3530 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 pre-colonial

period. Prereq: Human Culture recommended.

3555 Cherokee Ethno History (3) Survey of socio-political aspects of internal affairs and external
relationships from first European contact to present. Emphasis on 18th and 19th
centuries.

3610 Archaeology of United States and Canada (3) Survey of prehistoric peoples north of
Mexico from initial occupation to European contact. Prereq: Prehistoric Archaeology recommended.

3620 European Prehistory I (3) Cultural developments during the Paleolithic, Mesolithic,
and Neolithic. Prereq: Prehistoric Archaeology recommended.

3630 European Prehistory II (3) Cultural developments during the Metal Ages. From the
close of the Neolithic through the Iron Age. Prereq: Prehistoric Archaeology recommended. 3620 and 3630 should be taken in sequence.

3640 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.

3710 European Folk Cultures (3) Traditional aspects of European life, as expressed in technology, beliefs, art, and folklore, under changing historical and socio-economic conditions.

3800 Language and Culture (3) Relationship between linguistic categories and patterns of
culture. Knowledge of linguistics not required. Prereq: Human Culture recommended.

3811 Introduction to Museology (3) (Same as Art 3811).

3909 Human Osteology (4) Intensive examination of the human skeleton. Prereq: Human
Origins and consent of instructor. 3 hrs and 1 lab.

3920 Principles of Physical Anthropology (3) Survey of materials and methods in physical

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

3950 Human identification (3) Introduction to techniques and methods in human skeletal material in Forensic Medicine.

4200 Contemporary North American Indian (3) Survey of Indian cultures from initial Euro-American contact to present; emphasis on culture change, U.S. Government Indian policy, reservation life; contemporary Southeastern Indian social and cultural problems. Prereq: Human Culture or consent of instructor.

4210 Ethnographic Research Techniques (3) Methods of collecting, organizing, 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 and non-Western cultural aspects of health, disease, treatment, death, and related concepts and theories. Prereq: written and descriptive approaches to the analysis and interpretation of anthropological fieldwork.

4259 Medical Anthropology: Laboratory (3) Fieldwork in medical anthropology. Emphasis is on cultural aspects of health, disease, and death in industrial societies. Prereq: written and descriptive approaches to the analysis and interpretation of anthropological fieldwork.

4300 Readings in Anthropology (1-9) Intensive reading, problem oriented. Prereq: Consent of instructor.

4340 Field Work in Archaeology (3-9) Practicum work surveying, excavating, processing, and analyzing of data; intensive reading. Prereq: 3 quarters of Introductory Anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

4350 Field Work in Cultural Anthropology (3-9) A practicum devoted to fieldwork methods, ethnographic fieldwork reporting, survey and interviews, and identification and carrying out of fieldwork projects. Prereq: 3 quarters of Introductory Anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

4360 Field Work in Physical Anthropology (3-9) Practicum in the collection and analysis of human biological data. May include either skeletal or living populations. Prereq: 3 quarters of Introductory Anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

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 conflict. 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 research and the influence on group behavior. Prereq: Human Culture or consent of instructor.

4440 Urban Anthropology (3) Survey of theoretical and methodological issues anthropologists encounter researching cross-cultural urban settlements. Focus is on anthropological perspective and urban problems and planning. Prereq: 3450 or consent of instructor.

4480 Current Trends in Anthropology (3) An analytical introduction to a review in symposium of the current debates, research directions, theories, fieldwork methods, and general assumptions of the four subfields of anthropology: archaeology, physical anthropology, linguistics, and cultural anthropology.

4490 Cross-Cultural Survey of Sex Roles and Behavior (3) Examination of sex roles and behavior from cross-cultural and diachronical viewpoints. Duration, distribution, and scattered surveys together and attempts to arrive at conclusions on 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-Shang, dynastic and early Western contact periods. Prereq: Human Cultures 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 West, and development of modern 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 American groups prior to European contact. Prereq: Human Cultures, 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 contact and development to pre-European contact. Prereq: Human Cultures, or consent of instructor, or an East Asian course.

4580 Asians in the Americas Since 1800: Anthropological Perspectives (3) Character, factorization and migration to the Americas. Emphasis on Chinese, Japanese and other Asians. Prereq: Human Culture or consent of instructor. Recommended: 3510 or an East Asian course.

4590 Peoples of Japan (3) An analysis of the cultural diversity and unity of the people of Japan. Prereq: Human Cultures 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, south of the Sahara, from earliest evidence of human activity to time of European contact. Prereq: Prehistoric Archaeology or consent of instructor.

4640 ZOOARCHAEOLOGY (3) Basic osteological studies of wild and domesticated animals. Emphasis on aboriginal man's utilization of native animals in his subsistence and culture. Identification, analysis, and interpretation of archaeological faunas. May be repeated. Maximum 8 hrs.

4650 Archaeology of Southeastern United States (3) Intensive study of the prehistoric American Indian. Special emphasis on Tennessee prehistory. Prereq: 3610 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, economic activities, household, interpersonal relations, song, dance, and oral traditions and customs. Prereq: Consent of Instructor. May be repeated.

4778 Cherokee Language (3) Linguistic survey of structure of the Cherokee language.

4930 Physical Growth and Constitution (3) Comparative growth patterns throughout the life cycle of man, skeletal and dental maturation; sex differences in growth; human constitutional 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 comparative anatomy and non-human primate behavior. Prereq: Human Origins or consent of instructor.


4970 Human Paleontology (3) Survey of the major human fossil formations of Southeast Asia and in the Neogene and recent Hominid evolution. Emphasis on Pliocene and more recent Hominid forms and the factors that shaped the emergence of modern man. Prereq: 3 quarters of Introductory Anthropology. Recommended: 4960 and Zool. 4380.

5000 Thesis

5010 Graduate Research (1-9) Independent investigation of special problems in anthropology.

5100 Seminar in Cultural Anthropology (3-9)

5101 Foreign Study (1-12) See page 137.

5102 Off-Campus Study (1-12) See page 137.

5103 Independent Study (1-12) See page 138.

5140 Seminar in Zooarchaeology (3) Approaches to the analysis and interpretation of archaeological remains. Intensive reading; evaluation and discussion of major faunal studies. Prereq: Permission of instructor. May be repeated. Maximum 6 hrs.

5149 Laboratory Studies of the Vertebrate Skeleton (3) Examination of vertebrate skeletal of the major groups of fish, amphibians, reptiles, birds, mammals. Oriented toward establishing identification and classification. Prereq: 3 quarters of Introductory Anthropology. Recommended: 3510 or Zool. 4360.

5160 Seminar in Archaeology (3-9) Theoretical and practical issues central to contemporary archaeology. Prereq: Permission of instructor. May be repeated. Maximum 9 hrs.

5210 Community Anthropology: The Local Community (3) Courses dealing with ethical issues, researcher models and research methods on the local community. Prereq: Consent of instructor.

5340 Fieldwork in Archaeology (3-9) Practicum work surveying, excavating, processing, and analyzing of data; intensive reading. Prereq: 9 hours of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

5400 History of Anthropological Theory (3) Review of theoretical contributions of the more influential anthropologists. Prereq: Consent of instructor.

5440 Peasant Societies (3) Critical analysis of existing literature and theories regarding rural, regional, and international issues. Prereq: Consent of instructor.

5450 Comparative Social Organization (3) Social structure in non-literate societies. Kin-
ship, age, sex, locality, and other factors in determining relations between individuals and groups. Prereq: At least one area course.

5460 Quantitative Methods in Anthropology
(3) Application of quantitative methods to anthropological data. Emphasis on correlation and derivative procedures, distance analysis, discriminant analysis, and implementation of computer routines. Prereq: Statistics and probability or equivalent.

5510 Seminar in Ethnology of Western North America
(3) Native North American culture types west of the Rockies; selected social systems, economics, technologies, and environmental factors. Prereq: 3540 or 4550 or consent of instructor.

5600 Theory in Archaeology
(3) Review of development of archaeological theory. Coverage up to and including recent systems approaches.

5610 Problems in North American Archaeology
(3) Graduate seminar designed to explore specific research problems in North American archaeology. Research topics on prehistoric ecology and settlement patterns in North America. Prereq: Consent of Instructor. May be repeated once. (Same as Classics 5620.)

5620 Problems in Old World Archaeology
(3) Selected topics and research problems in European, Asian, and African prehistory will be investigated in depth. Prereq: Consent of instructor. May be repeated once. (Same as Classics 5620.)

5630 The Maya
(3) Intensive survey of Maya culture of Yucatan and Guatemala pre-Columbian times to the present. Prereq: 3560.

5640 Archaeological Resource Management
(3) Theory and practice—public, conservation, constitutional, and research-oriented archaeology. Special emphasis on: legislation, contracts, responsibilities, and certification; agencies and policies; project design, administration, and logistics; standards of field work, analysis and publication; archaeology and the public; conservation archaeology as a career. May be repeated. Maximum 6 hrs.

5660 Seminar in Prehistoric Lithic Technology
(3) Analysis of techniques employed in production of prehistoric stone industries; raw materials employed; resultant implements, their forms and functions; and typological constructs utilized in archaeological analysis. Prereq: Consent of instructor.

5670 Seminar on Aboriginal Lithic Resources
(3) Training and research in stone materials utilized by populations—their properties, natural occurrence and geologic context, relative abundance and quality, extraction and distribution, processing and ultimate forms and functions. Emphasis is on theory and implementation of regional resource surveys and on discrete regions in terms of lithology, and cultural homogeneity, particularly East and Middle Tennessee. Course work includes input from professional geologists and field research. Prereq: 5660 recommended.

5700 Theory in Folk Culture Studies
(3) Graduate seminar analyzing major theoretical viewpoints of European and American folklore and folkloric studies from inception to the present.

5710 Problems in Folk Culture Studies
(3) Topical seminar dealing with selected problems and aspects of traditional behavior in European and American culture. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5910 Measurement of Man
(3) A survey of the techniques of measuring and describing skeletal material and the human subject with emphasis on the biological applications to growth, nutrition and human engineering. Prereq: Consent of instructor.

5920 Advanced Physical Anthropology
(3) An intensive investigation of the theory and problems in physical anthropology.

5930 The Human Skeleton in Forensic Medicine
(3) The application of physical anthropology to problems in human identification. Determination of age, race and sex of the skeleton and preparation of reports for legal use. Prereq: 3900.

5940 Skeletal Biology of Early Human Populations
(3) An intensive treatment of practical and theoretical approaches to analysis of prehistoric human skeletal populations. Demographic, palaeo-statistics, pathology, nutrition, and measures of biological relationships will be covered as they relate to the population as an adaptive unit. Prereq: 3900.

5945 Comparative Primate Anatomy
(4) A laboratory-oriented course dealing with the functional anatomy of the primates. Particular emphasis will be placed on the musculo-skeletal system and the evolution of various primate adaptive patterns. Prereq: Osteology and one dissection course in zoology.

5950 Paleopathology
(4) Identification and descriptive analysis of pathological conditions affecting the human skeleton. Roentgenological, histological and gross visual examination of skeletal material. Lecture and laboratory. Prereq: 3900 and/or consent of instructor.

5960 Dermatoglyphics
(3) Methods of dermatoglyphic analysis; genetics and population variation of various dermatoglyphic elements; forensic applications; relationships to various genetic and chromosomal abnormalities. Prereq: Consent of instructor.

5970 Emegence and Early Evolution of Man
(3) A detailed study of the ancestry and evolutionary significance of the Australopithecines. Prereq: 4970 or consent of instructor.

5980 Neanderthal Man and Human Evolution
(3) An in-depth consideration of the morphology, distribution and evolutionary relationships of the Neanderthals. Prereq: 4970 or consent of instructor.

5990 Human Variation
(3) Nature of human biological variation with emphasis on micro-evolutionary processes responsible for establishing and maintaining variation and relationships of population structure. Prereq: 3930 or consent of instructor.

6000 Doctoral Research and Dissertation

6110-20-30 Seminar in Cultural Anthropology
(3, 3, 3) This seminar is offered each quarter primarily for doctoral candidates.

6480 Seminar in Social Structure
(3) This seminar examines the existing literature on kinship systems and especially focuses upon synthesis of those data.

6970 Seminar in Human Paleontology
(3) Prereq: 4970 and consent of instructor.

The above 6000-level courses are contingent upon approval of the Ph.D. program by the THEC.

Archaeology—Greek and Roman

See Classics

Art

MAJOR DEGREES

Art

MAJOR

M.A., M.F.A.

Professors:


Associate Professors:


Assistant Professors:


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. The general requirements are that the applicant must have an undergraduate major in art or present evidence of outstanding proficiency.

MASTER 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. At least five quarters beyond the baccalaureate degree is required.

Curriculum:

Projects in Lieu of Thesis
(5011-21-31) ................ 9 hrs.
Major Area ............... 27-33 hrs.
Seminar in Art History .... 3 hrs.
"Art History ............. 6-12 hrs.
Seminar in Art Criticism .... 3 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:

5011-21-33, Projects in Lieu of Thesis (3, 3, 3)
5110-20-30-40-50-60, Drawing and Composition (3, 3, 3, 3, 3, 3)

* Six to twelve hours to be decided by the student's committee on the basis of the under-graduate preparation. Any reduction from the 12 hours in Art History would be added to the basic 9 hours of Art electives.

Electives may be outside the departmental major area and may be any course offered by the University for graduate credit.
and America (4)

3745 History of Modern Architecture in Europe

3746 History of Twentieth Century Painting in Europe and America (4)

3755-56-57 Studies in Art History, 3765 History of American Art (Art from the Colonial Period to the present day.

3775-76-77 History of Oriental Art (Art of Indian Asia and the Far East. 3775—Indian Asia; 3776—China; 3777—Japan.

3811 Introduction to Museology (Concepts, practices and historical development of museums of art, archaeology, anthropology and science. (Same as Anthropology 3811.)

4015 Individual Problems (May be repeated. Maximum 12 hrs. Prereg: Consent of instructor.

4115 Drawing IV (May be repeated. Maximum 12 hrs. Prereg: 12 hrs. of 3115.

4215 Painting IV (May be repeated. Maximum 12 hrs. Prereg: Consent of instructor.

4315 Watercolor IV (Advanced composition in transparent and opaque watercolor. May be repeated. Maximum 12 hrs. Prereg: Consent of instructor.

4415 Sculpture IV (May be repeated. Maximum 12 hrs.

4515 Visual Communication IV (Corporate design: introduction.

4525 Visual Communications V (Corporate design: advanced concepts. Prereg: 4515.


4545 Visual Communications Seminar (Poitical, social, economic and moral problems of contemporary designer. Prereg: 4515.

4615 Intaglio IV (Color problems with intaglio lithography. May be repeated. Maximum 12 hrs.

4616 Lithography IV (Color problems in lithography. May be repeated. Maximum 12 hrs.

4617 Serigraphy IV (May be repeated. Maximum 12 hrs.

4855-56-57 Reading and Research in Art History (2, 2, 2) Prereg: 16 hrs of Art History and consent of instructor.

4875-76-77 Studies in Oriental Art History (4, 4, 4) Concentration in selected areas.

5011-21-31 Exhibition in Lieu of Thesis (3, 3, 3)

5101 Foreign Study (1-12) See page 137.

5102 Off-Campus Study (1-12) See page 137.

5103 Independent Study (1-12) See page 138.

5110-20-30-40-50-60 Drawing and Composition (3, 3, 3, 3, 3, 3)

5210-30-40-50-60 Oil Painting (3, 3, 3, 3, 3, 3)

5310-30-40-50-60 Watercolor Painting (3, 3, 3, 3, 3)

5410-30-40-50-60 Sculpture (3, 3, 3, 3, 3)

5510-30-40-50-60 Communication Design (3, 3, 3, 3, 3)

5610-20-30 Intaglio (3, 3, 3) Individual problems with etching and engraving. May be repeated.

5611-21-31 Lithography (3, 3, 3) Individual problems with lithography. May be repeated.

5612-22-32 Serigraphy (3, 3, 3) Individual problems with silk screen. May be repeated.

5770 Seminar in Art History (3)

5855-56-57 Reading and Research in Art History (2, 2, 2)

5900 Seminar in Art Criticism (3) Theory and practice. Intended for majors in studio art.

Audiology and Speech Pathology

MAJORS

Audiology

Speech and Hearing Sciences

Speech Pathology

Professors:

H. L. Luper (Head), Ph.D. Ohio State; S. Adler, Ph.D. Ohio State; C. W. Asp, Ph.D. Ohio State; D. M. Lipscomb, Ph.D. Washington; H. A. Peterson, Ph.D. Illinois; B. Silverstein, Ph.D. Purdue.

Assistant Professors:


Assistant Professors:


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 the Audiology program, a student may emphasize audiological assessment, aural habilitation—rehabilitation, medical or pediatric, or industrial audiology. Within the M.A. in the 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 practice experiences but the maximum number of practicum credit hours that may be counted toward the Master's degree is 15 quarter hours. If the undergraduate preparation does not include sufficient course work in speech pathology, audiology, psychology, and related fields, the student may be required to make up such deficiencies.

Students may elect either the thesis
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 in general knowledge of the bases of audiology, speech and language pathology, and speech and hearing science; and advanced knowledge of the specifics of his area of specialization.
5. Research and dissertation to give at least 36 hours of graduate credit (6000 level).
6. A final oral examination.

4040 Appraisal of Speech and Language Disorders (3) Diagnostic procedures for children and adults with speech and language problems. Concurrent enrollment in 4049 required for majors. (Same as Special Education 4040.)
4049 Lab in Appraisal of Speech and Language Disorders (1) Observation and practice with diagnostic tests. Concurrent enrollment required in 4040. (Same as Special Education 4049.)
4060 Speech Science II (3) Speech production; clinical applications of speech science research. 2 lectures and 1 hour lab per week. Prereq: Speech Science I.
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.)
4250 Introduction to the Education and Psychology of the Deaf (3) (Same as Special Education 4250.)
4310 Stuttering (3) Modern interpretations of stuttering and methods of treatment. (Same as Special Education 4310.)
4320-30-40 Clinical Practice in Speech Pathology (1-6, 1-6, 1-6) Prereq: Intro. to Speech Pathology, Phonetics, Articulation Disorders, 4040, and consent of instructor. 4340 may be repeated. S/NC only. (Same as Special Education 4320-30-40.)
4400 Voice Disorders (3) Etiology, diagnosis and treatment of organic and functional voice disorders. Prereq: Intro. to Speech Path. and Speech Science II. (Same as Special Education 4400.)
4450-60-70 Clinical Practice in Audiology (1-6, 1-6, 1-6) Prereq: 4720, 4630, or 4940. S/NC only. (Same as Special Education 4450-60-70.)
4520 Speech Pathology (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.
4650 Speech and Language of the Culturally Different Child (3) Discussion of speech and language differences of children of various minority groups, of different ethnic and class membership and from different geographic regions; their causes, and their effects upon educational programs.
4710 Introduction to Audiology (3) The fundamental aspects of hearing, including a study of physics of sound, anatomy and physiology of the ear, etiology and rehabilitation of hearing loss, and the psychological ramifications of sensory loss. (Same as Special Education 4710.)
4720 Audiology (3) Assessment of auditory functions by pure tone and speech audiometric procedures. (Same as Special Education 4720.)
4730 Medical Audiology (3) Survey of medical aspects of audiology pertaining to pathologies encountered in medical environments, with emphasis on specific etiologies. Prereq: 4710.
4740 Pediatric Audiology (3) Survey of test techniques employed in measuring the hearing of small children. Prereq: 4710 and 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 abatement, acoustical factors, and physiological concomitants in noise stimulation. A knowledge of acoustics is advisable.
4930 Aural Rehabilitation: Speechreading and Auditory Training (3) Development of receptive language process and development of maximum use of residual hearing in the acoustically handicapped. (Same as Special Education 4930.)
4939 Laboratory in Aural Rehabilitation (1) (Same as Special Education 4939.)
4940 Advanced Aural Rehabilitation: Acoustic Training (3) Development of maximum use of residual hearing in the acoustically handicapped. (Same as Special Education 4940.)
5000 Thesis
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.)
5050 Practicum in Aural Habilitation and Rehabilitation (1-6) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.
5060 Anatomy and Physiology of Speech (3) Structure and function of the non-muscular 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 psycho-acoustics of audition. Prereq: 4710.
5071 Physiological Acoustics (3) Techniques for electro-physiological measurement of auditory sensitivity, 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 comparative 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 statistical methods, and completion of a pilot research project.
5119 Instrumentation in Speech and Hearing Science (3) An instrumentation course involving the spectrum of laboratory equipment available in speech and hearing science. Upon
5500 Independent Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5600 Independent Study in Audiology (1-3) 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 in the discussion and utilization of testing tools and analyses of habilitative philosophies, specialties and techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5651 Seminar in Language Differences (3) Study of significant research relevant to language differences of culturally different children.

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 3210 or equivalent. (Same as Psychology 5790.)

5950 The Verbo-tonal System (3) Theory, etiology, and study of the role of the audiologist in treatment or use, and language symbolization. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5660 Advanced Seminar in Hearing Science (1-3) May be repeated. Maximum 9 hrs.

Biochemistry

MAJOR

DEGREES

Biochemistry

M.S., Ph.D.

Professors:

J. W. Greenawaft (Head), Ph.D. Purdue; J. E. Churchich, Ph.D. Sheffield (England); K. J. Monty, Ph.D. Rochester; T. P. Saio, Ph.D. Michigan; J. R. Totter, Ph.D. Iowa State.

Associate Professor:

J. G. Joshi, Ph.D. Poona (India).

Assistant Professors:

R. H. Feinberg, Ph.D. California (Berkeley); S. W. Hawkkinson, Ph.D. Chicago.

THE MASTER'S PROGRAM

Candies 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. One year each of Introductory Organic Chemistry (i.e., Chemistry 3211-21-31* and 3219-39*), Inorganic Quantitative Analysis (i.e., one quarter each of Analytical Chemistry, plus Chemistry 3630 or 4210), and Physical Chemistry (i.e., Chemistry 3410-20-30, 4110 or Biochemistry 4210-20-30.)

2. A minimum of 12 quarter hours of approved biology courses beyond the introductory level.

3. Biochemistry 4110-20, 4119, and at least two of the following: Biochemistry 5110, 5120, 5130, 5220, 5230.

4. At least nine hours of advanced lecture-seminar courses from the following: Biochemistry 6110, 6120, 6130, 6210, 6220, 6230, 6310, 6320, 6300, 6410-20-30.

5. Between nine and 18 hours of Master's research and a thesis.

6. A final comprehensive examination which will cover both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

An incoming student must present an undergraduate major in either chemistry or biology. Departmental requirements include the satisfactory completion of:

1. Introductory Organic Chemistry (i.e.,

* Though completion of these courses or the equivalent is required, they may not be taken for graduate credit.
5130, 5220, 5310-20-30.

An introductory level.

at least 18 hours of Biology beyond the
chemistry 4210-20-30) ; Introductory Physics*;
Chemistry 3211-21-31 * and 3219-29-39*);

function, protein synthesis and biochemical
credit, at least half of which must be at or
a Master's degree. The additional re-
dissertation.

out during the term of candidacy.

of original and significant research carried
comprehensive fashion the mastery of the
istered at the beginning of the fall quarter
Chemistry 3410-20-30, 4110 or Biochem-
5110-20-30); Physical Chemistry (i.e.,
Reaction Mechanisms (i.e., Chemistry
3410-2030) ; Introductory Physics*;

Students who have passed the pre-
liminary examination in the Ph.D. program may petition the department for award of a Master's degree. The additional re-
quirements 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 manu-
script suitable for submission for publica-
tion 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
(44) Electrolyte behavior; the chemistry
and structure of membranes; enzyme beh-
and biological function; catabolism and energy
capture; synthetic metabolism; nucleic acid
function and 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 analy-
ical chemistry. Prereq or coreq: 4110.

4210-20 Introduction to Physical Biochemistry
(33) 4210—Introduction to thermodynamics;
phase stability and phase change; chemical
potential; osmotic pressure; activity and the
Debye-Huckel model; electrophoresis; mem-
brane 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 bio-polymer con-
siderations. Prereq: Analytic Geometry and
Calculus of a Single Variable; Organic Chem-
istry.

4230 Introduction to Physical Biochemistry
(3) Physical characterization of macromo-
cules; polarization; absorption and fluore-
scence, sedimentation and transport hydrody-
namics, electrophoretic mobility, light scatter-
ing, and structural x-ray crystallography of
proteins and nucleic acids. Prereq: Biochem-
istry 4220 or Chemistry 3430, or equivalent.

5000 Thesis

5010 Biochemical Techniques (2) Theory and
and laboratory practice in sedimentation, chromato-
graphic, and electrophoretic techniques in the
isolation and characterization of macromo-
ecules of importance in biochemistry and
molecular biology. Prereq: 4119 or equivalent.
Open to undergraduates with consent of the
department.

5110 The Metabolism of Nitrogen Containing
Compounds (3) Nitrogen fixation. The syn-
thesis and degradation of amino acids, purines,

5120 Membranes, Components, and the
Regulation of Energy Metabolism (3) Examina-
tion of the metabolic pathways for electron
transport, oxidative phosphorylation, and lip-
synthesis, storage and degradation, and of
the intracellular and inter-organ compartmental-
ization and the phenomenon of permeation
which make possible the physiological control of
these pathways. Prereq: 4110-20.

5130 Protein Structure and Enzyme Function
(3) Physico-chemical properties of proteins;
primary, secondary, tertiary and quaternary
structure; denaturation, renaturation and other
confomational change; function-structure corre-
lations; enzyme specific models of catal-
thesis; study-state, induced light, relaxation,
and allosteric kinetics of catalysis. Prereq: 4110
and either 4220 or Chemistry 3430.

5220 Structures and Functions of the Nucleic
Acids (3) Chemistry of the nucleic acids; hy-
drogen bonding and double-stranded struc-
tures; coaxing, supercoiling, and other higher
order structural considerations; the biosyn-
thesis of DNA's and RNA's; repair mechanisms;
hybridization and the phenomenon of permeation
which make possible the physiological control of
these pathways. Prereq: 4110-20 or equivalent.

5250 Protein Synthesis and its Role in Me-
tabolic Regulation (3) Mechanism of assembly
of peptide chains; ribosome structure and
function; deciphering and genetic code; regu-
lation 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, 2)
A tutorial laboratory course in modern experi-
mental methodology and instrumentation.
Introduction to some of the technical methods
in use today in chemical biology. May be
repeated.

5450 Special Topics (1-3) Registration only
by prior arrangement with department. May be
repeated.

6000 Doctoral Research and Dissertation
ADVANCED BIOCHEMISTRY SEMINARS

To be presented by students and staff,
surveying special subjects not covered in
detail in the formal lecture courses. One
series will be presented each year in a
three-year repeating cycle. May be
repeated for credit with the permission of the
department.

6110 Enzyme Kinetics and Mechanisms of
Enzyme Action (1)

6120 Functions of the Vitamins (1)

6130 Functions of the Trace Elements (1)

6210 Structure and Function of Macromole-
cules (1)

6220 Biochemical Genetics (1)

6230 Metabolic Regulation (1)

6310 Biological Energy Transformations (1)

6320 Antibody-Antigen Interactions (1)

6330 Biochemistry of Specialized Physiologi-
ocal Processes (1)

6410-20-30 Current Topics in Biochemistry (2, 2, 2)
Seminars and lectures dealing with cur-
rent advances in the field of chemical biology.
May be repeated with the consent of the
department.

Biology

MAJOR

DEGREE

M.A.C.T.

The Master of Arts in College Teaching
program is administered by an interde-
partmental committee composed of one
representative from each of the following
departments: Biochemistry, Botany, Micro-
biology and Zoology. Inquiries regarding
the program should be addressed to the
Chairman of the Committee.

The admission requirements are:

1. Bachelor's degree with satisfactory
record.

2. Nine quarter hours of college
mathematics.

3. Twelve quarter hours of physical
sciences.

4. Twelve quarter hours of general
biology, general botany, or general
zoology.

5. Eighteen quarter hours of advanced
biology courses.

Requirements for the degree:

All candidates for the M.A.C.T. degree in
Biology will meet a minimum distribution of
graduate and undergraduate courses as
follows:

A. Eight quarter hours in each of the
following:

1. Taxonomy and/or Ecology.

2. Morphology, Developmental Biology
and/or Anatomy.

3. Physiology and/or Biochemistry.

4. Genetics, Cytology and/or Cyto-
genetics.

B. Eighteen quarter hours of graduate
credit in each of the following four
fields: Biochemistry, Botany, Microbiology,
Zoology or 36 quarter hours of
graduate credit among the four fields as
specified by the interdepartmental com-
mittee administering the M.A.C.T. program
in Biology.

C. At least 21 quarter hours of course
work in requirement B (not including spe-
cial projects and thesis) numbered at the
5000 or 6000 level.

D. At least nine quarter hours of
Master's research and an acceptable
thesis.

E. Total graduate credit in the biological
sciences (or appropriate supporting fields)
of 57 quarter hours (including that in A,
B, C and D).

F. A three quarter one-hour seminar (or
seminar series) on the problems and tech-
niques of college teaching.

G. Six quarters of part-time, supervised
college teaching experience.

H. A final comprehensive exami-
nation, oral, covering the thesis endeavor and the
subject matter of the course requirements.
DOCTOR OF PHILOSOPHY DEGREE

1. Satisfactory presentation of a written formulation and oral defense to the student's committee of a research proposal suitable for a dissertation problem. Must be completed before enrollment in Botany 6000.

2. Satisfactory performance on a written comprehensive preliminary examination.

3. Presentation of one or more cognate areas outside of the department totaling nine 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 nine 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 requirements and specific stipulations or requirements such as additional foreign languages, additional oral preliminary examinations, etc., may be required by the individual student's faculty committee.

1. Satisfactory presentation of a written dissertation and/or ancillary services performed in the department related to the instruction of courses.

2. Satisfactory performance on a written comprehensive preliminary examination.

3. Presentation of one or more cognate areas outside of the department totaling nine 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 nine 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 requirements and specific stipulations or requirements such as additional foreign languages, additional oral preliminary examinations, etc., may be required by the individual student's faculty committee.

1. Satisfactory presentation of a written dissertation and/or ancillary services performed in the department related to the instruction of courses.
5800 Experimental Cell Biology (4) Limited re-
search problems with emphasis on those col-
lected from among the following: analytical
microscopy; electron microscopy; cytonuclo-
morphology; fractionation; isolation and char-
acterization of cellular organelles; culture, phy-
siology, biochemistry and growth kinetics of
cellular systems. Lectures and laboratory. Pre-
req: 5780 or Zoology 4310 and Bio-
chemistry 4110-20. 1 hr and 3 labs.

5810 Cytogenetics (4) Changes in chromo-
somes and genes with relation to mutations, hy-
bridization, speciation, and phylogeny. Prereq: General Genetics. 5780, or Zoology 4310. 2
hrs and 2 labs.

5820-21, 22-23-24 Methods and Instrumenta-
tion in Laboratory Investigation (1, 1, 1, 1, 1)
A laboratory course providing project ex-
perience and theoretical background in various
currently used research methods. These may
include ion-exchange resins, adsorption spec-
trum, disc electrophoresis, polyacryl,
zon and cell ultra-centrifugation, the micro-
chromatography, automatic analyzers, microscopy,
culture methods, use and detection of radio-
isotopes; chemical and physical methods. A course
in plant physiology, Organic Chemistry or equiva-
 lent, Elements of Physics or equivalent. S/NC only.

5920 Advanced Plant Physiology III (3) Plant
cell components and their metabolism includ-
ing photosynthesis, respiration, and biosyn-
tasis. Control mechanisms. Water and solute
movement into the cells and within the plant.
Mineral nutrition. Prereq or Coreq: Chemistry 3200.

6200 Advanced Plant Physiology II (2) Growth
and differentiation of plants at the molecular,
cellular, and organismic levels. Chemical
regulation of development; macro-molecular
interpretations of differentiation; photoperiod-
ism and endogenous rhythms; dormancy; ger-
mination: flowering and senescence. Prereq: 5210
or Biochemistry 4120 and a plant or cell
physiology course.

6290 Quartenary Problems (4) (Same as Ge-
ology 5290).

5310-20-30 Special Problems in Botany (1-6,
1-6, 1-6)

5340 Plant Geography (4) Distribution of eco-
systems with emphasis on American types.
Vegetation, climatic and historical aspects are
emphasized. Prereq: 4310. 2 hrs and 2 labs.

5350 Analysis of Plant Communities (4) Plants
and ecosystems components considered from
the standpoint of genecology, ordination, and
ecosystem function. Prereq: 4310. 2 hrs and 2 periods (field trips).

5410-20-30 Seminar in the Teaching of College
Botany (1, 1) Objectives in the teaching of
general botany. Supervised teaching in the
general course; seminars in techniques, test-
ing and methods. Required of teaching
assisting. Prereq: Consent of instructor. S/NC only.

5510-20-30 Systems Ecology (3, 3, 3) 5510—
Nature of ecological systems. System state and
change of state. Elementary network concep-
tions of the ecosystem. Prereq: 4310 or Zool-
y 4240; last quarter of General Mathematics or
equivalent. 5520—Flows of energy and ma-
terials in ecosystems. Analog computation, with
application to multicompartamental exchanges.
Advanced. Prereq: 5510 and a course in eco-
system optimization and adaptation. Prereq: 5410.
5530—Development, dynamics and dis-
ruption of larger ecosystems. Statistical models of
community structure and change. Application of
digital computers in simulation and data-
processing. Prereq: 5510.

5780 Plant Cytology (4) An intensive con-
sideration of plant organization, structure,
and function, with emphasis on the correlation
where possible, of ultrastructure, biochemistry
and development of plant organs. Statistical mod-
elsses and application of various analytical and
and electron microscopic techniques; cell frac-
tionation and isolation of subcellular compo-
ents; differentiation and analytical centrifuga-
tion: photometry and microcinematog-
ography. Intended for graduate students in the
biological sciences. 2 hrs and 2 labs.
Students majoring in chemistry for the Master's or Doctor's degree are required to present as a prerequisite one year each of general, analytical, organic and physical chemistry with a satisfactory record. Students lacking any of these prerequisites may be admitted with appropriate deficiencies which must be removed without graduate credit.

For students minoring in chemistry, the prerequisite is two years of chemistry including quantitative analysis.

MASTER OF SCIENCE

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

1. Research and a thesis to give nine to 18 hours of graduate credit (5000).
2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.
3. Sufficient additional graduate course work in chemistry and/or a related field to make an overall total of 45 hours.

These additional hours must include one of the following sequences: 5110-20-29-30, 5250-59-60-69-70-79, 5340-50, 5410-20-30, 5710-20-30.
4. Participation in seminar (5911-21-31) during the entire period of graduate study. No more than three credit hours of seminar may be applied to the above requirements.
5. A final oral examination.

A program leading to the M.S. degree with specialization in Polymer Science is conducted jointly with the Department of Chemical and Metallurgical Engineering, which offers a degree with similar specialization. This specialization requires satisfactory completion of:

1. Research and a thesis to give nine to 18 hours of graduate credit (5000).
2. Chemistry 4160-70, 5531, 5140-50, Chemical 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.

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 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) during the entire period of graduate study.
4. Thirty-nine hours of additional graduate course work including at least six hours at the 6000 level and one of the following sequences: (a) for analytical, 5250-59-60-69-70-79; (b) for inorganic, 5420-5710-20-30-35 and at least nine hours from the following courses: 5250-60-70, 5340-50-60, 5410-20-30-35, 5710-20-30; (c) for physical, 5530-50, 5410-20-30-35; (e) for theoretical, 5510-20-30, 5610-20-30, Physics 5210. Graduate course work in related fields may be used for undesignated course work in this program upon approval of the student's faculty committee.
5. A comprehensive advanced examination in the field of specialization.
6. Demonstration of a reading knowledge of one of the following languages: French, German, Russian, or an approved alternate.
7. A final oral examination.

For the Ph.D. degree in chemistry with specialization in chemical physics, 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 one of the following: 5511, 5521, 5531.
3. An examination covering the basic principles of mechanics, electricity, and magnetism.
5. The requirements listed in Items 3, 5, 6, and 7 above.

The program in chemical physics is conducted jointly with the Physics Department which offers a similar degree.

A program leading to the Ph.D. degree with specialization in Polymer Science is conducted jointly with the Department of Chemical and Metallurgical Engineering, which offers a degree with similar specialization. This specialization requires satisfactory completion of:

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 six hours of graduate level research, are required, as determined from the Department of Chemistry offerings.

5. A comprehensive advanced examination in Polymer Science.

6. Demonstration of a reading knowledge of one of the following languages: French, German, Russian, or an approved alternate.

7. A final oral examination.

**3211-21-31 Organic Chemistry (3, 3, 3)** The compounds of carbon and their reactions, reaction mechanisms, spectroscopic and other physical properties. Must be taken in sequence. Prereq: General Chemistry. The corresponding laboratory (3219-29-39) is a coreq for students not having credit for the laboratory.

**3219-29-39 Organic Chemistry Laboratory (1, 1)** Experiments on topics discussed in 3211-21-31. The corresponding lecture (3211-21-31) is a coreq for students not having credit for the lecture.


**3429-39 Physical Chemistry Laboratory (1, 1)** Gases, liquids, chemical equilibria, solutions, phase equilibria, reaction kinetics and electrochemistry. The corresponding courses (3420 and 3430) are corequisites. 1 lab.

**3511-21-31 Principles of Organic Chemistry (3, 3, 3)** Structure and reactivity of aliphatic and aromatic compounds emphasizing reactions of synthetic utility. Use of spectroscopic and physical techniques to elucidate reaction mechanisms. Recommended for chemistry majors and students planning careers in physical or biological sciences. Must be taken in sequence. Prereq: General Chemistry. Corresponding laboratory: 3219-29-39; or 3219, with 3239-39 as a corequisite. The latter is recommended.

**3529-39 Organic Chemistry Laboratory (1, 1)** Experiments on topics discussed in 3211-31. Similar to 3229-39 except designed for students who have need for operating knowledge of various spectroscopic and chromatographic techniques. Corresponding lecture (3211-21-31) is a corequisite for students not having credit for the lecture.

**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, etc. Not for credit by chemistry or physics majors or minors. Prereq: 1 year of general mathematics or equivalent, 1 year of general chemistry. 2 hrs and 1 lab.


**4119 Physical Chemistry Laboratory (1)** Solutions, phase equilibria, reaction kinetics and spectroscopy. The corresponding course 4110 is corequisite.

**4150-70 Intermediate Physical Chemistry (3, 3)** (Designed for entering graduate students who have had one year of physical chemistry.) 4160—The three laws of thermodynamics, phase equilibria and chemical potential. 4170—Gases and kinetic theory, chemical kinetics, molecular spectroscopy, and introduction to chemical statistics. 4120 Advanced Analytical Chemistry (3)** Chemical separations including chromatography, ion-exchange, and solvent extraction; spectroscopic 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 potentiometry, coulometry, polarography, and voltammetry); magnetic resonance methods; mass spectrometry; x-ray absorption and fluorescence techniques. Prereq: Analytical chemistry. Recommended: 3420 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 theoretical concepts of the inorganic elements, their chemical states, and their reactions. Prereq: 4420.

**4510 Organic Qualitative Analysis (3)** Identification of organic compounds and mixtures. Prereq: 3211-21-31, 3219-29-39 or 3219, 3239-39, 3 labs. Not open to students who have completed 4610.

**4550 Organic Reaction Mechanisms (3)** Theory of bonding and reaction mechanisms. Prereq: 1 year of organic chemistry.

**4610-20 Advanced Chemical Experimentation (2, 2)** Laboratory course in application of modern experimental techniques to solution of chemical problems. Emphasis applied chemistry; practical and chemical aspects of organic and inorganic compounds with emphasis on independent study using advanced techniques. Prereq: 4110 or 4160-70. Coreq: 3430-39. 4220. 4610 not open to students who have completed 4510.

**4640 Electronics for Chemists (4)** Electronics, applications to chemistry. Prereq: 4610 or 5250 for 5259; 5290 for 5260; 526b, 5270 for 5279.

**5110-20-30 Advanced Organic Chemistry (3, 3, 3)** Structure, reactions and reaction mechanisms of organic compounds illustrating modern techniques. Coreq: Biochemistry 4120 or equivalent.

**5129 Advanced Organic Chemistry Laboratory (3)** Laboratory course in application of modern techniques. Prereq: 1 year 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 year each of undergraduate organic and physical chemistry.

**5150 Kinetics of Polymerization (3)** Kinetics of formation and molecular weight distributions of polymers, homogeneous and heterogeneous growth and chain growth polymerizations. Prereq: 5140 and 4150-70 or equivalent.

**5160 Organic Chemistry of Polymers (3)** Synthesis of monomers; mechanism, stereochemistry, and surface chemistry of polymerizations. Formation of block, graft, and network polymers. Reactions on polymers, including degradation. Prereq: 5140 and 5531.

**5170 Physical Chemistry of Polymers (3)** Rubber elasticity; solution properties of macromolecules; structural, configurational, and conformational statistics of polymers. Prereq: 5150.

**5240 Electronics for Chemists (4)** Includes the material of Chemistry 4640 plus a special project. Prereq: Consent of the 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; 5270—Electroanalytical methods; 5280—Advanced analytical methods; on-stream and automatic analysis. Prereq: 1 year of physical chemistry.

**5259-79 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 year of physical chemistry. Prereqs or coreqs: 5250 or 5259; 5260 or 526b; 5270 or 5279.

**5280-90 Clinical Chemistry (3, 2)** Introduction to clinical chemistry, significance of physiologic parameters, electrolyte balance, metabolic dyfunctions, analytical methodology, data processing, and special problem areas. Prereq: Biochemistry 4110; 1 year of instrumental and separation methods of analysis. Coreq: Biochemistry 4120 or equivalent.

**5290 Advanced Analytical Chemistry Laboratory (1)** Techniques of handling physiologic samples, analytical methods and special problem areas. Prereq or coreq: 5290.

**5310-20-30 Research in Chemistry (3, 3, 3)** Research in Organic Chemistry Laboratory (not applicable to formal course requirements.)

**5350-50-60 Quantum Chemistry (3, 3, 3)** Introduction to the principles of quantum mechanics with special emphasis on applications to chemical systems of interest to organic and inorganic chemists. Molecular orbital theory and ligand field theory from the basic frames of reference. Prereq: 4110 or equivalent.

**5410-20-30 Advanced Physical Chemistry (3, 3, 3)** 5410—Classical thermodynamics. 5420—Molecular spectroscopy and structure. 5430—Chemical kinetics. Prereq: 4110 or 4160-70.

**5440 Experimental Methods of Infrared and Raman Spectroscopy (3)** (Same as Physics 5440.)


**5460 Radiation Chemistry (3)** Interaction of high-energy radiation with matter, emphasis on the medium. Some primitive theories; radiation chemical units; stopping phenomena; loss spectra; secondary processes and transient intermediates; diffusion models in the...
radiation chemistry of water and aqueous solutions; gas-phase radiolysis; liquid organic compounds; solid state studies. Prereq: 5430 or Physics 4610, 4720-30. (Same as Physics 5460.)

5480 Molecular Spectroscopy Laboratory (3) Experimental study of nuclear magnetic resonance, infrared, Raman and electronic spectra. Prereq: 4110 or 4170. 1 hr and 2 labs.

5511 Survey of Inorganic Chemistry (3) Atomic structure, the wave mechanical atoms, ionic and covalent bonding, periodic relationships of the elements, inorganic stereochemistry, coordination chemistry, and the descriptive chemistry of the elements.

5521 Survey of Analytical Chemistry (3) Volumetric and gravimetric analysis; acid-base, oxidation-reduction, complexation and precipitation equilibria; spectroscopic, electrolytical, and separation methods.

5531 Survey of Organic Chemistry (3) Bonding in organic molecules, chemistry of hydrocarbons, alicyclic compounds and conformational analysis, reagent functional oxygenated derivatives, carboxyl compounds, stereochemistry, aromatics, and spectral analysis of organic molecules by infrared, ultraviolet, nuclear magnetic resonance and mass spectral techniques.

5710-20-30 Theoretical Inorganic Chemistry (3, 3, 3) 5710—The nature of chemical bonding; ionic, covalent, metallic, molecular. 5720—Coordination compounds. 5730—Investigational methods of structural inorganic chemistry. Prereq: 1 year of physical chemistry.

5740 Advanced Inorganic Chemistry Laboratory (3) Techniques of crystalization, distillation, furnace methods, electrolytic processes and gas handling as involved in the synthesis of metals, alloys, coordination compounds, polyacids, anomalous salts and colloids. Prereq: 1 yr of physical chemistry. 1 hr and 2 labs.

5810 Nuclear Chemistry (3) Nuclear properties, radioactivity, radioactive decay processes, nuclear structure and models, nuclear reactions, radiations and matter, radiation detection. Prereq: 1 year of physical chemistry.

5911-21-31 Chemistry Seminar (1, 1, 1) Discussion of departmental research, current references to literature and general topics. May be repeated. Registration required each quarter except summer for resident graduate students. S/NC only.

6000 Doctoral Research and Dissertation

6110 Stereoechemistry (3) Influences of dimensions of groups and configuration of molecules on the reactions of organic compounds. Prereq: 5110-20-30.

6111 Selected Topics in Organic Chemistry (3) Subject matter varies among important topics of current significance. Prereq: 5110-20-30. May be repeated.


6180 Alkaloids (3) Structure elucidation of nitrogenous bases derived from the plants. Prereq: 5110-20-30.


6210 Topics in Analytical Chemistry (3) Advanced instrumental methods including emission spectroscopy, infrared, mass spectrometry, x-ray, nuclear magnetic resonance, etc., with emphasis on molecular functionality. Prereq: 5210-20 or consent of instructor.

6211 Selected Topics in Analytical Chemistry (3) Subject matter varies among important topics of current significance. Prereq: 5250-60-70. May be repeated.

6211 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.

6411 Selected Topics in Physical and Theoretical Chemistry (3) Subject matter varies among important topics of current significance. Prereq: 5410-20-30-50, 5340-50. 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: 5110-20-30.

6430 Photochemistry (3) Photoactivation and properties of photoactivated molecules, photolysis of inorganic and organic compounds and photosensitization. Prereq: 5410-20-30.

6450 Electrochemistry (3) Electrical double layer; electrode kinetics; transport properties of electrolytes; electroanalytical methods. Prereq: 5450.

6460 Analytic Chemistry (3) Theory of contact catalysis and the application of catalysis to various chemical processes. Prereq: 5410, 5430, 5450.

6480 Statistical Thermodynamics (3) Statistical derivation of thermodynamic laws and application of statistical mechanical methods to systems of chemical interest. Prereq: 5410, 5430, 5450; Physics 3210-20; Mathematics 4540, 4610.

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: 5420 and either 5540 or Physics 5210.

6710 Crystal Chemistry (3) Laws governing arrangement of atoms and ions in solids and influence of arrangement and electronic structure upon physical and chemical properties of solids. Prereq: 5410, 5430, 5450 or 5710-20-50.

6711 Selected Topics in Inorganic Chemistry (3) Subject matter varies among important topics of current significance. Prereq: 5710-20-30. May be repeated.

6730 Topics in Quantum Chemistry (3) Continuation of quantum mechanics as applied to chemical theory.

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) Normal coordinates; group theoretical methods; potential functions; resonance; Wilson F & G matrices; selection rules for Raman spectra or crystals. Prereq: 5340-50, 5420, or consent of instructor. (Same as Physics 6810.)

6811 Selected Topics in Nuclear Chemistry (3) Subject matter varies among important topics of current significance. Prereq: 5810. May be repeated.

6820 Molecular Vibrations-Rotation Theory (3) (Same as Physics 6820.)

Classics

Professors: H. C. Rutledge (Head), Ph.D. Ohio State; A. Rapp (Emeritus), Ph.D. Illinois.

Associate Professor: M. L. Henbest, M.A. Arkansas.


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

Greek

3910 Plato (3)

3920 Herodotus (3)

3930 Euripides (2)

4020 Aeschylus; Sophocles (3)

4030 Lysias (3)

4040 Aristophanes (3)

4050-60-70 Directed Readings in Greek (3, 3, 3)

5110-20-30 The Greek Epic, Homer, (3, 3, 3)

5210-20-30 Greek Drama (3, 3, 3) Aeschylus, Sophocles, Euripides, Aristophanes.

Latin

3440 Livy (3)

3450 Pliny and Martial (3)

3460 Elegiac Poets (3)

4110 Seneca, Essays and Letters, or Tragedies (3)

4120 Horace, Satires and Epistles (3)

4130 Catullus, Martial (3)

4310 Readings from Medieval Latin (3)

4320-30 Selected Readings from Latin Literature (3) (Latin 3410-20-30 will correlate with Latin 4110-20-30) May be repeated.

4340 Horace, Odes (3)

4350 Tacitus (3)

5310 Seminar in Caesar (3) Reading in the writings of Caesar, including the Gallic Wars. Recommended for teachers. Summer.

5410-20-30 The Latin Epic: Lucretius, Vergil, Lucan (3, 3, 3)

5510-20-30 Roman Comedy: Plautus, Terence (3, 3, 3)

GENERAL COURSES

3310 Art and Archaeology of the Aegean Bronze Age and Early Greece (3) Troy, the Cyclades Islands, Greek mainland, and Crete. Emphasis on palaces of Crete and Mycenae, Tiryns, and Pylos, their fall, the following
Dark Age, and rebirth of Greek civilization. Illustrated lectures.

3320 Art and Archaeology of Archaic and Classical Greece (3) Survey of development of Greek architecture, sculpture, and painting 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 Mycense, 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, Epidaurus, Paestum, Cumae, Pera, 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; directed observation 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, Chairman

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, Wellek, 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 Pelt, Church, Tagliabue, Baldensperger, Wellek. 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.

Computer Science

MAJOR

Computer Science

DEGREE

M.S.

Professors:

R. T. Gregory (Head), Ph.D. Illinois; R. E. Bodenheimer, Ph.D. Northwestern (Electrical Engineering); R. E. Cline, Ph.D. Purdue (Mathematics); F. Donaldson, 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; A. O. Bishop, Ph.D. Chemistry; J. M. Moseley, Ph.D. Ohio State; C. P. Pfeiffer, Ph.D. Pennsylvania State; J. R. Pinkert, Ph.D. Wisconsin; D. W. Straight, Ph.D. Texas; M. G. Thomasen, Ph.D. Duke.

Assistant Professors:

A. M. Davis, Ph.D. Illinois; C. P. Huang, Ph.D. SUNY (Buffalo); S. R. Jordan, Ph.D. Wisconsin; R. P. Lenius, Ph.D. Wisconsin (Computer Sciences Division, Union Carbide Nuclear Division, Oak Ridge); J. M. Moseley, Ph.D. Ohio State; C. P. Pfeiffer, Ph.D. Pennsylvania State; J. R. Pinkert, Ph.D. Wisconsin; D. W. Straight, Ph.D. Texas; M. G. Thomasen, Ph.D. Duke.

ENTRANCE REQUIREMENTS TO M.S. PROGRAM

1. Mathematical maturity at least equivalent to that of a student who has completed a 2-year calculus sequence.

2. Computer Science 3150 (or C. S. 3155) or an equivalent introductory numerical mathematics.

3. Statistics 3450 (same as Statistics 3155) or an equivalent.

A graduate minor in Computer Science may be obtained by completion of nine hours of resident credit in computer science course work numbered above 4000 and approved by both major department and the computer science faculty.

REQUIREMENTS FOR THE M.S. DEGREE

All students must receive departmental credit for or exhibit proficiency in the following courses:

1. C. S. 4410-20-30

2. EE 5615-25-35 (These courses may not be used to satisfy 5000-level requirements specified below; however, they do count towards the 45 total graduate level credits required of all M.S. candidates.)

3. C. S. 4010 and 4510 or C. S. 4035-45 (the latter two sequences to be taken by students interested in concentrating in numerical analysis)

The student may then select either Plan A or Plan B:

Plan A. Thesis Option.

1. Completion of 36 hours of courses at the 4000 level or above, including at least 18 hours at the 5000 level in addition to the above 5000 level required courses.

2. Completion of at least nine additional hours of thesis credit, C. S. 5000.

3. Pass an oral examination administered by a committee of at least three faculty members.

Plan B. Non-Thesis Option.

1. Completion of 45 hours of courses at the 4000 level or above, including at least 27 hours at the 5000 level in addition to the above 5000-level required courses.

2. Pass written and oral comprehensive examinations.

Related courses may be taken by other departments: Mathematics 5240-50-60, 5340-50-60, 5480-90, 5560-70-80, Electrical Engineering 4835, 4800, 4820, 4830, 5610-20-30, and 6910-20-30.

3030 Introduction to Structured Programming (4) Intermediate computer programming. Use of general purpose language such as PL/1. Concept of structured programming. Prereq: 3 hrs in programming or consent of instructor.

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. Prereq or Coreq: Multivariable Calculus and Matrix Algebra. 2 hrs and 1 lab. 3150 and 3155 may not both be taken for credit; students with knowledge of FORTRAN should take 3155. (Same as Math 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. Coreq: Multivariable Calculus and Matrix Algebra. 3150 and 3155 may not both be taken for credit; students with knowledge of FORTRAN should take 3150. (Same as Math 3155.)

4010 Discrete Structures and Logical Foundations of Computing (3) Sets, relations, orderings, boolean algebra, propositional logic, functions and computable functions; graph theory and its applications to computer systems; set theoretical characteristics of computing machines and computing languages. Prereq: 3150 or consent of instructor.

4020 Introduction to Algorithms, Languages, and Automata (3) Introduction to finite automata: 'effective procedures' and algorithms; Turing machines; formal languages and grammars. Prereq: 4010 or equivalent.

4035-45 Introduction to Numerical Linear Algebra (3, 3) (Not for credit for Computer Science majors.) Numerical algorithms for solving systems of linear equations; least-squares methods and eigenvalue computations. Prereq: 3150 or 3155. (Same as Math 4035-45.)

4225-35 Introduction to Numerical Analysis (3, 3) (Same as Math 4225-35.)

4310 Computation in Statistical Analysis (3) Use of digital computer in standard statistical analysis, such as frequency tabulations, percentiles and data reduction, correlation and regression, analysis of variance. Elementary programming in a problem-oriented scientific language, e.g., FORTRAN. Use of statistical package programs. Not intended for persons who have credit for a computer course. Not for credit for Computer Science majors or minors. Prereq: Probability and statistics or equivalent.

4320 File Maintenance and Data Processing (3) (Not for credit for Computer Science majors.) Applied computer programming. Error analysis of FORTRAN programs, overlay structures, maintenance, computer-time accounting, debugging, information storage files, use of utility programs, sort and merge. Prereq: 1 course in FORTRAN programming.

4330 Special Problems in Applied Programming (3) Applied programming in an area of student's primary interest, using the digital computer. To be directed jointly by Computer Science faculty and student's faculty advisors. Oral and written reports. Prereq: 4320 or equivalent. Not for credit for Computer Science majors. May be repeated. Maximum 9 hrs.
programming languages. Formal grammars and languages, syntax and semantics of programming languages, structure of ALGOL and EULER. Prereq: 4610 or equivalent.

5420 Formal Languages and their Relation to Automata. Studies various types of automata based on their ability to translate (accept) different languages. Acceptors and translators, finite state and push-down store acceptors, deterministic and non-deterministic automata, regular expressions. Prereq: 5410.

5430 Compiler Design (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: 4430. Recommended: 5410 and 5420.

5455 Finite Difference Methods for Partial Differential Equations (3) (Same as Math 5455.)

5465 Mathematical Aspects of the Finite Element Method (3) (Same as Math 5465.)

5855-65-75 Numerical Mathematics (3, 3, 3) (Same as Math 5665-65-75.)

5760-80 Advanced Operating Systems (3, 3) Principles and techniques for understanding and designing modern operating systems. Abstract models. Topics include: concurrency, mechanisms for automatic resource allocation, sharing, multiplexing, remote conversational access, long-term storage, protection, measurement and evaluation. Prereq: 4430 or equivalent and consent of instructor.

5710-20 Automata Theory (3, 3) Survey of mathematical methods of computation, multiple tape automata, Turing machines and recursive functions, computational complexity, the classification of automata and the algebraic structure of finite state machines. Prereq: 4010 or equivalent.

5810 Information Organization and Retrieval (3) A study of the structure, analysis, organization, storage, searching and retrieval of information. Information analysis and dictionary construction; dictionary operations; syntactic language analysis operations; retrieval process; information search and matching procedures; automatic information dissemination systems; database retrieval systems. Prereq: 4430 or 4510.


5910-20-30 Special Topics in Computer Science (1-3, 1-3, 1-3) May be repeated. Maximum 9 hrs.

5000 Thesis

5010 Computer Assisted Instruction (3) Study of the history and development of CAI systems. Emphasis on studying success and failure of major projects as well as investigating future role CAI will assume in education. Research projects involve use of a CAI programming language to implement a CAI course. Prereq: 4410 or consent of instructor.

5050 Computer Modeling and Simulation of Physical Systems (3) Techniques for computer modeling and simulation. Inputs, driving functions, errors, outputs, interactive simulations as applied to various physical systems. Models to represent special relationships. Prereq: 3150 or 3155, 4420 and Statistics 3450.

5210 Introduction to Artificial Intelligence (3) Approaches to artificial intelligence. State-space representations of problems. Search and reduction methods. Theorem-proving methods by computer. Examples of programs that play chess, chess-playing. Practical applications. Computer simulation of elementary artificial intelligence problems. Prereq: 4010 or 4510 or consent of instructor. (Same as Elec. Engr. 5690.)

5410 Theory of Formal Languages (3) Investigation of formal languages for use in the development and description of features of programming languages. Formal grammars and languages, syntax and semantics of programming languages, structure of ALGOL and EULER. Prereq: 4610 or equivalent.

4610-20 Operating Systems (3, 3) Hardware interrupt systems and concurrence of input/output processes, multiprogramming, operating systems and program monitors; multiprocessing systems, memory management, protection, resource allocation and control, job management and task management; real time systems, time sharing systems, paging, virtual memory, schedulers, reliability; multiprocessing systems, graceful degradation; file management services, system accounting. Prereq: 4430. Coreq: 4510.

4850 Small Computer Systems (3) (Same as Electrical Engineering 4850.)


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. Maximum 8 hrs.


4880 Afro-American Psychology (4) (Same as Psychology 4880.)

5101 Foreign Study (1-12) See page 137.

5102 Off-Campus Study (1-12) See page 157.

5103 Independent Study (1-12) See page 138.

Economics

See College of Business Administration.

English

MAJOR

DEGREES

English

MA, M.A.C.T., Ph.D.

Professors:

J. H. Fisher '71 (Head), Ph.D. Pennsylvania; P. G. Adams, Director, Graduate Program

Ph.D. Texas; K. Curry, Ph.D. Yale; R. B. Davis, Ph.D. Virginia; R. Y. Drake, Ph.D. Yale; A. Hansen, Ph.D. Yale; M. A. Kert, Ph.D. Duke; F. D. Miller, Ph.D. Virginia; J. E. Reese (Chancellor), Ph.D. Kentucky; N. Sanders, Ph.D. Shakespeare Institute, Stratford-upon-Avon; A. T. Stewart, Ph.D. Northwestern; T. V. Wheeler, Ph.D. North Carolina; N. Wright, Ph.D. Yale.

Associate Professors:


Assistant Professors:

J. A. Armistead, Ph.D. Duke; L. S. Burghardt, Ph.D. Chicago; D. R. Cox, Ph.D. Missouri; B. J. Gaines, Ph.D. Wisconsin; R. T. Goode, Ph.D. Texas; D. F. Goslee, Ph.D. Yale; N. M. Goslee, Ph.D. Yale; M. A. Lotaro, Ph.D. Maryland; M. P. Richards, Ph.D. Wisconsin; F. K. Robinson, Ph.D. Texas.

Detailed information about the Master's and Doctor's programs may be obtained by writing the Director of the Graduate Program in English, McClung Tower. For admission forms, write to the Graduate School.

THE MASTER'S PROGRAM

The departmental requirement for the normal M.A. degree in English is a thesis, 36 quarter hours of courses and evidence of proficiency in one foreign language. 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 nine hours of 5000-6000 courses for the thesis, making a total of 45 hours.

For the degree of Master of Arts in College Teaching, 45 quarter hours are required, plus six hours in special courses designed for M.A.C.T. students and evi-
dence of proficiency in one foreign language. Candidates must also write a thesis or take an additional nine quarter hours of 5000-6000 level courses.

The language requirement may be fulfilled in one of the following ways:

a. The completion, before beginning graduate study, of a second year of a language in college with a grade of C or better.

b. The completion of French 3030 or German 3030, at The University of Tennessee, with a grade of B or better.

c. The passing of the regular Ph.D. language examination as currently administered.

Registration in any course in the 5000 or 6000 series may be repeated for credit 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 quarter-courses (or their equivalent) in English: 12 courses at the 5000 level; six additional courses at the 5000-6000 level; and six courses for graduate credit at any level, including the 3000-4000 level. In addition, 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 designated as the department directs. Successful completion of these examinations will be followed by the writing of the dissertation and an oral examination.

*1111 Written and Oral English for Foreign Students (6) - A foundation of English grammar structures and pronunciation with intensive oral and written drill. Required during the first quarter of residence of all foreign students (graduates, undergraduates, and transfer students) who are not excused from it on the basis of the English Proficiency Examination required of every new foreign student. Meets 10 hrs a week.

*1112 Written and Oral English for Foreign Students (3) - 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 1111. Meets 5 hrs a week. Replace English 1110 for undergraduate foreign-student enrollment.

*1121 English Composition for Foreign Students (3) - Composition and reading for students whose native language is not English. Emphasis on organization, paragraph and theme structure with attention to grammar and mechanics. Prereq: English 1111 or recommendation based on English Proficiency Examination.

*1131 English Composition for Foreign Students (3) - Typical writing problems encountered by foreign undergraduate and graduate students with attention to library research and to the writing of research papers. Prereq: English 1121 or recommendation based on English Proficiency Examination.

3070 Modern British Poetry (3) - From Housman to Thomas and more recent poets.

3080 Modern American Poetry (3) - From Robinson to Crane and more recent poets.


3150 Melville (3)


3411-12-20-30 Modern Drama (3, 3, 3, 3) - 3411—Continental to 1930. 3412—Continental since 1930. 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 Poetry (3) - Emphasis upon Dryden and Pope.

3620 Restoration and Eighteenth-Century Drama (3) - Dryden through Sheridan.

3630 Restoration and Eighteenth-Century Prose (3) - Defoe, Addison, Steele, Swift, and others.

3670 The Age of Johnson (3)

3710 The Literature of the English Bible (3)

3910-20-30 Comparative Literature (3, 3, 3) - 3910—Ancient. 3920—Medieval and Renaissance. 3930—Modern.

3940 The Novel of the Contemporary Western World (3) - Proust, Joyce, Mann, and others.

4010-20 Shakespeare (3, 3) - 4010—Early plays. 3) c. 1580-1601, including 1 Henry IV, Twelfth Night, and 4020—Later plays. 1601-1613, with emphasis upon tragedies and dramatic romances.

4050-60 The American Novel (3, 3) - 4050—From the earliest, sentimental novels through Brown, Cooper, Kennedy, and the major figures to 1875. 4060—From Henry James and Mark Twain through Faulkner and Hemingway.

4210-20-30 Victorian Poetry (3, 3, 3) - 4210—Tennyson and the Pre-Raphaelites. 4220—Brownie. 4230—Arnold, Clough, Fitzgerald, and others.

4310-20-30-40 The British Novel (3, 3, 3, 3) - 4300—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 generative-transformational 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.

4660 Special Topics in English Linguistics (3) - May be repeated with consent of department.

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.

4660 Emerson and Thoreau (3) - Selected writings of American Transcendentalism.

4680 American Humor through Mark Twain (3)

4720 Introduction to Folklore (3)

4730 The Popular Ballad (3)

4850 Milton (3) - Emphasis on major poems.

4860 Seventeenth-Century Prose and Poetry: Bacon, Donne to Marvell (3)

4910 Chaucer—Early Poems and Trolus 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.

4960 Advanced Composition and Rhetorical Analysis (3) - Reading and analysis of selected prose models, study of rhetorical principles, practice in various forms of writing.

5000 Thesis

5101 Foreign Study (1-12) - See page 137.

5102 Off-Campus Study (1-12) - See page 137.

5103 Independent Study (1-12) - See page 138.

5110-20-30 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 M.A.C.T. candidates. S/NC only.

5150 Old English Prose (3)

5170-30 History of the English Language (3, 3) - 5170-Phonemic 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)

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)

5610-20-30 Readings in English Literature of the Nineteenth Century (4, 4, 4)

5710-20-30 Readings in English Literature of the Eighteenth Century (3, 3, 3)

5810-30 Readings in English Literature of the Renaissance (3, 3, 3)

5850 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
110 College of Liberal Arts

6110-20-30 Studies in Elizabethan Literature (3, 3, 3)
6150 Old English Poetry (3) Prereq: $510.
6160 Beowulf (3) Prereq: $510, 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) 6241—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 Spencer 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
Geography
DEGREES
M.S., Ph.D.

Professors:
E. H. Hammond (Head), Ph.D. California (Berkeley); S. R. Jumper, Ph.D. Tennessee; R. G. Long, Ph.D. Northwestern; T. H. Schumardt, Ph.D. Wisconsin.

Associate Professors:
C. S. Aiken, Ph.D. Georgia; L. W. Brinkman, Jr., Ph.D. Wisconsin; J. B. Rehter, Ph.D. Louisiana State.

Assistant Professors:
T. L. Bell, Ph.D. Iowa; J. R. Carter, Ph.D. Georgia; W. N. Cherry, M.S. Tennessee.

M.A.S.T.E.R.’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. Thesis and comprehensive examination required.

DOCTORAL PROGRAM

The doctorate is a research degree and is granted 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. Specific course requirements will be determined by the student’s committee in accordance with his 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 among surface form, water, vegetation, and surface materials. Man as evaluator and agent of change.

3610 Political Geography (4) Importance of geographic factors for understanding political relationships within and between nations; spatial implications of political decision-making process; geography of administrative units.

3660 Cultural Geography (4) Basic concepts of culture; methods and background of cultural geography; world patterns of cultural phenomena.

3790 Geography of Middle America (4) Covers Mexico, Central America, and the West Indies.

3800 Geography of South America (4)

3870 Geography of Asia (4) A survey of the physical, cultural and economic characteristics of the countries of Asia, excluding the Soviet Union.

3910 Regional Geography of United States (4) Major physical, economic, and social distributions as they interrelate to give distinctive character to regions of United States and Canada.

3920 Geography of the American South (4)

3940 Geography of Appalachia (4) Interrelation of physical, economic, and social patterns to give distinctive character to the region and its parts, especially Southern Appalachia, in perspective in the current American scene.

4100 Quantitative Methods in Geography (4) Geomorphic applications of statistical techniques, point pattern analysis and analysis of areal units. Prereq: Elementary Quantitative Methods or consent of instructor.

4101 Foreign Study (1-16) See General Catalog.

4102 Off-Campus Study (1-16) See General Catalog.


4240 Historical Geography of the United States (4) Survey of changing human geography of United States during four centuries of settlement and development. Emphasis upon changing population patterns, development of agricultural regions and patterns of urban development.

4510 Principles of Geomorphology (4) (Same as Geology 4510.)

4550 Geography of Soils (4) Soils as physical systems and their relationship to environments. Investigation of specific cases of the role of soil in the management of environmental systems.

4610 Industrial Geography (4) Factors affecting location of manufacturing activities, with emphasis on the United States. Prereq: 3410 or consent of instructor.

4630 Geography of Agriculture (4)

4710 Cartography (4) Map construction, reproduction, and practice in map drawing.

4720 Data Mapping (4) Methods for representing spatial distributions by maps and graphs. Mapable data may include phenomena as diverse as birth rates, voting patterns, and air pollution levels. Prereq: Consent of Instructor.

4740 Remote Sensing; Types and Applications (4) Basic principles and uses of aerial photography and other remote sensing techniques. Emphasis upon value of various types of imagery for geographic information and simple mapping. Prereq: Consent of Instructor.

5000 Thesis

5101 Foreign Study (1-12) See page 137.

5102 Off-Campus Study (1-12) See page 137.

5150 Introduction to Geographical Research (3) The aims of geographical research; survey of principal source materials; practice in effective presentation of research findings.

5160 Research Design and Field Problems (4-6) Development of research problems, preparation of appropriate study designs, and practical application, normally offered as a 4-week summer course for 6 hours credit. Students may not take other courses or have duty assignments during this 4-week period.

5170 Geographic Concept and Method (3) Traditional and modern thought regarding the nature, scope, problems, and methods of geography.

5200 Special Problems in Geography (2-6) Reading and research on problems or topics of interest to individual students. Student must define topic and receive instructor’s approval of study plan before registering for course. May be repeated with consent of Instructor.

5250 Advanced Historical Geography (3) Approaches, principles and techniques of research in historical geography. Critical review of work of major historical geographers, with emphasis on current literature and ideas. Prereq: 4240 or permission of instructor. May be repeated with consent of instructor.

5260 Advanced Cultural Geography (3) Geomorphic analysis of cultural data, and in the Eastern United States, with emphasis upon New England, Tidewater East, and Upland South, and specific application to Southern Appalachians. Includes field work and final paper. Prereq: 3660 or consent of instructor.

5310 Advanced Regional Geography of the
THE MASTER'S PROGRAM

The department requires a minimum of 45 quarter hours including at least 18 hours in courses (other than thesis) numbered above 5000. A minimum of 24 hours in geology courses, in addition to thesis, is required. Students who enter the program without having had an acceptable field camp are required to take Geology 4440, or an equivalent course elsewhere, as part of the above department requirements. One year of general physics is required, if physics was not entered [ ]

Orientation examinations will be given to determine course program, which must be approved by the student's committee.

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 84 quarter hours in courses for graduate credit. In addition to dissertation. These courses must include a minimum of 45 hours in the 5000-6000 series, of which at least 15 hours must be in the 6000 series. Up to one-third of the required hours may be taken in related fields. 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. One foreign language required (to be determined by the faculty committee). Preliminary examination will be both written and oral.

*3160 Introduction to Earth Materials (4) An introduction to the study of minerals, rocks and soils. Laboratory includes hand specimen and analytical methods and identification of important rock-forming and economic minerals and major rock and soil types. Prereq: Geology I. 2 lectures and 2 labs.

3180 Mineralogy (4) Classification and identification of silicate and non-silicate minerals. Minerals and their uses in geologic education. Laboratory includes hand specimen, chemical and x-ray methods of identification. Prereq: 3160; General Chemistry or equivalent. 2 lectures and 2 labs.

3210-20 Invertebrate Paleontology (4, 4) Systematic study of important invertebrate fossil groups. Prereq: Protista to Brachiopoda, including sponges, coelenterates and bryozoans. Prereq: Phoronida to Hemichordata, including annelids, molluscs, arthropods and echni- derms. May be taken separately or in any order. Prereq: Paleobiology, General Biology, or consent of instructor. 3 hrs and 1 lab or field period.

3220-30 Seminar in Economic Geography (3, 3)

3240-50 Seminar in Historical Geography (3, 3)

3260-70 Seminar in Cultural Geography (3, 3)

3310-20 Seminar in Regional Geography of the United States (3, 3)

3360-20 Seminar in Regional Geography of Latin America (3, 3)

3710-20 Seminar in Physical Geography (3, 3)

Geological Sciences

MAJOR DEGREES

Geology M.S., Ph.D.

Professors:

G. Briggs (Head), Ph.D. Wisconsin; N. J. Kiepers, Ph.D. Ohio State; O. C. Kopp, Ph.D. Columbia; R. E. McLaughlin, Ph.D. Tennessee; R. M. Perhac, Ph.D. Michigan; J. L. Roeder, Ph.D. Geology; J. W. McCollum, Ph.D. North Carolina.

Associate Professors:


Assistant Professors:

D. W. Byerly, Ph.D. Tennessee; K. C. Misra, Ph.D. Western Ontario; W. P. Staub, Ph.D. Iowa State.

*3280 Paleobiology (4) An introduction to the principles and materials of paleobiology as applied to the earth's history. Prereq: Geology II, General Biology, or consent of instructor. 3 lectures and 1 lab or field period.

3270 Geological History of Land Organisms (4) The geological history and development of the terrestrial biota and ecosystems with special emphasis on the fossil record of land plants and vertebrates. Prereq: General Biology or consent of instructor. 3 lectures and 1 lab or field period.

3290 Physical and Biological Quaternary Environment of Humans (4) Interdisciplinary investigation techniques appropriate to the study of Quaternary environment with humans, stressing important effects on landscapes and biota that influence humans today. 2 lectures and 2 labs or field periods.

3310 Lithology (4) Classification and properties of igneous, metamorphic and sedimentary rocks. Laboratory includes both hand specimen and microscopic study of important rock types. Prereq: 3160 or strongly recommended: 3180. 2 lectures and 2 labs.

3330 Geology of East Tennesee (4) Lectures and field excursions. Prereq: 12 hrs of geology and consent of instructor.

*3360 Stratigraphy-Sedimentation (4) An introductory study of stratigraphic principles and practices and of sedimentary processes and the interpretation of depositional environments. Prereq: Geoscience II and 3160, 3 hrs and 1 lab or field period.

3370 Structural Geology (4) Introductory discussion of structures such as folds, faults, joints, cleavage and primary structures. Laboratory work includes depth and thickness problems, structure contour maps, etc. 3 hrs and 1 lab. Prereq: Elements of Geology (3 quarters) and Geomorphology and Calculus of a Single Variable (2 quarters) or equivalent.

3410 Principles of Ground Water Geology (3) Geological materials and processes affecting the occurrence and behavior of water. 2 lectures and 1 lab. (Same as Water Resources Development 3410.)

3510 Introductory Environmental Geology (4) Geologic problems involving earth environment and resources, and geologic parameters associated with their control and misuse. Prereq: Geoscience or consent of instructor. 2 lectures and 2 labs or field periods.

3520 Our Changing Landscapes (4) A basic introduction to the study of landscape-forming processes and their interactions with earth materials to produce landscapes. Laboratory experience includes slope and streamtable experiments and field experience. 2 hrs and 2 labs or field periods.

3610 Quaternary Geology for Engineers (3) Erosional and depositional processes, landforms, ground-water. 2 lectures and 1 lab or field period. (Same as Water Resources Development 3410.)

3710 Origin and Evolution of the Continents and Ocean Basins (4) An introductory study of the origins of and changes that have occurred in the earth's crust with emphasis on modern concepts of continental drift and plate tectonics. Prereq: Geoscience II.

4110 Principles of Economic Geology (4) Formation of mineral deposits. Prereq: 3160, 3370, or equivalent.

4115 Elementary Applied Geophysics (4) Basic principles of electrical, seismic, gravity and magnetic surveying. Prereq: Geoscience II and elementary physics. Differential and integral calculus desirable. 3 lectures and 1 lab.

4116 Sedimentology (4) Prereq: 3160. 2 hrs and 2 labs.

4210 Biostratigraphy (4) Fossil faunas and floras and their use in geochronology, stratigraphic correlation, and paleoecology. Prereq: 3260. 3 hrs and 1 lab.

4230 Paleocology (4) Principles of environ-
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mental 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 of major plant groups and chronological succession and geographic distribution of past floras on earth's surface and the landforms produced. Prereq: Geoscience II; Plants in Evolution or consent of instructor. 3 hrs and 1 lab. (Same as Botany 4240.)

4310 Geologic Mapping (3) Interpretation and methods. Prereq: 12 hrs of Geology. 3 lectures and 1 lab. (Same as Botany 4310.)

4440 Field Geology (3) Five weeks' field course, first term summer quarter. Employs entire time of students. A report is required, to be submitted no later than end of fall quarter. Prereq: 3150. 4 lectures 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, interpretation of imagery covering selected geologic features. Practice in photo interpretation and aerial geologic photography, including photographic principles and practice, interpretation of terrestrial and aerial photographs, and image interpretation. Prereq: 3370 or consent of instructor. 3 lectures and 1 lab. 3 hrs and 1 lab. (Same as Geography 4510.)

4510 Principles of Geomorphology (4) A study of the gradational processes acting at the earth's surface and the landforms produced. Prereq: Elements of Geology (2 quarters) or consent of instructor. 3 hrs and 1 seminar or lab. 3 hrs and 1 lab. (Same as Geography 4510.)

4510 Principles of Geomorphology (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: Introduction to earth materials.

4650 Mineral Phase Equilibria (3) Principles of phase chemistry and application of phase equilibria studies in rock-forming mineral systems as applied to understanding conditions of formation and modification of rocks. Prereq: 3310 or consent of instructor.

4660 Electron Microprobe Analysis: Theory and Application (3) Techniques and applicability of electron microprobe analysis: emphasis on applications in the earth sciences. Prereq: 3310 or consent of instructor. 2 lectures and 1 lab.

4760 Global Tectonics (3) The earth's gravity field, geomagnetics and the internal structure of the earth; the geomagnetic field, paleomagnetism, radioactivity and the age of the earth; the earth's internal heat, creep and anelasticity of the mantle. 3 lectures per week. Prereq: 4115 or consent of instructor.

4810 Special Problems in Geology (1-4) May be repeated. Maximum 4 hrs.

5000 Thesis

5050 Geochemistry of Ore Mineral Deposits (3) Study of ore deposits based on experimental, empirical, and theoretical geochemical considerations. Prereq: 4650 and 4110 or consent of instructor.

5060 Experimental Geochemistry (3) Study of various experimental techniques for investigating mineral phase equilibria at elevated temperatures and pressures, and an evaluation of the geochemical applicability of the derived data. Prereq: 5050 or consent of instructor.

5069 Experimental Geochemistry Laboratory (1-3) Independent lab study of a problem in geochemistry using lab techniques 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 and Advanced Calculus or consent of instructor. Advanced engineering mathematics desirable. 3 lectures and 1 lab.

5130 Geophysics—Seismic Exploration Methods (4) Seismic reflection and refraction methods discussed in depth, introduction to earthquake seismology and the earth's interior. Prereq: 4115 or consent of instructor. 3 lectures 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 (3 quarters) or consent of instructor. (Same as Botany 5290 and Zoology 5290.)

5310 Principles of Stratigraphy (4) Prereq: 4150.

5320-30 Advanced Historical Geology (3, 3, 3) 5320-30—Geologic history of the Paleozoic, Mesozoic—Mesozoic and Cenozoic. Prereq: 5310.

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. S/R/NC only.

5360 Selected Topics in Geology (1) May be repeated for credit with consent of department.

5370 Mesofabric Analysis (4) Introduction to techniques of gathering, processing, and interpreting tectonic mesoscopic fabric data. 3 lectures and 1 lab or field meeting. Prereq: 3370.

5460 Photogeologic Interpretation (4) Advanced photogeologic 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) Geometry and kinematics of plate motion are used to devise models of geosynclines, fold belts, metamorphic and plutonic belts, with recent and ancient examples. 3 lectures and 1 seminar or lab. Prereq: 3370.

5510 Optical Mineralogy (4) Identification of nonopaque substances by immersion methods, using petrographic microscope.

5520 Igneous Petrology (4) Description, classification, and origin of igneous rocks. Laboratory emphasizes thin section study. Prereq: 5310 or consent of instructor.

5530 Metamorphic Petrology (4) A study of the physical and chemical characteristics of the metamorphic environment; its gradational nature with diagenesis on one hand and igneous activity on the other. Laboratory will consist of study of both hand specimens and thin sections and a field trip in the Blue Ridge province. Prereq: Mineralogy and 5510. 3 lectures and 1 lab.

5540 Non-carbonate Sedimentary Petrology and Basin Analysis (4) A study of clastic depositional environments, e.g., deep-water trough, abyssal plain, continental shelf, intracratonic basin, and shoreline features. 3 hrs and 1 lab. Laboratory will consist of thin section studies of and field trips to representative ancient deposits. Prereq: 5510 or consent of instructor.

5550 Carbonate Sedimentology (4) Emphasis on environments of deposition of modern and ancient carbonates. Prereq: 4130 or consent of instructor. Recommended: 5510. 3 lectures and 1 lab.

5530 X-Ray Diffraction and Spectroscopy (4) Production and use of x-rays in identifying crystalline substances; identification of chemical elements by their x-ray spectra. Prereq: 5360 or consent of instructor. 2 lectures and 2 labs.

5540 Clay Mineralogy (4) Origin of the clay minerals, their structures and properties; application of mineralogical techniques in clay mineral studies. Prereq: Mineralogy and 5630 or equivalent. 2 lectures and 2 labs. To be offered on alternate-year basis.

5560 Thermodynamics for Geologists (3) Principles of chemical thermodynamics as related to geologic processes. Prereq: General Chemistry and Analytic Geometry and Calculus of a Single Variable or equivalents.

5560 Chemical Geology (3) Chemical approach to selected geologic problems. Topics of study include oxidation-reduction, phase equilibrium, chemical mineralogy. Prereq: 5560.

5570 Geochemical Prospecting (3) Theory and practice of geochemical prospecting for metallic ore deposits, i.e., the use of chemical analysis of rock, soil, plants, water, and stream sediment for locating ore. Prereq: 4110 and General Chemistry or equivalents.

5710 Advanced Paleontology (4) Fossil invertebrates.


5810 Geology of Fuels (4) Origin, occurrences, and uses of natural fuels.

5820 Metallic Mineral Deposits (4) Origin, occurrence, and uses of metal minerals.

5830 Nonmetallic Mineral Deposits (4) Origin, occurrence, and uses of nonmetallic minerals. 3 hrs and 1 lab or field period.

5840 Ore Microscopy (4) The study of ores and ore minerals by reflected light microscopy, x-ray, and other techniques. Prereq: 4110, 5510, and consent of instructor. 2 hrs and 2 labs.

5850 Regional Studies in Economic Geology (3) Literature study and lectures during winter quarter, followed by field trip between winter and spring quarters to mining operations and other places of geological interest. Prereq: 4110 and consent of instructor. 2 hours plus field trip. May be repeated with consent of department.

5915 Regional Geomorphology (4) Study of selected geomorphologically-related areas, 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

6110-20-30 Seminar in Stratigraphic Geology (3, 3, 3)

6210-20-30 Seminar in Paleontology (3, 3, 3)

6310-20-30 Seminar in Structural Geology (3, 3, 3)

6410-20-30 Seminar in Mineralogy (3, 3, 3)

6510-20-30 Seminar in Petrology (3, 3, 3)
Germanic and Slavic Languages

MAJORS

German

MA., M.A.C.T.

German Language and Literature

Ph.D.

Emeritus Professor:

E. T. Hankaeker, Ph.D. Bonn (Germany).

Professors:

H. Kratz (Head), Ph.D. Ohio State; H. W. Fuller, Ph.D. Wisconsin; R. L. Hiller, Ph.D. Cornell; N. A. Lauckner, Ph.D. Vanderbilt.

Associate Professors:

J. E. Fellen, Ph.D. Pennsylvania; D. E. Lee, Ph.D. Stanford; M. P. Rice, Ph.D. Vanderbilt.

Assistant Professors:

E. T. Hankamer, Ph.D. Bonn, Germany.

The Department of Germanic and Slavic Languages offers three advanced degrees. They are: the Master of Arts (M.A.) in German, the Master of Arts in College Teaching (M.A.C.T.) in German, and the Doctor of Philosophy (Ph.D.) in German Language and Literature.

MAJOR OF ARTS PROGRAM

In addition to the general Graduate School requirements as stated on page 17, 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 may get a maximum of nine hours credit. The minimum quarter hour credit for the M.A. is 45 quarter hours.

MASTER OF ARTS IN COLLEGE TEACHING PROGRAM

The M.A.C.T. program is essentially an expanded M.A. program. The minimum requirement is 60 hours of graduate study, including nine hours of thesis and a three quarter hour seminar in college teaching. The aim of this program is to prepare highly qualified college teachers. Students receiving the M.A.C.T. degree would be well prepared to go on to the Ph.D.

DOCTOR OF PHILOSOPHY PROGRAM

The student must fulfill the general requirements for the Ph.D. degree set by the Graduate School. The candidate for the Doctor's degree must complete a minimum of 81 quarter hours of course work beyond the Bachelor's degree in addition to 36 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 pro-seminar (5200) and the literary or philological seminars (6210-20-30-40-50-60 and 6310-20-30). At least nine 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 show a fluent command of German, both oral and written, and a knowledge of two other foreign languages, French and another language, such as Italian, Latin or Russian, appropriate to his 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 his 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 scholarly qualifications.

The field of study is divided into (1) German Literature and (2) German (or Germanic) Philology or Linguistics. A student 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

3010-20-30 Elements of German for Upper Division and Graduate Students (3, 3, 3) For graduate students preparing for language examinations. No graduate credit allowed.

3210-20-30 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 Vindland sagas, narrating discovery of America around year 1000. Mythological and epic poems of the Edda. No foreign language credit.

3250 Modern Scandinavian Literature in English Translation (3) Introduction to modern literature of Sweden, Norway, Denmark, and Iceland. Representative readings by such writers as Ibsen, Strindberg, Lagerlöf, Hamsun, Vesaas, Lagerkvist, Bang Nexo, and Laxness. No foreign language credit.

4050 The Faust Legend (3) Survey of development of legend from Faust chapbook to present, excluding Goethe's Faust. No foreign language credit.

4110-20-30 Studies in Classical and Modern Writers (3, 3, 3) Content varies. May be repeated for credit. Prereq: 9 hrs of 4000 courses (exclusive of 3010-20-30) or equivalent.

4140-50 Selected Topics in German Literature from 1750 to the Present (3, 3) Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30) or equivalent.

4160 Studies in German Authors (3) Study of the life and works of a single outstanding German literary figure. Content varies. May be repeated for credit. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30).

4170 Theatrical German (1-3) Performance in one or more German plays. May be repeated for credit with consent of department. Prereq: Immediate German or equivalent or consent of instructor.

4210-20-30 Studies in German Literary Types (3, 3, 3) 4210—Narrative Prose. 4220—Drama. 4230—Lyric Poetry. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30) or equivalent.

4250 Introduction to Descriptive Linguistics (3) (Same as French 4250.)

4260 Introduction to Historical and Comparative Linguistics (3) Linguistic change, proto-languages. Phonological and morphological change. Cultural, historical, sociological influences upon the development of language. Semantic change. Lexicography. All these topics copiously illustrated by selected examples from Indo-European languages. 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 3010-20-30), courses in literature in translation, and general courses in Latin and Greek requiring no knowledge of these languages, or consent of department. (Same as French, Russian, and Spanish 4260.)

4270 Introduction to Germanic Linguistics (3) The phonetics and phonemics of German. German grammar and the German vocabulary from prehistoric times to the present. The dialects of German. An introduction to the study of the other Germanic languages.

4310-20 History of the German Language (3, 3)

4810-20-30 Advanced Conversation and Composition (3, 3, 3) Prereq: 3810-20-30 or equivalent or consent of department.

5000 Thesis

5100 German Phonetics and Advanced Grammar (3)

5101 Foreign Study (1-12) See page 137.

5102 Off-Campus Study (1-12) See page 137.

5103 Independent Study (1-12) See page 138.

5160 Introduction to German Semantics (3)

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., M.A.C.T., or Ph.D. candidates, except those whose previous teaching experience warrants exempt this requirement or those who wish to pursue vocations other than teaching.

5410-20-30 Medieval German Language and Literature (3, 3, 3) 5410—Introduction to Medieval 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 (1889-1945) (3)

5590 Modern German Literature (1945-Present) (3)

5600 German Literary Theory and Criticism (3)

5610-20-30-40-50-60 Directed Readings in German Language and Literature (3, 3, 3, 3, 3, 3, 3)
4210 Readings in Old Norse Prose (3) Intensive readings of Old Norse prose works. The study of the Icelandic saga as a literary genre.

4230 Russian Romanticism. 4220-20-30 (exclusive of 3010-20-30, Russian Literature in English Translation, Russian Scientific and Technical Literature) or equivalent.

4250 Introduction to Descriptive Linguistics (3) (Same as French 4250.)

4260 Introduction to Historical and Comparative Linguistics (3) (Same as German 4260.)

4270 Introduction to Slavic Linguistics (3)

4310-20-30 Advanced Studies in Russian Language (3, 3) Intended primarily for students majoring or minoring in Russian who are interested in language and linguistics. Includes problems in morphology and syntax, stylistics and translation techniques, and history of Russian languages and other special problems for advanced students of Russian.

4410-20-30 Directed Readings (3, 3, 3)

Greek

See Classics

History

MAJOR DEGREES

History

M.A., M.A.C.T., Ph.D.

Professors:

L. P. Graf (Head), Ph.D. Harvard; G. Breker, Ph.D. Minnesota; F. V. Chmielowski, Ph.D. Harvard; H. S. Fink (Emeritus), Ph.D. Princeton; A. G. Haas, Ph.D. Chicago; Y. P. Mao, Ph.D. Harvard; W. Haselberger, Ph.D. California (Berkeley); J. W. Hoffman (Emeritus), Ph.D. Chicago; G. C. Jackson, Ph.D. Emory; M. M. Klein, Ph.D. Columbia; R. C. Manles, Ph.D. Yale.

Associate Professors:

P. H. Bergeron, Ph.D. Vanderbilt; J. D. Bing, Ph.D. Indiana; G. D. M. Mason, Ph.D. Maryland; R. E. Duncan, Ph.D. California (Berkeley); J. R. Finger, Ph.D. Washington; C. W. Johnson, Ph.D. Michigan; P. A. M. P. Harnd, Ph.D. Harvard; M. C. McDonald, Ph.D. Pennsylvania; J. M. Johnston, Ph.D. Yale; P. J. Pinckney, Ph.D. Vanderbilt; E. H. Trainer, Ph.D. Emory; W. B. Wheeler, Ph.D. Virginia.

Assistant Professors:


MASTER'S PROGRAM

Master of Arts—Plan I: Course requirements include History 5240, and either 5250 or 5260; one M.A. reading course; at least six additional hours above 5300; Total hours, including thesis—45. Plan II: History 5240, and either 5250 or 5260; two M.A. reading courses; 12 additional hours above 5300, at least 2 of which must be above 6300. Total hours—48. Plan III requires evidence of proficiency in one foreign language before the M.A. degree is granted.

Master of Arts in College Teaching—Course requirements include History 5240-50-56, 5271-72-73, and Cont. and High. Ed. 5110. Students must spend one year as a graduate assistant and one year as a teaching assistant. Total hours, including thesis—60. Students seeking the M.A.C.T. degree may substitute nine quarter hours of courses numbered above 6300 for the Master's thesis.

DOCTORAL PROGRAM

1. Admission: (a) Acceptable scores on the Graduate Record Examination (General Aptitude and History Achievement). (b) Students successfully completing the M.A. degree at The University of Tennessee must be recommended by the Department of History.

(c) Students from other institutions should have an M.A. degree and must be reviewed and approved by the Graduate Awards and Review Committee after their first year of work at The University of Tennessee.

2. Residence and Course Work: Beyond the Bachelor's degree a minimum of 75 credit hours in course work is required, of which not less than 45 must be at the graduate level. Not less than six quarters of the required nine quarters of residence work shall be under the supervision of the staff of The University of Tennessee.

3. Language Requirements: Candidates shall be required to possess a reading knowledge of an 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 any 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 should consult with his advisor. The appropriate forms and the time of the examination may be obtained from the Graduate School.

(b) By course work. Upon consultation with his advisor, he 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 transferable). 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 (History); two minor fields (History); and one minor field which may be either in History or outside the department.

In any case, the student is required to have nine 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, 1551-1815
Second Reich, 1713-1890. 3730—From a Uni-
ified to a Divided Germany, 1890 to present.
3750-60-70 Ancient History (3, 3, 3) 3750—
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 16th Century to World War I.
3795 Contemporary Middle East (4) Back-
ground of current problems in the area, from
World War I to present.
3810-20-30 History of East Asia (3, 3, 3) 3810—
Traditional China and Japan, ancient to
mid-nineteenth century. 3820—Modern China,
Japan, and Korea, mid-nineteenth century to
1920's. 3830—Contemporary China, Japan and
Korea, 1920's to present.
3870-80-90 History of Latin America (3, 3, 3)
3870—Exploration, conquest, settlement and
Colonial life to 1800. 3880—Major Countries of
South America, 1800 to present. 3890—
Mexico, 1821 to present. Latin America and the Caribbean.
1800 to present.
3911-21-31 United States, 1877 to the Present
(3, 4, 3) 3911—Gilded Age and Progressive Era, 1877-1917. 3921—W.I, New Deal, WW II,
1914-1945. 3931—Post World War II.
4015 Studies in History (3-4) Variable content
course affording opportunity to offer subject
matter not covered in an existing course. May
be repeated.
4120-30 History of Colonialism and Im-
perialism (3, 3) 4120—Background: age of
discovery and exploration to 19th century.
4130—19th century to present.
4250-60-70 European Intellectual and Cul-
tural History (3, 3, 3) 4250—From Reformation to
the Scientific Revolution (1500-1700). 4260—
From the Enlightenment to the Age of Realism
(1700-1870). 4270—From Subjectivism to Rela-
tivism (1870-present).
4280 Women in European History (4) Com-
aparative analysis of role and image of women in
Medieval, Renaissance, and Victorian per-
iods. Attention given to parallel changes in
structure of family as well as relationship be-
 tween Western cultural women and women's protest
movements.
4290 Women in American History (4) Ap-
proaches of women applied to American Society.
4311-21 History of American Foreign Rela-
tions (4, 4) 4311—From Revolution to 1812. 4321—
1812 to present.
4370 U.S. Military History, 1754 to the Present
(4) Examination of nation's broad strategic
aims and means used to attain them, shifting
strategy, tactics and weaponry involved in
our wars, and relationship between American so-
ciety and its armed forces.
4380—Civilian-Military Relationships in the
Modern Western World (3) Civilian-military
affairs from about 1900 to 1960 in Western Europe,
Asia, and America; emphasis on the Western
World: e.g. the Dreyfus Affair, the
Army in Nazi Germany, and the Truman-Mac-
Arthur controversy.
4410-20-30 Europe Since 1914 (3, 3, 3) 4410—
Pre-war European society and politics to the
World Depression. 4420—The World Depres-
sion to the end of World War II. 4450—Postwar
Europe and its Neighbors (3) A survey of
Polish history from its beginnings to the
present with some emphasis on the Polish
question and its context of modern inter-
national affairs.
4480 Russian Intellectual History (3) A survey of
Russian intellectual history from the eight-
teenth century to the present, emphasizing the
problems of Westernization, nationalism, and
the revolutionary tradition.
4490 Soviet Foreign Policy (3)
4500 History of Medieval England (3)
4510-20 Tudor-Stuart England (3, 3) 4510—
1485-1603. 4520—1603-1714.
4551 Great Britain from Burke to Burke
(1780-1848) (3)
4570 Twentieth Century Britain (3)
4580 Revolution & Reform: Ireland in the
19th and 20th Centuries (4)
4590 History of Canada, 1774-Present (3)
4610-20-30 The American Frontier and West-
ward Movement I, II, III (3, 3) The settlement
and development of the "West" throughout
American history. 4610—From the Atlantic to
the Mississippi. 4620-30—The Trans-Mississippi
West.
4630-40-50 Social and Cultural History of the
United States (3, 3, 3) 4640—Colonial Society
and Early Nation to 1825. 4650—1825-ca. 1900.
4660—1900-present.
4670 American Urban History (4)
4710-20-30 Medieval History, 500-1400 (3, 3,
3) 4710—Early Medieval period to Revival of
Empire in 962. 4720—962 to Renaissance of
12th century. 4730—Renaissance of 12th
century to Italian Renaissance.
4740 The City in Europe, ca. 1200-1900 (3)
European urban growth, with comparative
analysis of the major periods of urbanization of
the 13th and 19th centuries. Emphasis on
the relationship between the demographic,
economic and social foundations of the cities
and political and cultural developments.
4770-80 Austria and Central Europe (3, 3)
4770—To 1867. 4780—Since 1867.
4811-21 History of Japan (4, 4)
4840 History of Mexico (3)
4850 History of the Caribbean (3) The Carib-
bean region from discovery and colonization to
contemporary times.
4870-80-90 China (3, 3, 3) 4870—Cultural his-
tory of modern China. 4890—History of contemporary China.
4910-20-30 History of the South (3, 3, 3) 4910—
1607-1840. 4920—1840-1870. 4930—Since
1870.
4950-60 The Negro in American History (3, 3)
A history of the Negro since 1619.
5000 Thesis
5101 Foreign Study (1-12) See page 137.
5102 Off-Campus Study (1-12) See page 137.
5103 Independent Study (1-12) See page 138.
5211-5225 M.A. Reading Courses (3 hrs each)
Directed reading courses in preparation for
fields required for the Master's oral examina-
tion. 5211, Ancient; 5212, Medieval; 5213, Early
Modern Europe; 5214, Europe Since
1789; 5215, American History to 1815; 5216,
American History since 1789; 5217, Latin
America; 5218, Far East; 5219, Colonialism and
Imperialism; 5220, Early and Mid-Europe; 5222,
Russia; 5223, Germany; 5224, France; 5225,
Middle East. S/NC only. Open only to master's candidates
in history.
5240 Introduction to Historical Research (3)
Principles and procedures of research in
the study of history. Required of all candidates for advanced degrees who do not present evidence of similar training elsewhere.
5260 European Historiography (3) Introduces
the student to the historical literature of the leading European nations.

5240 American Historiography (3) Like 5240 in the American field.

5271-72-73 The Teaching of College History (0, 0, 3) An introduction to the problems of teaching at the college level. The place of history in the curriculum, types and levels of courses, and techniques of teaching. Prereq: Consent of instructor. Required of candidates for the M.A.C.T. Credit will be withheld until the completion of 5273, with grades of "S" or "NC" submitted at the end of each of the first two quarters.

5280 Philosophy and Methodology (3) Philosophies of history and their relationship to the milieux from which they emerge; modern trends in historical methodology.

5290 Quantitative Analysis of Historical Data (3) Prereq: Sociology 4150 and 5310, or consent of instructor.

5300 Topics in History (3)

5350 U.S. and the Far East (3)

5360 Topics in American Foreign Relations (3)

5410 Topics in Early Modern European History (3)

5440 Revolution and Restoration in Central Europe, 1780-1815 (3) Reform, resistance, and the advent of Liberalism and Nationalism.

5444 Topics in French History (3)

5445 Topics in 19th Century European History (3)

5450 Topics in 20th Century European History (3)

5480 Topics in Russian History (3)

5510 Topics in Tudor-Stuart England (3)

5520 Topics in Modern English History (3)

5550 Reaction and Reform in England, 1789-1848 (3)

5560 Anglo-Irish Relations (3)

5640 Topics in American Social and Cultural History (3)

5645 Topics in American Urban History (3)

5650 Topics in the American Westward Movement (3)

5660 Topics in Negro History (3)

5670 Topics in American Colonial History (3)

5675 Topics in the Early National Period of American History (3)

5680 Topics in 19th Century American History (3)

5690 Topics in 20th Century American History (3)

5710 History of the Crusades (3) The Crusades from 1095 to the 15th century.

5720 Topics in Medieval History (3)

5740 Topics in European Urban History (3)

5750 Topics in Ancient History (3)

5780 Topics in German National Socialism (3)

5790 Topics in Middle Eastern History (3)

5810 Topics in Andean History (3)

5820 Topics in Mexican History (3)

5850 Topics in Chinese History (3)

5860 Topics in Japanese History (3)

5910-20 Topics in Southern History (3, 3) 5910-The Old South. 5920-The New South.

6000 Doctoral Research and Dissertation

6210-20-30-40 Directed Readings (3, 3, 3, 3) Individual readings directed toward preparation for preliminary examination fields. Open only to candidates for the Ph.D. degree who are in residence and who have been in residence at least two quarters. Only one course may be taken in preparation for each of the four fields. Depending on the field in which he is reading, the student will be assigned to an appropriate member of the department. S/NC only.

6300 Seminar in Special Studies (3)

6310 Seminar in Tennessee History (3)

6350 Seminar in American Diplomatic History (3)

6410-20 Seminar in Western Europe (3, 3)

6444 Seminar in French History (3)

6480 Seminar in Russian History (3)

6510 Seminar in English History (3)

6610 Seminar in American Colonial History (3)

6620 Seminar in the Era of the American Revolution (3)

6630 Seminar in Early National Period of American History (3)

6635 Seminar in Jacksonian Period (3)

6640 Seminar in Social and Cultural History of the United States (3)

6650 Seminar in the American Westward Movement (3)

6710 Seminar in Medieval Institutions (3)

6740 Seminar in the Crusades (3)

6770 Seminar in Central European History (3)

6810 Seminar in Latin American History (3)

6910 Seminar in the Civil War Era (3)

6930 Seminar in Twentieth-Century America (3)

6940 Seminar in the History of the South (3)

6960 Seminar in Negro History (3)

Registration in topics and seminar courses may be repeated for credit with the permission of the department.

Latin
See Classics

Mathematics
MAJOR DEGREES

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

Professors:

L. K. Barrett (Head), Ph.D. Pennsylvania; G. B. Albert (Emeritus), Ph.D. Wisconsin; J. S. Bradley, Ph.D. Iowa; R. E. Cline, Ph.D. Purdue; D. J. Dessart, Ph.D. Maryland; E. D. Eaves (Emeritus), Ph.D. Texas; H. Franzen, Ph.D. Illinois; D. A. Gerdes, Ph.D. North Carolina State; R. T. Gregory, Ph.D. Illinois; D. R. Hinton, Ph.D. Tennessee; A. S. Householder (Emeritus), Ph.D. Chicago; L. H. Huch, Ph.D. Florida State; R. M. Mcconnell, Ph.D. Duke; H. T. Mathews, Ph.D. Tulane; D. D. Miller, Ph.D. Michigan; R. J. Piemmons, Ph.D. Auburn; K. C. Reddy,* Space Institute, Tullahoma.

Ph.D. Indian Institute of Technology (India); F. W. Stillman, Ph.D. Giessen (Germany).

Associate Professors:

A. Berman, Ph.D. Northwestern; J. H. Caruth, Ph.D. Louisiana State; C. E. Daverman, Ph.D. Louisiana State; R. J. Daverman, Ph.D. Wisconsin; D. E. Dobbs, Ph.D. Cornell; W. E. E. New York (Binghampton); J. W. Hecht, Ph.D. Iowa; R. A. Kimba,* Ph.D. Ohio State; G. A. Klaassen, Ph.D. Nebraska; Y. Kubo, Ph.D. Cincinnati; H. L. Lee (Emeritus), Ph.D. Duke; B. S. Raitt, Ph.D. Illinois; P. W. Schaefer, Ph.D. Maryland; L. J. H. Penniman, Ph.D. California (Berkeley); K. Soni, Ph.D. Oregon State; L. H. Turner, Ph.D. Purdue; W. R. Wade, Ph.D. Colorado (Riveria); C. G. Wagner, Ph.D. Duke.

Assistant Professors:

W. Brandal, Ph.D. Northwestern; E. L. Evans, Ph.D. Houston; J. F. Hall, Ph.D. Rice; G. S. Jordan, Ph.D. Wisconsin; W. F. Keicher, Ph.D. Illinois at Urbana-Champaign; J. E. Leech, Ph.D. California (Los Angeles); W. Leggatt, Ph.D. Kentuck; R. Lowry, Ph.D. Calif. Inst. Tech; D. R. Peterson, Ph.D. Michigan State; W. E. Row Jr., Ph.D. V. D. Will, Ph.D. Virginia; S. M. Sarbin, Ph.D. Cornell; C. C. Travis, Ph.D. Calif. (Davis); A. M. Wang, Ph.D. Minnesota; R. D. Weidner, Ph.D. California (Berkeley).

Math 3050, 3060, 3090, 3100, 3110, 3120, 3130, 3220, 3420, 3510, 3510-20-30, 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 versions of courses listed in the Graduate Catalog 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 for 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 (aptitude portion), and have had at least one year of college mathematics including analytic geometry.

The following requirements must be met:

(1) Completion of 45 hours of course work. A minimum of 30 hours must be taken in residence.

(2) A minimum of 36 hours must be selected from the mathematics courses 3350, 3400, 3500, 3910, 3920, 3930, 3950, 3950, 3970, 3980, 3990, or other mathematics courses numbered above 4000.

(3) Passing a comprehensive examina-
tion on completion of all course work. (4) A minimum of nine hours of courses numbered above 5000 subject to the approval of the mathematics department and the department in which the courses are taken.

MASTER’S PROGRAM

The Master of Arts degree and the Master of Science degree are designed primarily for prospective high school or college teachers and also for people interested in applied mathematics.

The departmental requirement for either of these degrees is a thesis, for which nine credit hours must be earned, and 36 additional hours of acceptable course work numbered above 4000. Of the above 36 hours, nine hours may be in a minor outside the department and 18 hours (exclusive of thesis) must be completed from courses in mathematics numbered above 5000.

It is strongly recommended that a candidate for the Master’s degree with a major in mathematics develop a reading knowledge of French, German, or Russian.

A student offering mathematics as a minor for the Master’s degree is required to obtain at least nine hours of resident graduate credit in courses numbered above 4000 and approved by both his major department and the Department of Mathematics.

DOCTORAL PROGRAM

The preliminary examination for the Ph.D. degree in mathematics will include four of the following subjects (including at least two from Group A) to the extent indicated by the accompanying course numbers, and such other subjects as the graduate faculty may prescribe.

(A) Algebra 5510-20-30 Functions of a Complex Variable 5110-20-30 Functions of a Real Variable 5210-20-30 Topology 5910-20-30

(B) Linear Analysis 5240-50-60 Mathematical Statistics 5750-60-70 Numerical Analysis 5650-60 Partial Differential Equations 5450-60-70

Note: A student selecting two subjects from Group B above is required to take a one year graduate level (numbered 5000 or above) course, where mathematics is extensively used, outside of the Mathematics Department. This course must be approved by the Mathematics Department Head.

It is expected that the candidate will participate in courses and seminars in mathematics and related fields beyond those required to qualify for the preliminary examination. The amount and nature of this work will be determined by the candidate’s major department.

Two foreign languages are required. German or French 3030 with a grade of A or B may be substituted for the corresponding language 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, events, and probability; axiomatic probability; random variables and their distributions; simple random processes; Binomial, Poisson, and normal distributions; statistical independence; statistical independence; axiomatic probability theory; random variables and their distributions; simple random processes. Prereq: Calculus, General Mathematics or equivalent.


*3110 The Real Number System (3) Laws of arithmetic; rational and irrational numbers; fields; Prereq: 1 yr. of college math. Primarily for students in the College of Education.

*3110 The Real Number System (3, 3) Introduction to numerical analysis algorithms and programming (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, constructions, modern concepts. Prereq: 1 yr. of college math.

3320 Non-Euclidean Geometry (3) Foundations of geometry. Elementary transformations of line. Prereq: 1 yr. of college math.

3330 Transformational Geometry (3) Fundamental invariance. Prereq: 1 yr. of college math.


3780-90 Introduction to Combinatorial Theory (3, 3) Introduction to problems of arrangement and selection within discrete systems. Enumeration by recurrence relations and generating functions, graph theory, finite geometries and finite fields, partitions, block designs. 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 participation in seminar setting. Prereq: 1 yr. of college math. Consent of instructor. May be repeated with consent of department. Maximum 9 hrs.

4035-45 Introduction to Numerical Linear Algebra (3, 3) (Same as Computer Science 4035-45)

4050 Matrix Algebra and Applications (3) Matrices, elementary operations, and vector spaces, 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 similar transformations, quadratic forms, vector and matrix norms, internal form, and related topics. Prereq: Multivariable Calculus and Matrix Algebra or Calculus.

4120 Linear Algebra (3) Abstract vector spaces, linear transformations, and their matrices, 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 factor systems, integers, the ring of polynomials, the ring of integers, Euclidean theory, group of rings, polynomials, rings, integral domains, divisibility, unique factorization domains, fields. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra or Calculus.

4225-35 Introduction to Numerical Analysis (3, 3) Interpolation and approximation, numerical differentiation and integration, roots of equations, linear and nonlinear equations. Prereq: 3150 or 3155. (Same as Computer Science 4225-35)

4230 Intermediate Numerical Methods (3) Numerical methods in differential and algebraic equations; linear algebraic equations; and other topics in numerical mathematics. Emphasis on application of computers. Must be taken in sequence. Prereq: 3150 or 3155.

4250 Elementary Complex Variables (3) Complex numbers, Cauchy-Riemann equations, elementary functions, Cauchy’s theorem and formula, Taylor and Laurent series, residues and poles. Prereq: Multivariable Calculus and Matrix Algebra; one 4000-level mathematics course recommended.

4510-20-30 Introduction to Analysis (3, 3, 3) Real number system, functions, sequences, limits, continuity, differentiation, integration. Functions of several 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.

4540 Infinite Series and Functions of Several Variables (3) General theory, power series and Taylor's formula. Functions of several variables. 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; solutions by series; heat flow. Beltrami equations. Prereq: Multivariable Calculus or Matrix Algebra.

4560-20-30 Ordinary Differential Equations (3, 3, 3) 4610—Linear first and second order equations. Power series solutions. Systems of linear differential equations and the matrix exponential. 4620—Numerical methods for ordinary differential equations including one-step methods (Euler, Runge-Kutta) for initial value problems and methods of stability and two point boundary value problems. 4630—Special topics which may include existence and uniqueness theorems, Lyapunov stability, singular perturbations, and asymptotic solutions. Prereq: 4610; Multivariable Calculus and Matrix Algebra or 4540 or Multivariable Calculus and Matrix Algebra and 3150 or 3155; 4630: 4610 or consent of instructor.

4640 Calculus of Finite Differences (3) Real difference equations, application to problems in engineering and physics. Prereq or coreq: 4610.

4650-60-70 Introduction to Mathematical Statistics (3, 3, 3) Introduction to probability; discrete and continuous distributions; correlation, regression, and independence; foundations of sampling theory; significance tests. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra.

4710 Vector Analysis (3) Fundamental operations, basis vectors, dot and cross products, directional derivatives, divergence and curl of vector fields, line and surface integrals, divergence theorem of Gauss, and Stokes' theorem. Prereq: Multivariable Calculus and Matrix Algebra.

4750-60-70 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 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; Poison, birth and death processes; Kolmogorov equations. Prereq: Multivariable Calculus and Matrix Algebra.

4810 Elementary Number Theory (3) Divisibility; congruences; theorems of Fermat and Wilson, including Wilson's theorems; the second congruence; quadratic reciprocity. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

4980 Readings in Mathematics (1-3) Open to superior students with permission of department head. Projects are worked under faculty guidance. May be repeated. Maximum 9 hrs.

4990 Studies in Mathematics (1-4) Credit determined at registration. May be repeated. Maximum 9 hrs. Prereq: Recommendation of Math Department faculty member and consent of department.

5000 Thesis

**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, arc length of curves in the plane and curves on a surface, curvature, torsion, asymptotes, local coordinates, Frenet formulas. Prereq: 3511, or 1 year of calculus, or consent of instructor.

**5013 Geometry for Teachers (3-4) Primarily for high school teachers of geometry. Historical as modern presentations of topics encountered in a high school geometry class: axioms, synthetic and metric; models; betweenness; congruence of segments and triangles; parallel postulate; 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, and 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 3500 or consent of instructor.

5050-60-70 Mathematical Logic (3, 3, 3) Truth functions; the syntax and semantics of some propositional theory; Gentzen's sequence-calculus; completeness and incompleteness theorems; proof theory; predicate 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 mapping; analytic continuation; special functions; Riemann surfaces. Prereq: 4510-20 for 5110; 4530 for 5120. Must be taken in sequence.


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; uniform convergence, compactness; integration. Prereq: 4510-20-30. Must be taken in sequence.


5310-20-30 Introduction to Higher Geometry (3, 3, 3) Projective spaces; coordinates and transformations; conics and quadrics. Elliptic and hyperbolic geometry from the viewpoint of the model geometry. Prereq: 4510-80. 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 Cebotarev, Graeffe, and others for obtaining numerical solutions; theorems of Budan and Fourier, Sturm, Routh and Hurwitz, and others for localizing roots.


5440 Calculus of Variations (3) Function spaces, the variation of a functional, strong and weak extremals, conditions for an extremum—Euler's Equation. Variational problems in parametric form, functionals depending on higher-order derivatives. Broken extremals—the Weierstrass-Erdmann conditions. Quadratic functionals, the second variation of a functional, Legendre's condition, conjugate points, Jacobi's condition, sufficient conditions for a weak extremum. Fields, Hilbert's invariant integral, the Weierstrass E-Function, sufficient conditions for a strong extremum. Prereq: 4510-20-30 and 4610.

5450-60-70 Introduction to Partial Differential Equations (3, 3, 3) Linear second-order equations in two variables; properties of elliptic, hyperbolic and parabolic types; solutions of the Poisson, Laplace, and hyperbolic equations. Separation of variables, 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 3155 and 4550. (Same as Computer Science 5455.)

5465 Mathematical Aspects of the Finite Element Method (3) Implementation of the Ritz-Galerkin methods for the solution of ordinary and partial differential equations. Local bases, approximation theory, rates of convergence, eigenvalues and eigenfunction problems, variational principles, hybrid elements. Prereq: 3150 or 3155 and 4550. (Same as Computer Science 5465.)

5480 Mathematical Programming (3, 3) Optimization of functions or variables subject to constraints. Prereq: 3150, 4680 and 4380.

5500 Lattice Theory (3) Parity ordered sets,
semilattices, lattices; completeness and conditional completeness; modularity and semimodularity; distributivity complementation and relative complementation; embedding theorems; applications to groups and rings.


5520-20-30 Advanced Ordinary Differential Equations (3, 3, 3) Theory of ordinary differential equations from an advanced viewpoint. Topics to be covered according to time available. Prereq: 5520 and consent of instructor.

5540 Galois Theory (3) Fields and their extensions, separable and normal extensions, algebraic closure, groups of automorphisms, fundamental theorem, solvability of equations by radicals. Prereq or coreq: 5520.

5560-70-80 Theory of Matrices in Numerical Analysis (3, 3, 3) 5560—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; minmax and maximin theorems for Hermitian matrices; Kantorovic inequalities. 5580—Singular and eigenvector problems. Prereq: 5520. Consent of instructor.

5590 Theory of Rings (3) Direct and subdirect sums of rings, prime and maximal ideals; maximal and prime rings of endomorphisms; radicals; Wedderburn-Artin structure theorem. Prereq: 5520.

5610-20-30 Mathematical Methods in Physics (3, 3, 3) (Same as Physics 5610-20-30)

5640 Numerical Methods in Physics (3) (Same as Physics 5640)

5655-65-75 Numerical Mathematics (3, 3, 3) The numerical solution of large systems of linear algebraic equations, systems of ordinary and partial differential equations, and the algebraic eigenvalue-eigenvector problem. Prereq: 4404 or 4235. (Same as Computer Science 5655-65-75)

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; exterior differential space. Prereq: Major in mathematics or physics. Must be taken in sequence.

5750-60-70 Advanced Mathematical Statistics (3, 3, 3) Distribution functions and mathematical expectation; the central limit theorem; characteristic functions; independence of functions; decision theory. Prereq: 5520.


5910-20-30 Elementary Topology (3, 3, 3) Topological spaces; metrization, homeomorphic invariants of point sets; structure of Peano continua. Mapping; homotopy. Introduction to combinatorial topology.

5990 Graduate Reading in Mathematics 1-3 Open to graduate students with permission of the department head. Independent study with faculty guidance. May be repeated. Maximum 9 hrs.

5991 Seminar Analysis (3)

5992 Seminar Topology (3)

5993 Seminar Algebra (3)

5994 Seminar Foundations (3)

5995 Seminar Applied Mathematics (3)

6000 Doctoral Research and Dissertation
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<tr>
<th>DEGREE CURRICULA</th>
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<td><strong>Music</strong></td>
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<tr>
<td><strong>The Department of Music offers the degrees of Master of Music with concentra-</strong></td>
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<tr>
<td><strong>tions in performance, composition, theory, vocal, choral conducting, suzuki string techniques, and piano literature and the Master of Arts with a major in music with concentra-</strong></td>
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<td><strong>tions in theory and musicology.</strong></td>
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<td><strong>Applicants for these degree programs must have completed an undergraduate degree approximately equivalent in music requirements to those required in degrees conferred by the University of Tennessee at Knoxville, appropriate to the prospective area of concentration on the master's level.</strong></td>
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<td><strong>Applicants who plan to pursue the degree in performance (applied music) are required to audition before the appropriate area committee. Applicants for admission to the program in composition must submit scores and tape recordings of representative works. All applicants are required to take the Diagnostic Examination in music theory and music history and literature.</strong></td>
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<tr>
<td><strong>General requirements for the Master's degree begin on page 17 of this catalog.</strong></td>
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The Department of Music offers the degrees of Master of Music with concentrations in performance, composition, theory, vocal conducting, suzuki string techniques, and piano literature and the Master of Arts with a major in music with concentrations in theory and musicology.

Applicants for these degree programs must have completed an undergraduate degree approximately equivalent in music requirements to those required in degrees conferred by the University of Tennessee at Knoxville, appropriate to the prospective area of concentration on the master's level.

Applicants who plan to pursue the degree in performance (applied music) are required to audition before the appropriate area committee. Applicants for admission to the program in composition must submit scores and tape recordings of representative works. All applicants are required to take the Diagnostic Examination in music theory and music history and literature.

General requirements for the Master's degree begin on page 17 of this catalog.
hours in research techniques, (d) 6 hours in ensemble, (e) 3 hours in theory, (f) 3 hours in recital, and (g) 12 hours in music electives.

Wind and Percussion Instruments: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 6 hours in Suzuki literature, (c) 6 hours in music research, (d) 3 hours in advanced conducting, (e) 3 hours in music theory, (f) 3-6 hours in ensemble, (g) 3 hours in recital, and (h) 9-12 hours in music electives.

Composition: 45 hours distributed as follows: (a) 9 hours in applied composition, (b) 3 hours in music research, (c) 15 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 music history/literature, (c) 6 hours in recital, and (d) 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 choral conducting performance or document, and (g) 12 hours in electives.

Suzuki String Techniques: 45 hours distributed as follows: (a) 12 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.

MASTER OF ARTS CURRICULA

Music Theory: 45 hours distributed as follows: (a) 18 hours in theory, (b) 3 hours in music research, (c) 9 hours in music history/literature, (d) 9 hours in thesis, and (e) 6 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 (2) 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 (2) Prereq: 3041 and organ proficiency at the 2000 level.

3114-24 Choral Arranging (3, 3) Analysis of scores and writing of arrangements for choruses. 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: Instrumentation or consent of instructor.

3230 The Concerto (3) Survey of literature from seventeenth century to present.

3240-50 The Symphony (3, 3) Survey of symphonic literature from Mannheim School to present.

3260-70 Chamber Music (3, 3) Survey of chamber music from 1750 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 church.

4001 Orchestration Design (3) Historical, tonal, and mechanical principles of organ design.

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.

4070-80-90 Opera Production (1, 1, 1) Problems of lyric stage: casting, production selection, production procedures, opera dramatics. Emphasis on acting techniques and student participation in practical production of opera and other works for lyric stage.

4111-21-31-41 Analysis of Music Literature (3, 3, 3, 3) Detailed examination of musical compositions by historical period with emphasis on harmony, thematic material, and structure. Traditional and contemporary analytical techniques. 4111—2000-1750, 4121—1750-1825, 4131—1825-1890, 4141—1890 to present. Prereq: Analysis II.

4112 Twentieth Century Composition 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) Analysis of scores and scoring 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.

4134 Band Transcription (3) Technique and application of transcribing keyboard and orchestra music for concert band; editing and rehearsal. Prereq: Instrumentation or equivalent.

4210-20 Nineteenth Century Music (3, 3) Music from 1800 to 1914. 4210—musical trends from Beethoven through Wagner; 4220—musical nationalism and post-Romantic instrumental and vocal styles.

4230-40 Contemporary European Music (3, 3) 4230—music from 1890 to World War II. 4240—music of romanticism and post-Romanticism; musical trends in the twentieth century. 4250—music of the early twentieth century. 4260—music of the early twentieth century. 4270—music [illegible].


4290 Gregorian Chant (3) Chants of Latin rite. Masses and Offices examined as functional music as well by type.

4310 History of Art Song (3) Survey of art song from fifteenth century to 1930.

4315 Wind Chamber Music (3) Study of wind chamber music from 16th through 20th 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


5010 Organ Literature Seminar (3) Topics vary. Prereq: Organ Literature.


5030 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)

5060 Seminar in Choral Performance (3) Study of rehearsal and performance problems and techniques as allied to score reading and preparation. Particular attention will be afforded to individual problems. Prereq: 4050 or equivalent.

5100 Independent Study in Music Theory (1-3) May be repeated for credit. 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 work 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 Colonial times through the music of 1900s; 4251—from 1930 to present (Copland to Cage). Prereq: Orientation in music appreciation or equivalent.

4260 Introduction to Ethnomusicology (3) Basic attitudes and techniques of ethnomusicology. Survey of music cultures of the Pacific, Near East, Asia and Africa. Prereq: Orientation in music appreciation or equivalent.
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)

5220-30 Proseminar (3, 3) Research techniques in music emphasizing bibliographic 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.

5350-60 Medieval Music (3, 3) To 1400; emphasis on early Christian chant, medieval secular song, early theory, the development of polyphony and of musical notation; transcription and editing of MSS. 5350—monody; 5360—polyphony.

5352-62 Renaissance Music (3, 3) Music from 1400 to 1600; Mass, motet, chanson, and madrigal; the use of instrumental music, performance practice, theory and notation; transcription and editing MSS. 5352—1400-1550; 5362—1550-1600.

5353-63 Baroque Music (3, 3) Music from 1600 to 1750; rise of opera and oratorio, church and secular cantata, instrumental forms, performance practice. 5353—1600-1700; 5363—1700-1750.

5355 Music in the Classical Period (3) Pre-classic music (Rococo) and music of Haydn, Mozart and early Beethoven. Includes background of other cultural and artistic activities.

*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)

*5555 Voice (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: 5199 and consent of instructor.

*5599 Composition (1-3) Prereq: 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 Band (1)

*5620 U.T. 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)

*5684 Campus Chorus (1)

*5686 Men's Glee Club (1)

*5687 Women's Glee Club (1)

*5699 Accompanying (1)

**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 (Emory), Ph.D. Chicago; O. van de Vate, Jr., Ph.D. Yale.

Associate Professors:

R. E. Aquila, Ph.D. Northwestern; L. Cebik, Ph.D. Nebraska.

Assistant Professors:


MASTER'S PROGRAM

See general requirements on page 17.

" May be repeated. Maximum 12 hrs.

** May be repeated. Maximum 6 hrs.

Courses below 4000 may not be taken for graduate credit by Philosophy majors except with special permission.

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 nine 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.

Registration in any course in the 5000 or 6000 series (except 5050-60-70, and 5810-50-40) may be repeated for credit with the permission 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.

3111 History of Ancient Philosophy (4) Pre-Socratic through Aristotle.

3121 History of Hellenistic, Roman, and Medieval Philosophy (4)

3131 History of Seventeenth and Eighteenth Century Philosophy (4)

3141 History of Nineteenth and Early Twentieth Century Philosophy (4)

3270 Russian Philosophical and Theological Thought (4) (Same as Religious Studies 3270.)

3311-12 American Philosophy (4, 4) 3311—Colonial to late 19th century. 3312—Late 19th 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, functions, value and epistemic principles of literary arts.

3440 Social Ethics (4) Ethical theory as related to politics, economics, law, religion and the family.

3510 Existentialism (4)

3550 Marxism as Philosophy (4)

3630 World Religions (4) Philosophic study of major living religions. May not be taken by students who have completed any of the following: 3650-50-70. (Same as Religious Studies 3630.)

3650 Philosophy and Religion in India (4) May
College of Liberal Arts

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Physics and Astronomy

MAJOR DEGREES

Physics

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

Professors:

W. M. Bugg (Head), Ph.D., Tennessee; R. D.
Birkschoff, Ph.D., Northwestern; M. A. Brozezaile,
Ph.D., Michigan State; L. G. Christosforou,
Ph.D., University of Manchester (England);
G. T. Condo, Ph.D., Illinois; C. P. Ph.D.
North Carolina; W. E. Deeds, Ph.D., Ohio
State; J. B. Dicks, Ph. D., Vanderbilt;
J. L. Fowler, Ph.D., Princeton; J. K. Fox,
Ph.D., Michigan; N. M. Gailor, Ph.D., Ohio
State; J. H. Gibbons, Ph.D., Duke; E. G. Harris,
Ph.D., Penn.; D. T. King, Ph.D., British
University (England); R. J. Lovell, Ph.D.,
Vanderbilt; A. A. Mason, Ph.D., Tennessee;
A. H. Nielsen, Ph.D., Illinois;
R. D. Present, Ph.D., Harvard;
R. A. Ritchie, Ph.D., California;
F. C. Schweinier, Ph.D., Massachusetts
Institute of Technology; J. O. Thompson,
Ph.D., Illinois; T. A. Weilin, Ph.D., Illinois;
J. White, Ph.D., North Carolina.

Associate Professors:

L. Adler, Ph.D., Pennsylvania; C. R. Bingham,
Ph.D., Tennessee; W. E. Blass, Ph.D.,
Michigan State; T. A. Callcott, Ph.D., Purdue;
R. W. Childers, Ph.D., Vanderbilt; J. Connell,
Ph.D., Colorado State; H. W. Crater, Ph.D.,
D. Yale; K. E. Ducett, Ph.D., Tennessee;
W. A. Dunnill, W. D. Ehrig, Ph.D.,
California (Berkeley); E. L. Hart, Ph.D.,
Cornell; P. G. Hosch, Ph.D., Maryland;
H. C. Jacobsen, Ph.D., Yale; J. Lewis,
Ph.D., Mississipp; R. W. Lide, Ph.D., Michigan;
W. K. McGregot, Ph.D., Pennsylvania;
D. J. Pegg, Ph.D., New Hampshire;
L. L. Riedinger, Ph.D., Vanderbilt; S. Y. Shieh,
Ph.D., Maryland.

Lecturers:

R. L. Becker, Ph.D., Yale.

A student who enrolls in the Graduate
School with the intention of attaining an
advanced degree in physics shall, in
general, have completed an undergraduate
major in physics or its equivalent. Physics
3210-20, 3710-20 or 3110-20, 4210-20,
4230 or 4240 constitute the minimum
course work prerequisite to graduate study.

A student who intends to present physics
as a graduate minor shall, in general,
have completed an undergraduate
major in physics or its equivalent. Physics
3210-20, 4210-20 constitutes 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, ele-
mental particle physics, atomic and low
temperature physics, magnetic and nuclear
spectroscopy, nuclear physics, plasma physics,
solid state physics, theoretical physics,
and ultrasonics.

Departmental graduate programs pro-
sing special opportunities for academic

1 Alumni Distinguished Professor.
2 Space Institute, Tallahassee.
3 Presently on leave of absence.
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.

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 nine 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 45 hours of course work composed of 27 hours from courses numbered above 5000 (e.g., 5110-20-30, 5210-20-30, 5310-20-30, etc.); nine hours in a minor field (e.g., mathematics); and nine hours from other courses in physics numbered above 4000 (preferably of advanced laboratory nature). In addition, the candidate must pass a comprehensive examination administered by his 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 M.A.C.T. degree in physics requires 15 more hours of work, making a total of 60 quarter hours. Nine of these hours are specified as follows: three hours in a seminar course dealing with general problems of college teaching; three hours in a seminar course dealing with special problems in the teaching of physics; and three hours in a course dealing with the history and philosophy of physics. The other six hours of course work may be elected from any of the physics courses numbered above 5000. During the two-year program leading to the M.A.C.T. degree, the candidate will be continually engaged in supervised teaching activities.

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 nuclear physics, Physics 6410-20-30 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 physics. (The Master's degree is not portable.)

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


4120-20-30 Mechanics (3, 3, 3) 3210-Statics, kinematics, and dynamics of a particle. 3220—Statics, kinematics, and dynamics of systems of particles and rigid bodies; 3250—LaGrangian and Hamiltonian treatments of motion. Must be taken in sequence. Prereq: Fundamentals of Physics: Waves and Optics; and Multivariable Calculus and Linear Algebra.

3230 Heat and Thermodynamics (3) Concepts of temperature laws and heat; 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; 3510-20 or consent of instructor.

3540-50-60 Health Physics Practicum (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 models, nuclear reactions, nuclear astrophysics, nuclear decay, nuclear spectroscopy. Prereq: 1 yr of general physics and consent of instructor. Required of M.A.C.T. candidates.

4110-20-30 Introduction to Quantum Mechanics (3) 4100-0-50—Introduction to fundamental principles of quantum mechanics and methods of calculation. Applications to atomic, molecular, and nuclear physics. Prereq: Fundamentals of Physics or equivalent, advanced calculus and differential equations.

4160 Physical Acoustics (4) Considerations fundamental to detailed investigation of any branch of acoustics; propagation of acoustic waves in various media, the ultrasonic, the hypersonic, and the hypersonics of 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; electromagnetic fields of moving charges. Must be taken in sequence. Prereq: Fundamentals of Physics, general physics, or equivalent.

4320-40 Geometrical and Physical Optics (4, 4) Lectures, problems and experiments in geometrical (4230) and physical (4240) optics. Prereq: College physics and calculus. 3 hrs and 1 lab.

4510-20-30 Atomic Physics Laboratory (3, 3, 3) Experiments in: fundamental particle properties, photoelectricity, conduction of electricity through gases, atomic and molecular spectroscopy, X-ray. Prereq or coreq: 3710-20-30. 3 labs.

4540-50 Experimental Nuclear and Radiation Physics (4, 4) Interaction of charged particles and electromagnetic radiation with matter; theory and characteristics of various detectors; statistics of counting, nuclear properties. Experiments illustrate recent techniques for investigating the nucleus and nuclear radiation. 1 hr lecture, 6 hrs lab. Prereq: Fundamentals of Physics: Electricity, Waves and Optics, Modern Physics.


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, counting techniques, energy deposition, criticality prevention, radiation biology and ecology. Prereq: 3730.

5000 Thesis
Advanced research techniques are studied under the supervision of a staff research director whose interests are in the interests of the student. Open to all graduate students in good standing. May be repeated with consent of department. S/NC only.

5110-20-30 Introduction to Theoretical Physics (3, 3, 3) Classical theoretical physics, with limit. Prereq. 3210-20; 4210-20; advanced calculus, differential equations, and vector analysis.

5210-20 Advanced Modern Physics (3, 3, 3) Basic principles of wave mechanics; one-electron atom; vector potential; atomic and molecular spectroscopy; molecular binding; relaxation; properties of nuclei (spin, magnetic moments, etc.); scattering phenomena; nuclear models and forces; high-energy physics. Prereq. 3210-20, 3710-20-30, 4210-20, differential equations. Must be taken in sequence.


5310-20-30 Advanced Dynamics (3, 3, 3) Equations of LaGrange and Hamilton, variational principles, the two-body problem, rigid body mechanics, special relativity, canonical transformations, normal coordinates, elasticity, fluid mechanics. Prereq or coreq: 5810-20-30.


5440 Experimental Methods of Infrared and Raman Spectroscopy (3) Experimental equipment; instrumental optics; detection systems; analytical methods. Analysis of the vibrational-rotational spectra of various molecules. Survey of present-day molecular physics. Prereq or coreq: 5810-20-30. (Same as Chemistry 5440.)

5460 Radiation Chemistry (3) Same as Chemistry 5460.


5610-20-30 Mathematical Methods in Physics (3, 3, 3) Vector and tensor analysis; linear algebra; multiple integrals; Fourier series and integrals; spherical harmonics; Bessel functions; linear second-order partial differential equations, 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 5610-30-30.)

5640 Numerical Methods in Physics (3) Numerical methods available for solution of physical problems, pointed toward use of automatic computing machinery; analysis of errors. Prereq or coreq: Consent of instructor. (Same as Math 5640.)

5720 Physics of Polyatomic Molecules (3) Introduction to the electronic structure of molecules and the physical processes of luminescence and photochemistry; theoretical and experimental aspects of intermolecular and intramolecular electron excitation energy transfer; optical properties of the molecule; photodynamic processes. Prereq: 5210-20 or consent of instructor.

5910-20-30 Special Problems (3, 3, 3) Specially assigned theoretical or experimental work on problems not covered in other courses.

5911-21-31 Special Problems in the Teaching of Physics (1, 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. Prereq: 4 years of physics or consent of candidate.


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. Dirac equation; quantum electrodynamics. Prereq: 4130 or 5210; 5310-20-30 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 nuclei; 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 tensors; relativistic mechanics; relativistic electrodynamics. Prereq: 5310-20-30, 5410-20-30, 6310.

6330 General Relativity (3) Tensor calculus; general theory of relativity; gravitational field equations. Prereq: 6320.

6420 Advanced Topics in Classical Theory (3) Course is designed to meet special needs of students. Possible fields are: (a) advanced dynamics and hydrodynamics, (b) electromagnetic theory, (c) statistical mechanics, including theory of non-equilibrium processes. Prereq: 5310-20-30, 5410-20-30, 5510-20-30. May be repeated with consent of department.

6430 Advanced Topics in Quantum Theory (3) Course is designed to meet special needs of students. Possible topics are: angular-momentum theory, beta-ray theory, theory of atomic spectra, nuclear structure, pair production, theory of radiation, electric and magnetic susceptibilities, high energy processes, scattering processes, etc. Prereq: 6110-20-30. May be repeated with consent of department.


6510 Interaction of Radiation with Gases (3) Interaction of electromagnetic radiation with atoms and molecules; oscillator strength, interactions of charged particles with atoms and molecules; ionization; transmutation and light emission. Electron interaction, transport and capture; electron beam experiments. Prereq or coreq: 6110-20-30.

6520 Interaction of Electrons with Solids (3) Collisions with free electrons; stopping power; electron slowing down spectra; energy straggling; nuclear scattering; electron diffusion; plasmon effects in irradiated solids; light emission from irradiated solids; techniques in electron spectroscopy; applications to dosimetry. Prereq or coreq: 6510-20-30.


6710-20-30 Advanced Solid State Physics (3, 3, 3) Lattice dynamics; phonons; Brillouin zones; heat capacity. Energy band structure of solids; cohesive energy; work function. Crystal oscillation strengths; effective mass approxima- tion. Dia-, para-, and ferromagnetism; neutron diffraction. The Fermi surface. Superconductivity; magnetic properties and magnetic fields; excitations from phonons, electrons, and defects. Excitations; polarons; surface states. F-centers; dislocations; and other defects. Prereq: 4630, 5210-30. Prereq or coreq: 4630 or 5240 or 5250; 6110 for 6710, 6120 for 6720.

6810 Vibrational Problems in Molecular Spectro- (3) Same as Chemistry 6810.

6820 Molecular Vibration-Rotation Theory (3) Molecular vibrations and rotative transitions in gases and solids. Quantum mechanical theory of symmetric and asymmetric molecular vibrations including vibration-rotation, overtone and combination states; selection rules and energies of molecular transitions. Methods of analysis used in high resolution molecular spectroscopy. (Same as Chemistry 6820.)

Political Science

MAJOR

DEGREES

Political Science M.A., Ph.D.

Public Administration M.P.A.


Associate Professors: R. B. Cunningham, Ph.D. Indiana; J. Dodd, Ph.D. Georgia; D. D. Nimmo, Ph.D. Vanderbilt; H. Piaas, Ph.D. Utah; N. M. Robinson, Ph.D. Syracuse; O H. Stephens, Ph.D. Johns Hopkins; D. M. Welburn, Ph.D. Texas; C. Zuzak, Ph.D. Maryland.

Assistant Professors: J. A. V. Allen, M.A. Michigan; B. P. Greene, Ph.D. Indiana; W. Lyons.
Registration in any courses in the 5000-6000 series may be repeated for credit with permission of the department.

THE BUREAU OF PUBLIC ADMINISTRATION

The University maintains 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 Ungr (Director); Professors Plass (Associate Director), Kronenberg (Associate Director, Nashville); Robson (Assistant Director); Assistant Professors Rogers (Nashville); Greene (Nashville); Instructors: Iascho (Nashville); Allen (Nashville); Senior Research Associate Tye; Research Associates Rawson, Smith, Thomas.

MASTER'S PROGRAM

See general requirements on page 17.

MASTER'S IN PUBLIC ADMINISTRATION PROGRAM

The department offers two programs leading to the degree of Master of Public Administration. The first program is available through the Nashville campus. The second is jointly offered by Middle Tennessee State University and The University of Tennessee. This program is directed primarily to career employees of federal, state and local governments in the Nashville area. Requirements for admission and graduation:

Applicants for admission to the joint degree program must have completed a Bachelor's degree from an accredited college or university and be eligible for admission to the Graduate School. (UT-MTSU applicants must gain admission to both of the sponsoring institutions and pass a qualifying examination, if required.) Specific requirements for graduation include:

1. The completion of 45 quarter hours of approved graduate courses including nine hours of thesis work. In lieu of thesis, candidates may complete a total of 48 quarter hours of course work.
2. At least 50% of the credit hours including thesis must be in approved courses numbered 6000 and above.
3. Demonstrate command of the material covered in course work in an oral comprehensive examination. A non-theis student must have a written examination which may be followed by an oral.
4. For the UT-MTSU program, the joint supervisory committee to which the student is assigned may require the student to complete a tools course (non-graduate credit), such as statistics, where such a course is requisite to successful completion of the program.
5. The student completing the joint program will receive his degree jointly from the University of Tennessee, Knoxville and Middle Tennessee State University. Inquiries concerning the UT-MTSU program should be directed to:

UT-MTSU Graduate Program in Public Administration

The Nashville Center
323 Mclemore Street
Nashville, Tennessee 37203

Inquiries concerning the Knoxville program should be directed to the Department of Political Science, Knoxville, Tennessee 37916.

DOCTORAL PROGRAM

Specific requirements for the degree of Doctor of Philosophy in political 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 shall be graduate level hours (i.e. earned in 5000-6000 level courses). At least 45 of these graduate level hours shall be at the 6000 level. This figure includes 36 hours of credit for the dissertation.
2. 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 or both.
3. 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.
4. The candidate must pass a final oral examination on his doctoral dissertation.
5. Successful completion of the degree also depends on course performance and other evidence of professional interest and conduct.

3545-46 United States Constitutional Law (4, 4)

3545—Analysis of judicial review, constitutional powers of President and Congress, federalism, sources of regulatory authority, and constitutional protection of political rights. United States Government and Politics desirable as a preceding course. 3546—Study of civil rights and liberties, with emphasis on judicial interpretation of First Amendment freedoms, rights of the accused, racial equality, and the right of privacy.

3555 Minority Group Politics in the United States (4, 4) Content varies from quarter to quarter. May be repeated with consent of department. Maximum 8 hrs.

3556 Introduction to Public Administrative Organization and Management (4) Organization and decision-making theory, line and staff services, political of organization, leadership, personnel and fiscal management, administrative responsibility. United States Government and Politics desirable as a preceding course. (Same as Water Resources Development 3565).


3615-16 Dynamics of Black African Politics (4, 4)

3621-22 Politics of Asian States (4, 4)

3625-26 Latin American Government and Politics (4, 4)

3630 Administration of Government Enterprises (3) Problems of special government enterprises, such as TVA.

3631-32 Government and Politics of the Soviet Union (4, 4)

3635-36 Politics in Western Democracies (4, 4) Political culture, consensus, and institutions of Western democratic systems.

3641-42 Government and Politics of Middle East and North Africa (4, 4)

3655 Political Change in Developing Areas (4)

3710-20 State, Regional, and Local Government and Administration (3, 3, 3) Constitutional and political structure; 3720—Governmental organs and their relationships; 3750—Functions and administration.

3715 Contemporary Problems of Soviet Foreign Policy (4)

3801-02-03-04 Studies in Political Thought (4, 4, 4, 4)

4110-20 Administrative Law (3, 3) 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, 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.

4580-91 The Urban Polity (4, 4, 4, 4) Analysis of political institutions and processes in metropolitan areas; urban problems and politics.

4610 The Budgetary Process (3) 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.

4665-66 Policy-Making in Democracies (4, 4)

4675 Special Topics in Comparative Government and Politics (4, 4) May be repeated with consent of department. Maximum 8 hrs.


4711 International Law (4)

4740-50-60 Politics and Elections (3, 3, 4) 4740-50—Structure and function of party system; nominations and campaigns. 4750—Voting behavior of the electorate.

4815—Contemporary Soviet Marxism-Leninism (4)

4831-32-33 The Systematic Study of Politics (4, 4, 4, 4)

4875 Special Topics in Political Thought (4) May be repeated with consent of department. Maximum 8 hrs.

4900 Aspects of Urban Environment (3) In-
terdisciplinary course in urban problems. Pre-
req: Consent of instructor. S/NC only. (Same as Architecture 4900, Psychology 4900, and
Real Estate 4900.)

4975 Proseminar in Political Science (4) Se-
lected research for seniors; primarily for ma-
jors. May be repeated with consent of de-
partment. Maximum 8 hrs.

5000 Thesis

5101 Foreign Study (1-12) See page 137.

5102 Off-Campus Study (1-12) See page 137.

5103 Independent Study (1-12) See page 138.

5110-20 Seminar in Political Theory (3, 3) Se-
lected political thinkers, schools, historical peri-
ods.

5210-20-30 Seminar in World Politics (3, 3, 3)
Research in world problems and organization.

5410 Politics, Administration and Community
in Non-metropolitan Areas (3) Analysis of prob-
lems and processes associated with commu-
nity development.

5510 Internship in Political Science (3-9)
Open to student participating in approved in-
ternship programs. May be repeated with con-
sent of instructor. Maximum 9 hrs.

5211 Directed Readings in Political Science (3)
May be taken for a letter grade or on an S/NC basis. May be repeated with consent of
instructor and student's advisor. Maximum 9 hrs.

5250 Seminar in African Politics (3) Selected topics in African politics.

5270-80-90 Seminar in the Politics of De-
velopment (3, 3, 3) Selected topics dealing with public problems of the less developed
countries.

5310-20-30 Seminar in Comparative Govern-
ment (3, 3, 3) Selected topics in modern govern-
ments.

5340-50-60 Seminar in Latin American Gov-
ernment (3, 3, 3)

5370-80 Seminar in Soviet Politics and Gov-
ernment (3, 3)

5410-20-30 Seminar in Public Law (3, 3, 3) Special problems in constitutional and admin-
istrative law.

5440-50 Theory and Analysis of U.S. Foreign
Policy (3, 4) Theoretical approaches to decision making in the foreign policy area and an an-
alysis of the policy making process.

5510-20 Seminar in International Organiza-
tion (3, 3) 5510—Introduction to regional in-
ternational organizations; political integration at the international level. 5520—Functional international organizations.

5540 Seminar in Comparative Public Admin-
istration (3) Approaches to and methods used in comparative analysis.

5550 Seminar in Administration in Developing Countries (3)

5600 Public Administration (3) Survey of pub-
lic administration theory and functions, ap-
proaches to public management, contemporary problems in public administration.

5605 Research and Methodology in Public
Administration (3) Introduction to basic as-
sumptions and techniques of research in public administration; topics include measurement, analysis, and reporting of data.

5610-20 Seminar in Organization Theory (3, 3)
An appraisal of major theories of organization and their applicability to the public sector.

5611-21 Seminar in State-Local Adminis-
tration (3, 3, 3)

5630 Seminar in Technology and Public Policy (3) Technological change and the policy
process, government interactions with the sci-
entific community, political characteristics of the science enterprise.

5635-45 Operations Research for Public Ad-
ministrators (3, 3) Operations research meth-
odology; applications and limitations of O.R. in the public sector; linear programming, tran-
portation and assignment problems, net-
work analysis, PERT, dynamic programming and other methods.

5640-50-60 Seminar in Metropolitan Areas (3, 3, 3)

5641 Seminar in Contemporary Public Policies (3) Examination of public problems in
one or more public policy areas from political and administra-
tive perspectives. Topics to be selected by the instructor.

5670-80 Seminar in Policy Analysis (3, 3) Role of administrators in policy analysis and de-
cision making with special attention to his-
torical and current issues.

5710 Seminar in the Politics of Administra-
tion (3) An examination of public administration in the context of the American political system with emphasis on policy making and the political roles of public administrators and agencies.

5740 Seminar in Organizational Analysis (3) Organization theory applications in public man-
gement; field analysis of public organizations.

5750 Seminar in Public Management (3) Ex-
amination of selected problems.

5755 Seminar in Public Management (3) Ex-
amination of selected problems.

5760 Seminar in TVA Personnel Man-
agement Practices (3) Exploration of public
management personnel through an in-depth examination of one of the national govern-
ment's foremost personnel systems—TVA. TVA staff and employee organization representatives serve as discussion leaders.

5765-75 Law and the Administrative Process (3, 3) Constitutional position; decisional pro-
cesses, regulation and management; limita-
tions and legal, governmental actions; questions of structure, role, and administrative choice.

5770 Practicum in Public Administration (3)

5780 Seminar in Fiscal Management (3) The
financial control of government in a mixed econ-
omy system. Sources of public revenue and credit, financial planning and control.

5785-95 Seminar in Staff Functions (3, 3) Func-
tions of administrative staff personnel serv-
ing political executives, public bureau-
ocracies, legislative bodies, and advisory and community groups in the public sector. Se-
lected topics include budgeting, personnel, evaluation, and other staff functions.

5810 The American Political Process (4) Prin-
cipal patterns of political activity linking citi-
zens and political institutions.

5820 The American Political Process (4) Se-
lected problems in American politics.

5850 Seminar in Comparative State Politics (3) Intensive readings in comparative state politics, including government of state politics, institutions and policy making.

5910-20-30 Methodology and Bibliography (3, 3, 3) 5910-20—Behavioral and mathematical approaches to research. 5930—Philosophical problems in research, traditional literature, and non-behavioral projects.

6000 Doctoral Research and Dissertation

6210 Advanced Studies in International Poli-
tics (3)
Knoxville, TN 37916.

write: Graduate Secretary, Department of

programs and admissions requirements,

the Department of Industrial Management

and School Psychology, and (jointly with

grams are offered in Clinical Psychology

128

are offered on an outpatient basis, with

chological diagnosis and psychotherapy

ate training in clinical psychology . Psy-

Psychology, University of Tennessee,

3220 Motivation and Emotion (4) Not approved

credit for psychology majors.

of theories, methods and research findings on

feral by a physician.

3120 Social Psychology (4) General survey

tories, methods and research findings on

individual behavior in a social context. Prereq:

General Psychology. Not approved for graduate

credit for psychology majors.

3150 Descriptive Statistics (4) Not approved

graduate credit for psychology majors.

3210 Learning and Thinking (4) Not approved

graduate credit for psychology majors.

3220 Motivation and Emotion (4) Not approved

graduate credit for psychology majors.

3550 Child Psychology (4) Psychology of behavior

infancy and childhood; physical, intellec-
tual, social, emotional, and language de-

development in the normal child. Not approved for

graduate credit for psychology majors.

3650 Abnormal Psychology (4) Constitutional

and environmental factors in abnormal be-

havior; neurotic and psychotic reactions; non-
technical discussion of diagnostic and thera-
petic methods. Not approved for graduate credit

for psychology majors.

4107 Experience in Individualized Instruction

(2) Supervised participation as a tutor in in-
dividualized instruction. Prereq: Consent of

structor. May be repeated. Maximum 4 hrs.

S/NC only.

4120 Topics in Social Psychology (4) Inten-
sive analysis of selected research topics.

Prereq: Sociology 3130 (Same as Sociology

4120.)

4230 Survey of sensory and perceptual processes

with emphasis on audition and vision. Prereq:

Psychological Statistics. Recommended: Bio-

logical Foundations of Behavior.

4230 Laboratory in Sensory Processes and Percep-

(2) Prereg or coreq: 4230. 2 periods.

4340 Human Factors in Man-Machine Systems

(4)

4460 Organizational-Industrial Psychology (3)

4510 Personality Theories (4) Prereq: Ab-

ormal Psychology or equivalent.

4519 Research in Personality (4) Discussion

and demonstration of research on individual

as it relates to major theoretical issues and to

substantive areas of investigation. Prereq: De-

scriptive Statistics or equivalent.

4520 Personality and Social Systems (4) Prereq:

Abnormal Psychology.

4550 Psychology of Aging (4) Behavioral

changes from maturity through old age. Prereq:

Consent of instructor.

4610 Group Processes (3) Study and experi-

ence of theory and techniques of group pro-

cessing and facilitation. Those participating in

4610 are expected to continue into 4620 and

4630. Prereq: Human Relations and consent of

structor.

4620-30 Seminar in Group Processes (0, 6)

Didactic and laboratory experience for those

qualified for further training as group facilita-

tors. Prereq: 4610 and consent of instructor.

No credit given until sequence is completed.

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 con-

cept-formation; the nature, use and develop-

ment of language. Prereq: Learning and Think-

ing or consent of instructor.

4660 The Psychology of Language (4)

Theories and descriptions of phonology, syn-
tax, and semantics as applied to psychology

and related disciplines. Recommended: 4850

or linguistics background.

4710 Physiological Psychology (4) Nervous

system and physiological correlates of be-

havior. Prereq: year of biology or zoology

and Biological Foundations of Behavior.

4719 Psychological Physiology Laboratory (4)

Coreq: 4710.

4720 Comparative Animal Behavior Method-
s 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 Be-

havior (4) Genetic, evolutionary, ecological,

and developmental processes as they apply

to social organization and dynamics of verte-

brates. Prereq: Consent of instructor.

4830 History and Systems of Psychology (4)

Prereq: 9 hrs of upper division psychology.

4850 Learning Theories (4) Historical and

developmental contributions to learning models.

Prereq: Learning and Thinking.

4860 Programmed Learning (3) (Same as Cur-

riculum 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 physiological

mechanisms involved.

4880 Afro-American Psychology (4) Review

and analysis of psychological literature on

African-Americans. Prereq: Consent of instructor.

(Same as Cultural Studies 4880.)

4890 Differential Psychology (3) The nature

and sources of individual differences in be-

havioral characteristics, and differences among

racial, ethnic, social-economic, sex, and other

groups. Prereq: 4640. (Same as Educational

Psychology 4890.)

4900 Aspects of Urban Environment I (3) An

interdisciplinary course in urban problems.

Prereq: Consent of instructor. S/NC only.

(Same as Architecture 4900, Political Science

9000, Real Estate 4900.)

5000 Thesis

5019-29-39 Laboratory Techniques in Exper-

imental Psychology (3, 3, 3) Required of all

first-year students in experimental, physiologi-

cal, and educational psychology. S/NC only.

5070 Seminar in College Teaching (2) Con-

cepts, methods, and materials in the intro-

duction of psychology at the college level.

Emphasis upon research. Required of all Ph.D.

candidates. S/NC only.

5079 Practicum in College Teaching (2) Super-

vised work-study in College Teaching. Re-

quired of all Ph.D. candidates. S/NC only.

5080 Current Topics in Applied Psychology (3)

5100 Development Psychology (3) Prereq:

Child Psychology or Child Study-Education

Psychology. (Same as Educational Psychology

5100.)

5110 Clinical Aspects of Human Sexuality (3)

Nature of sexuality; societal perspectives, per-

sonal identity, sexual orientation and isola-

tion including psychosocial and psychosexual

identity and models for decisions. Intended for

graduate students in clinical psychology, social

work, and community and mental health pro-

fessional. Prereq: Consent of instructor.

5111-12-13 Seminar in Current Issues in

Psychology (1, 1, 1) Historical, legal-

ethical, and technological issues impinging on

school psychological practice.

5140-50-60 Psychoeducational Assessment (3, 3, 3)

Naturalistic, psychometric, and socio-

metric assessment methods in school learning

environments. Must be taken in sequence. Coreq:

5140-50-60. S/NC only. (Same as Educational

Psychology 5140-50-60.)

5148-59-59 Practicum in School Psychology I

(2, 2, 2) First-year School Psychology Pro-

gram practicum core sequence. Coreq: 5140-

50-60. S/NC only. (Same as Educational

Psychology 5140-50-60.)

5170-80-89 Seminar in Organizational Psy-

chology (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 In-

dustral Management 5170-80-89.)

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 traineeship in

school psychology. Limited to students fully

admitted to the doctoral program in school

psychology who are assigned to program ap-

taken by students. Prereq: Consent of instructor.

5340 Group Dynamics (3) (Same as Educa-

ional Psychology 5340.)

5350-60-70 Seminar in Psychology (3, 3, 3)

5400 Psychophysics and Scaling Methods (3)

Prereq: 4239, 4490.

5420-30-40 Advanced Psychological Statistics

(3, 3, 3) Prereq: 4490. Must be taken in se-

quence.

5445 Advanced Correlational Methods (3) Bi-

serial, tetrachoric, and polychoric correlation;

partial and multiple correlation and regression;

stepwise regression and cross-validation; sim-
ple discriminant analysis; rank correlation methods. Prereq: 5430.

5450 Human Problems in Administration (3) (Same as Industrial Management 5230.)

5460 Personnel Research Seminar (3) (Same as Industrial Management 5240.)

5500 Fundamentals of Psychometrics (4) Basic ideas and orientation in psychometrics. All the graduate students who plan to take 1 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, 4640, and 5500.

5530 Test Construction and Interpretation (3) Construction of psychological and achievement tests, criterion development, item analysis, critical evaluation of published tests and manuals. Prereq: 5520.

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: 5550. May be used for credit in sociology.

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 two-credit courses, concurrently, each covering the content area from 1 of 3 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 on the origins of behavior. Prereq: 5580.

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 two-credit courses concurrently, each covering the content area from 1 of 3 major contemporary points of view.

5600 Psychopathology (3) An extension of general personality and psychodynamics into the study of patterns of behavior deviation. Prereq: 5590.

5601-02-03 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 two-credit courses concurrently, each covering the content area from 1 of the 3 major contemporary points of view.

5610-20 Psychology of Learning (3, 3) Prereq: 3210 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: M.A. in Psychology or equivalent. 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 ethology, or pathology. 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; critical evaluation of published tests and manuals. Prereq or Coreq: 4640 or equivalent and consent of instructor.

5780 Seminar in Psycholinguistic Concepts in Speech Pathology (3) (Same as Speech Pathology 5790.)

5810-20 Techniques of Psychological Examination (3, 3) Development and administration of basic examination techniques, intended primarily for those related to psychological testing using assessment procedures. Prereq or Coreq: 4640 or equivalent and consent of instructor.

5819-29 Practicum in Techniques of Psychological Examination (2, 2, 2) Coreq for 5819: 5810; Coreq for 5829: 5820.

5840 Student Appraisal (3) (Same as Educational Psychology 5840.)

5850-60-70 Psychological Appraisal (3, 3, 3) Objective and projective tests, clinical interviewing, case study preparation, organic and functional disorders. Prereq: 5819-29; Prereq or Coreq: 5580-90-600.

5859-69-79 Practicum in Psychological Appraisals (2, 2, 2) Ordinarily to be taken concurrently with 5850-60-70.

5880 Occupational and Educational Information (3) (Same as Educational Psychology 5880.)

5890 Counseling Techniques (3) (Same as Educational Psychology 5890.)

5950-60-70 Consultation in Human Development (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. (Same as Ed. Psych. 5950-60-70.)


6000 Doctoral Research and Dissertation

6050 Experimental Methods in Sociology and Social Psychology (3) (Same as Sociology 6050.)

6100 Community Psychology (3) A survey of emerging psychological practices in intervention, evaluation and research in the community.

6210-20-30 History, Systems, and Theories in Psychology (3, 3, 3) Prereq: M.A. in Psychology or equivalent. Must be taken in sequence.

6250-60-70 Seminar in Organizational Psychology (3, 3, 3) (Same as Industrial Management 6250-60-70.)

6280-90-300 Factor Analysis (3, 3, 3) Factor analysis; component analysis; introduction to latent structure analysis. Prereq: 4640 and 5590.

*6310 Seminar in Motivation and Emotion (3)

6319 Field Work in School Psychology: Level II (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. Maxi- mum 6 hrs. Prereq: 5950-60-70. (Same as Ed. Psych. 6319.)

*6320 Seminar in Research Methods (3)

*6330 Seminar in Learning (3)

*6340 Seminar in Developmental Psychology (3)

*6350 Seminar in Thinking (3)

*6360 Seminar in Sensation and Perception (3)

*6370 Seminar in Theoretical Psychology (3)

*6380 Seminar in Industrial Psychology (3) (Same as Industrial Management 6380.)

*6390 Seminar in Psychotherapy (2) The treatment of psychotherapy case, focusing upon psychodynamics, psychopathology, and the therapeutic techniques employed. Prereq: M.A. in Psychology or equivalent.

*6395 Seminar in Assessment (3) Seminar for advanced graduate students in clinical psychology, to deal with current research on the methods of evaluating the status of individuals seeking clinical aid.

*6400 Seminar on Changing Concepts in Clinical Psychology (3) New developments in the field in relation to their impact on experimentation and systems of thought. Prereq: M.A. in Psychology or equivalent.

6405 Seminar on Psychopathology (3)


6411-12-13-14 Psychotherapy: Elective Concentration Learning Laboratory (2, 2, 2) Typically four psychotherapy concentration areas offered each quarter. Clinical students in the core psychotherapy sequence must elect at least one of these in each quarter of the sequence. May be repeated. Limited to clinical psychology students enrolled in the core psychotherapy sequence or consent of instructor.


6450-60 Advanced Psychometrics (3, 3) Construction and standardization of psychological tests, questionnaires, and rating scales, theory of errors of measurement, item analysis, scaling, equating, and norms development. Prereq: 4640, 5440, and 5500.

6491 Field Placement in Clinical Psychology Level-I (1-8) Supervised clinical experience. Required of and limited to students fully admitted to the Ph.D. program in Clinical Psychology. May be repeated. Maximum of 8 hrs. S/N/C only.

6492 Field Placement in Clinical Psychology
### Level-2 (1-8) 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. S/NC only.

### 6493 Field Placement in Clinical Psychology Level-3 (1-8) 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. S/NC only.

### 6494 Field Placement in Clinical Psychology Level-4 (1-8) 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. S/NC only.

### 6500 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 with consent of department.

### 6550 Seminar in Advanced Social Psychology (3) Prereq: Consent of instructor.

**Note:** Psychology 5210-5300, 5350-60-70, 6840, and/or 6900 may be repeated. Maximum 8 hrs. S/NC only.

### 3061-71 History of Western Religious Thought and Institutions (4, 4) 3061—1st century to the 13th century. 3071—13th century to 1900. (Same as History 3061-71.)

### 3210 Early Greek Mythology (3)

### 3220 Greek Mythology in the Classical Period (3)

### 3230 Roman Mythology (3)

### 3270 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. No knowledge of Russian is required. (Same as Philosophy 3270 and Russian 3270.)

### 3411-12-13 Renaissance and Reformation (3, 3, 3) (Same as History 3411-12-13.)

### 3440 Religion of Primitive Peoples (3) (Same as Anthropology 3440.)

### 3560 Philosophy and Religion in India (4) (Same as Philosophy 3650.)

### 3660 Buddhist Philosophy and Religion (4) (Same as Philosophy 3660.)

### 3670 Religion and Philosophy in China and Japan (4) (Same as Philosophy 3670.)

### 3690 Philosophy of Religion (4) (Same as Philosophy 3690.)

### 4111-21 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 19th century. Prereq: 9 hrs of philosophy other than logic. (Same as Philosophy 4111-21.)

### 4210 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.

### 4310 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: Religion and Culture: Religions in History or Religion and Culture: Ancient Near-Eastern Religions and Images of Jesus.

### 4370-71 Theoretical Issues in Medical Ethics (4, 4) (Same as Philosophy 4370-71.)

### 4410 American Religious Thought (4) Selected figures, movements, and problems in American religious thought from colonial period to present.

### 4450 Topics in American Religion (4) Prereq: one of the following: Religion in America, 4410; or consent of instructor. May be repeated. Maximum 8 hrs.

### 4540 Social and Religious Change (4) (Same as Sociology 4540.)

### 4610 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.

### 4640 Topics in Early Christianity and Hellenistic Religions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: Religion and Culture: Ancient Near Eastern Religions or permission of instructor. May be repeated. Maximum 12 hrs.

### 4670 Topics in Eastern Religions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: 3650-60-70. May be repeated. Maximum 12 hrs.

### 4610-20-30 Readings in Religion and History and Institutions (3-4, 3-4, 2-3)

### 4640 Readings in Selected Languages Related to Religious Studies (3-4) Prereq: Consent of the instructor. May be repeated. Maximum 12 hrs.

### 4940 Sociology of Religion (4) (Same as Sociology 4940.)

### 4950 Theory of Religion (4) Elements for the construction of a theory of religions drawing on resources from fields of psycho-history, social psychology, sociology of religion, cultural anthropology, theology and comparative religion.

### 4960 Tradition, Change and Modernity in Asia (4) Comparative study of processes of religious and social change seen in historical context in Asian societies. Comparative focus of course will vary each year (e.g., China and Japan, India and South Asia, etc.) May be repeated. Maximum 8 hrs.

### 5101 Foreign Study (1-12) See page 137.

### 5102 Off-Campus Study (1-12) See page 137.

### 5103 Independent Study (1-12) See page 138.

### Romance Languages

### MAJORS DEGREES

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### Professors:


### Associate Professors:


### Assistant Professors:

K. D. Levy, Ph.D. Kentucky; M. P. Petrovskaya, 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 (M.A.C.T.) in the Romance Languages only; the Master of Arts (M.A.) in French and Spanish; and the Doctor of Philosophy (Ph.D.) in Spanish.

### 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 six credits in supervised instruc-

THE MASTER OF ARTS PROGRAM

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 three 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 nine 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 Hebrew 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 in 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 his committee. The candidate is expected to defend his dissertation in a final oral examination.

For additional information on the program, consult pages 19-22.
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 (3rd quarter) or equivalent.

3310-20-30 Italian Literature in English Translation (3-4, 3-4) 3510—The Sicilian School, the Florentine School, Dante, Petrarch, Boccaccio, Machiavelli, Ariosto, Tasso. 3320—From the Baroque to the eighteenth century, commedie dell'arte, Vico, Leopardi, 3330—Twentieth century, Carducci, Pirandello, Quasimodo, D'Ammunzio, Croce, Moravia. No foreign language credit. No change in credit hours after add deadline. Option of 4 hours 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.

4101-20, 4102-20 Italian Drama in English Translation (3, 3) 4101—La commedie dell'arte and major works of Machiavelli, Metastasio, Alfieri, Goldoni. 4102—Twentieth century theatre: operatic drama, the Grottesco, Pirandello, De Filippo, Frati. No foreign language credit. No change in credit hours after add deadline. Option of 4 hours 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 not enrolled in other departments. (Same as Comp. Lit. 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 9 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.

4590 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 137.

5102 Off-Campus Study (1-12) See page 137.

5103 Independent Study (1-12) See page 138.

5101 Foreign Study (1-12) See page 137.

5102 Off-Campus Study (1-12) See page 137.

5103 Independent Study (1-12) See page 138.

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-American Literature and Culture (3, 3, 3)

4110-20-30 Spanish Literature of the Golden Age (3, 3, 3) The picaresque novel; Cervantes; the Comedia.

4150 Theatrical Spanish (1-3) Performance in 1 or more Spanish plays. May be repeated for credit with consent of department. Prereq: 1 year of Intermediate Spanish and consent of the instructor.

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 9 hrs of courses on 3000 level.

4210-20-30 Phonetics and Advanced Grammar (3, 3, 3) Prereq: Intermediate Spanish (3rd quarter) or equivalent.

4250 Introduction to Descriptive Linguistics (3) (Same as French 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 Latin into the major Romance Languages. (Same as French 4270.)

4410 Spanish Civilization (3) Prereq: Intermediate Spanish (3rd quarter) or equivalent.

4420-30 Latin American Civilization (3, 3) Prereq: Intermediate Spanish (3rd quarter) or equivalent.

4450-60-70 Studies in Modern Spanish Style (3, 3, 3) Prereq: Int. Composition and Conversation or consent of instructor.

4510-20-30 Spanish Literature of the Nineteenth Century (3, 3, 3) Prereq: Intermediate Spanish (3rd quarter) or equivalent.

4710-20-30 Spanish Literature of the Twentieth Century (3, 3, 3) 4710—Non-dramatic prose fiction. 4720—Drama. 4730—Poetry.


5000 Thesis

5011 Techniques in Literary Analysis (2) Required for either Plan A or Plan B of the M.A. program. An intensive course in explication de texte.

5311-21-31 Special Topics in Spanish or Spanish American Literature (3, 3, 3) May be repeated.

5340 Problems in Hispanic Culture (3) Intensive study of prevailing social, political, artistic, literary and ideological conditions and patterns of any area or period within Spanish or Latin American culture. May be repeated with permission of the department. Maximum 6 hrs.

5510-20-30 The Spanish Theatre After the Golden Age (3, 3, 3) 5510—From the 18th century through Realism. 5520—From Realism through the Generation of 1898. 5530—Contemporary Theatre.


5610 Spanish American Pros to 1900 (3) Novel, chronicle, essay.

5611-21 Spanish American Lyric Poetry (3, 3)
introduction to the works of Latin American women writers, focusing on the feminine point of view, the modern image of woman, male-female relationships and society as a context for woman's destiny. Readings from poetry and fiction, including such authors as Alfonsina Storni, Delmira Agustini, Gabriela Mistral, Silvina Bullrich, Silvina Ocampo, and Rosario Castellanos.

5650-60 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) (Same as French 5670.)

5810-20-30 Spanish Lyric Poetry (3, 3, 3)

5910 Literary Criticism: The Foundations of Romance Criticism (3) (Same as French 5910.)

6000 Doctoral Research and Dissertation

6210-20-30 Seminar in Spanish Literature (3, 3, 3) Topics vary in the field of Peninsular Literature. May be repeated with consent of the department.

6310-20-30 Seminar in Latin American Literature (3, 3, 3) Topics vary. May be repeated with consent of the department.

Russian

See German

Sociology

MAJOR

DEGREES

Sociology

M.A., M.A.C.T., Ph.D.

Professors:

J. A. Black (Head), 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.

Associate Professors:

D. M. Betz, Ph.D. Michigan State; D. Clelland, Ph.D. Michigan State; D. Hastings, Ph.D. Massachusetts; T. C. Hood, Ph.D. Duke; N. Shover, Ph.D. Illinois; S. Wallace, Ph.D. Minnesota; P. L. Wuebben, Ph.D. Wisconsin.

Assistant Professors:

S. Kuth, Ph.D. Illinois; S. Miller, Ph.D. Kansas; S. Norland, Ph.D. Iowa; R. Perrin, Ph.D. British Columbia; T. Weirath, Ph.D. Wisconsin.

For a full statement of departmental requirements, students are referred to the Departmental Graduate Manual. All registration for 3000- and 4000-level courses require the consent of the instructor.

MASTER'S PROGRAM

The general requirements for the Master's degree are given on page 17.

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 his doctoral dissertation. At the oral examination the candidate will be expected to show a thorough knowledge of sociological theory and methodology related to his research.

4030 Society 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 law and law-like phenomena in formal organizations and primitive societies.

4110 Population Problems (4) Demographic factors and social structure; trends in fertility, mortality, population growth, migration, distribution, and composition; population policy.

4120 Topics in Social Psychology (4) (Same as Psychology 4120.)

4130 Sociology of Punishment and Corrections (4) Theories, development of correctional movement, develops a critical sociological perspective on contemporary correctional programs, and provides overview of evaluative research in corrections.

4310 Criminology (4)

4330 Urban Ecology (4) Examination of public, private, collective, and individual space. Classical school of ecology, its neo-classical revisions, social area analysis, and cognitive symbolic ecology emphasized.

4410 Educational Sociology (3) (Same as Curr. and Inst. 4410.)

4530 Community Organization (4) Structure; functions; linkages; change and development; important community studies are reviewed and discussed. Emphasis on sociological analysis, not on the implementation of change.

4540 Social and Religious Change (4) (Same as Religious Studies 4540.)

4560 Formal Organization (4) Analysis of the bureaucratization process, division of labor, delegation of authority, channelled communica"tion under a system of rationality.

4630 American Minority Groups (4) Minority groups and social structure in American society; analysis of inter-group relations with attention given to both past and present relationships of selected groups to broader society.

4690 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 contemporary social movements.

4840 Sociology of Religion (4) Interrelationships of society, culture, and religion. (Same as Religious Studies 4940.)

5000 Thesis

5040 Methodological Issues in Social Research (3)

5050 Seminar in Political Sociology (3) The political system from the societal, organizational, and group perspectives.

5060-70 Special Social Investigation (3, 3) Directed readings and/or research projects.

5200 Seminar in Collective Behavior and Social Movements (3)

5210 5240-30 Social Theory (3, 3, 3)

5220 Social Control (3)

5230 Seminar in Sociology of Medicine (3)

5240 Theory and Research in Human Migration (3)

5250 Selected Topics in Migration Research (3)

5310 Seminar in Methods of Sociological Research (3) A consideration of major methodological issues in sociology; scaling techniques; relationships of validity, sampling, and qualitative methodology.

5320-30 Social Statistics (3, 3) General survey of parametric and non-parametric procedures in analysis of sociological data; assumptions underlying procedures; advantages, disadvantages, and special applications. Must be taken in sequence.

5520 Crime, Law, and Social Control (3)

5530-40 Seminar in Community (3, 3)

5550 Seminar on Community Power (3) Analysis of theories and methods used in studying social power in communities.

5560-70 Field Research in Deviance (3, 3)

5580 Sociology of Mental Disorders (3) Relationship between formal sociological models and substantive theories of mental illness. Historical development of conceptualizations. Interdependence of theory and therapeutic techniques. Epidemiology of mental disorders. Review of major studies.

5590 Social Differentiation and Stratification (3) An examination of various sources of differentiation in society, their relation to conflict in society, and their relationship to class structure in society.

5610 Seminar in Occupations (3) Occupations and their relation to the individual and the society; technology and occupations; unequal rewards and occupations; social organization and occupations.

5620 Seminar in Occupations (3) A continuation from the material in Sociology 5610: the interface between occupations and the settings in which they are performed.

5630 Seminar in Occupations (3) Research participation; directed projects on subjects developed in 5620. Prereq: 5610 or 5620.

5640 Social Structure and Personality (3) Social interaction and personality; the genesis and functioning of the self; the cultural basis of personality. May be used for credit in psychology.

5670 Social Organization (3) Social interaction and personality; the genesis and functioning of the self; the cultural basis of personality. May be used for credit in psychology.

5720 Small Group Theory and Research (3) A critical assessment, through reading and active participation in group theory sessions, of contemporary theoretical orientations to the study of small groups. Research will be designed to test theoretical problems. May be repeated for credit.

5730 Seminar in Research Problems in Inter-group Relations (3) Research techniques and problems as encountered in race and inter-group relations are explored; actual field research projects are performed.
grams for social control. Prereq: 4310 and 5520.

6530 Sociology of Law (3) An analysis of the social and cultural factors influencing the emergence and maintenance of law as a social institution and affecting the relations between law and deviant behavior; an appraisal of the theoretical and methodological issues encountered in studying the law.

6540 Readings in Criminology and Deviance (3) Directed readings and selected topics on criminology and deviance.

6550 Advanced Studies in Community (3) Analysis of concepts of community, theories of community change, and techniques used in community research.

6610 Seminar in Formal Organization (3) Major formal organizational theories; bureaucratization; functions of theoretical models of organizations; major organizational variables; organizational authority patterns; communication in formal organizations. Prereq: 3610-20.

6620 Seminar in Formal Organization (3) Methods of studying organizations; organizational change and the effect of technology; social consequences of automation; unionization and organization; organizations and community interrelatedness. Prereq: 3610-20.

6630 Seminar in Formal Organization (3) Comparative organizational analysis; case studies, selected readings; personality and organization. Prereq: 3610-20.

6710 Seminar in Class and Status (3) Classic and recent studies of class and status. Methods used in the research and current position of theory.

6810 Advanced Studies in Social Psychology (3) Social interaction and personality; the genesis and functioning of the self; the interplay of social structures and individual actions; theories of social psychology related to these problems and recent research are discussed. May be repeated. Prereq: Social Psychology or 5640 or Psychology 5550.

6940 Advanced Studies in Urban Sociology (3) Field work projects and community studies examined and/or applied in specified areas. Prereq: 3410-20.

Spanish

See Romance Languages

Speech and Hearing Sciences

See Audiology and Speech Pathology

Speech and Theatre

MAJOR

Speech and Theatre

M.A., M.A.C.T.

DEGREES

Professors:

Assistant Professors:

M.A. Tennessee; M. R. Paskov, Ph.D. Illinois.

Speech

3011 Persuasion (4) Persuasive discourse: its psychological, sociological and cultural dimensions.

3021 Group Communication (4) Communication theory in its application to small groups, especially discussion groups; communication barriers, nonverbal communication, business communication.

3541 Rhetorical Theory and Criticism (4) Survey of Western rhetorical theory; contemporary approaches to criticism of public address.

4222 Advanced Argumentation and Debate (4) Prereq: Argumentation and Debate or consent of instructor.

4461 Quantitative Research Methods in Speech Communication (4) Designing experiments; planning field studies; using statistical analysis.

4551 Southern Oratory (4) Historical and critical study of public address in the South.

4560 Rhetoric of the Women's Rights Movement (4) Historical and critical study of public addresses in campaign for women's rights from the 1830's to the present.

4571 British Oratory (4) Historical and critical study of British public address.

4582 Public Discussion of Race (4) History and criticism of racial advocacy in America.

4591 Persuasive Uses of Imaginative Literature (4) Topics in social and political uses of novels, plays, and poems.

4811 Advanced Phonetics (4) Phonetic aspects of contemporary dialects of the English language. Prereq: Consent of instructor.


4999 Colloquium in Speech Communication (1) May be repeated.

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

5210 Topics in Group and Interpersonal Communication (3) May be repeated. Maximum 9 hrs.

5220 Quantitative Projects in Speech Communication (3) May be repeated. Maximum 9 hrs.

5430 Studies in Tennessee Oratory (3) May be repeated. Maximum 9 hrs.

5440 Organizational Communication (3) May be repeated. Maximum 9 hrs.

5450 Studies in Collection and Use of Re-
Speech and Theatre

4170-80-90 Film History and Theory (3, 3, 3)
Analysis of cinematic forms and styles. 4170—Narration. 4180—Exposition and persuasion. 4190—Experimental forms; films and other media.

4651 Theories of Oral Interpretation (4)
Theory concerning the literary, psychological, communicative, and aesthetic approaches to the methods and techniques of oral interpretation.

4661 Production Techniques for Oral Interpretation (4) Problems in collection, adaptation, and presentation of literature.

5000 Thesis

5110 Introduction to Graduate Research in Speech and Theatre (3)

5120 Directed Reading and Research (3) May be repeated. Maximum 9 hrs.

Theatre

3121-22 Advanced Acting (4, 4) Prereq: Consent of instructor.

3151-52 Major Productions (4)

3153 Outdoor Repertory Production (4)


3262-63 History of American Theatre (4, 4) Development of theatre as social institution in American life. 3292—from its beginnings to 1900. 3293—from 1900 to present.

3321-22 Introduction to Lighting Design (4, 4) Mechanics of stage lighting; elementary theory; problems in basic lighting practice. Prereq: Stagecraft or consent of instructor. Must be taken in sequence.

3451-52 Play Directing (4, 4) Must be taken in sequence. Prereq: Acting.

3511-12 Introduction to Costume Design (4, 4) Costume as an expression of character on stage; the application of costume history to specific design projects. Prereq: Basic stage costume or consent of instructor.

4133-34 Special Problems in Acting (4, 4) Advanced exercises in voice and movement; preparation of major role under performance conditions. Prereq: Advanced acting and consent of instructor.

4151-52 Major Productions (4, 4) Continuation of 3151-52. Available for credit only to theatre majors. Prereq: Consent of instructor.

4153 Outdoor Repertory Productions (4) Continuation of 3153. Available only to members of summer company by consent of instructor.

4241-42 Advanced Scene Design (4, 4) Play interpretation through scenic means; setting as environment of dramatic action. Prereq: 3221-22 and consent of instructor.

4341-42 Advanced Lighting Design (4, 4) Relationship of light to setting in creating stage environment. Prereq: 3521-22 and consent of instructor. Must be taken in sequence.


4541-42 Advanced Theatre Costume Design (4, 4) Advanced problems in costume design and construction; pattern drafting; draping. Prereq: 3511 or 3512.

4611 Play Production in Secondary Schools (4)

4751-52 Dramatic Theory and Criticism (4, 4) 4751—from Aristotle to Lessing. 4752—from Goethe to Sartre.

4951-52 Playwriting (4, 4) Prereq: Consent of Instructor.

5250 Seminar in Playwriting (3)

5310 Studies in European Theatre History (3) May be repeated. Maximum 9 hrs.

5320 Studies in American Theatre History (3) May be repeated. Maximum 9 hrs.

5620 Projects in Lighting Design (3) May be repeated. Maximum 9 hrs.

5630 Projects in Scene Design (3) May be repeated. Maximum 9 hrs.

5650 Projects in Costume Design (3) Problems of play interpretation and theatrical costume problems centralizing around individual projects. Students will design the costumes for a complex play for public performance. May be repeated. Maximum 9 hrs.

5890 Studies in Theatrical Production (3) May be repeated. Maximum 9 hrs.

5950-60-70 Studies in Dramatic Theory and Criticism (3, 3, 3)

Speech Pathology

See Audiology and Speech Pathology

Zoology

MAJORS DEGREES
Radiation Biology M.S., Ph.D.
Zoology M.S., Ph.D.

Professors:
J. C. Daniel, Jr. (Head); Ph.D. Colorado; D. L. Bunting, Ph.D. Oklahoma State; J. G. Carlson, Ph.D. Pennsylvania; A. C. Cole, Jr. (Emeritus); Ph.D. Ohio State; C. C. Congdon, M.D. Michigan; R. C. Fraser, Ph.D. Minnesota; N. N. Gogoszian, Ph.D. Wisconsin; R. F. Gell, Ph.D. Tennessee; B. Hochman, Ph.D. California (Berkeley); J. F. Howell, Ph.D. Cornell; A. W. Jones, Ph.D. Virginia; M. Ketchel, Ph.D. Harvard; J. H. Liles, Ph.D. Ohio State; C. A. Shivers, Ph.D. Michigan State; J. F. Tanner, Ph.D. Cornell; S. R. Tipton (Emeritus), Ph.D. Duke; G. L. Whitson, Ph.D. Iowa.

Assistant Professors:
P. B. Bagby, Ph.D. Illinois; K. D. Burnham, Ph.D. State University of Iowa; D. A. Etner, Ph.D. Minnesota; K. W. Jøen, Ph.D. London (England); J. R. Kennedy, Ph.D. Iowa; H. Tor. Wielch, Ph.D. Florida; M. C. Whiteside, Ph.D. Indiana.

Associate Professors:
R. M. Bagby, Ph.D. Illinois; K. D. Burnham, Ph.D. State University of Iowa; D. A. Etner, Ph.D. Minnesota; K. W. Jøen, Ph.D. London (England); J. R. Kennedy, Ph.D. Iowa; H. Tor. Wielch, Ph.D. Florida; M. C. Whiteside, Ph.D. Indiana.

Assistant Professors:
P. B. Bagby, Ph.D. Illinois; A. E. Echternacht, Ph.D. Kansas; D. S. Fox, Ph.D. Johns Hopkins; M. A. Handel, Ph.D. Kansas; A. M. Jungreis, Ph.D. Minnesota; J. A. McCabe, Ph.D.

1 Alumni Distinguished Service Professor.

California (Davis), M. L. Pen, Ph.D.; Pennsylvania (S. E. Rich); Wisconsin (G. A. Vaughan, Ph.D. Duke).

Requirements for Admission: Applicants for graduate study are expected to have a background no less extensive than that required of undergraduate majors in this department. This includes a knowledge of the basic principles of cell biology, genetics, and ecology. Other requirements for admission are: (1) General zoology or general biology, 12 quarter or eight semester hours of general zoology, 18 quarter or 12 semester hours of general inorganic; (4) Mathematics, nine quarter or six semester hours including differential and integral calculus; (5) Physics, 12 quarter or eight semester hours; (6) Graduate Record Examination scores (Verbal, Quantitative and Advanced Biology); and (7) a Grade Point Average of 3.0 out of a possible 4.0.

Special requirements in zoology are as follows: (1) course requirements shall be determined by the candidate’s faculty committee; (2) the preliminary examination shall be 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 his major field of study. The student has the option of demonstrating his 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 his preliminary examination.

The student’s faculty committee may require of the student any 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 Vertebrae (5) Behavior, life history, phylogeny, 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.

3070 Immunology (3) (Same as Microbiology 3070)

3080 Principles of Animal Physiology (5) Physiology of organ systems of animals in-
as Animal Science 3220.

3110 General Entomology (5) Introduction to ecology and behavior. Prereq: General Ecology 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, sources, and technology.

4007, 4010-4017 Minicourse in Zoology (2) 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.

4500 Developmental Biology (4) Experimental morphogenesis, fertilization, cell, organogenesis, 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) Experience in active research projects under supervision of staff members. Prereq: Consent of instructor.

4140 Practicum in Zoology (1-3) Participation in practical aspects of zoology in community institutions, government organizations and industry. Approximately 5 hours involvement per week. Prereq: General Genetics, Cell Biology, General Ecology, and senior standing.

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 control and interference by which the invertebrates and vertebrate animals. Prereq: Cell Biology or 3080. 3 hrs and 1 lab. Recommended prereq: Human Physiology or 3080.

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 3080 Endocrine Function. 3 hrs and 1 (3 hr) lab.

4290 Herpetology (4) Classification, distribution, life histories, collection and identification of amphibians and reptiles, primarily of local species. 2 hrs and 2 labs or field periods.

4300 ornithology (4) Morphology, physiology, behavior, reproduction, evolution, field identification. 2 hrs and 2 labs or field periods.

4310 Animal Cytology (4) Structure and function of cells and their components; special emphasis on mitosis and meiosis. Recommended prereq: General Genetics. 2 hrs and 2 labs.

4320 Microtechnology (4) Prereq: 3320 recommended. 2 hrs and 2 labs.

4369 General Genetics Laboratory (2) Experiments designed to illustrate basic principles of inheritance. Prereq: General Genetics. 2 hrs.


4410 General Parasitology (4) Morphology, taxonomy and ecology of parasitic worms and protozoa, with emphasis on host-parasite relationships. 3 hrs and 1 lab.


4450 Protozoology (4) Morphology, taxonomy, and physiology of protozoa in relation to fundamental biological concepts. 2 hrs and 2 labs. Recommended prereq: Cell Biology.

4510 Freshwater Fishery Biology (4) (Same as Wildlife and Fisheries Science 4510.)

4610-20 Comparative Animal Pathology (2, 2) Abnormal morphological changes and their causes. 4610—Organ, organ system, and organism changes. Recommended: 3060, 3080, 3320.

4619-29 Comparative Animal Pathology Laboratory (2, 2) 4519-Cell and tissue changes. 4620—Organ, organ system, and organism changes. Coreq: 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, methods of pollution. Prereq: General Chemistry, General Ecology. Recommended: General Botany and Intro. 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 4650.

4700 Arachnology (4) Biology of spiders, mites, and scorpions and their 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 4720.)

4810-20-30 Insect Morphology and Taxonomy (4, 4, 4) 4810—Internal morphology of both generalized and specialized 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.

4940 Physiology of Exercise (4) Functions of body in muscular work; physiological aspects of fatigue, training, and physical fitness. Prereq: Human Physiology or 3080. 3 hrs and 1 lab. (Not open to students with credit for 3940.)

5000 Thesis

5082 Graduate Research Participation (3) Advanced research techniques are studied under the supervision of a staff research director who has a research area 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 practical 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 Agricultural Biology 5210.)

5220-30-40 Advanced Vertebrate Physiology (4, 4, 4) Advanced vertebrate cellular and systemic physiology; 5220—membrane, blood, immunity, neurophysiological mechanisms and muscle physiology; 5230—respiratory, cardiovascular, renal, thermo-regulatory, and digestive physiology; 5240—endocrinology, physiological genetics, reproductive physiology, sensory physiology, and aging. Must be taken in sequence, except with consent of instructor. Prereq: 3080, Coreq: Biochemistry 4120.


5270 Advanced Neuromuscular Physiology (5) Cellular and molecular aspects of phenomena associated with conduction of excitation and muscular contraction. Prereq: 4250. 3 hrs and 2 labs.

5280 Insect Physiology (4) Functions and interrelationships of the systems relative to metabolism, growth, coordination, movement, and reproduction. Prereq: 4810, 1 yr. General Chemistry or consent of instructor. 2 hrs and 2 labs.

5290 Quarternary 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. 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, biology, collection, preservation, and identification of parasitic worms and protozoa. Prereq: Consent of instructor.

5430 Advanced Medical Entomology (3) Prereq: 4430.
6310-20-30 Seminar in Cytology (2, 2, 2) Prereq: 4310.

6210-20-30 Seminar in Physiology (2, 2, 2)

6610-20-30 Seminar in Ornithology (2, 2, 2) Prereq: 3050, 4310 Cell Physiology, General Genetics; Physics 3410-20-30.

6650-60-70 Seminar in Aquatic Biology (2, 2, 2) Prereq: 4200, 4510.

6710-20-30 Seminar in Ecology (2, 2, 2) Prereq: Consent of Instructor.

6810-20-30 Seminar in Entomology (2, 2, 2) Prereq: 6 hrs of graduate course work in department.

6910-20-30 Seminar in Radiation Biology (2, 2, 2) Prereq: 4310; General Genetics; Physics 3410-20-30.

Interdepartmental Program In Radiation Biology

John R. Tatter, Director

MAJOR

DEGREE

Radiation Biology

M.S., Ph.D.

A graduate major in the field of Radiation Biology is offered through the Institute of Radiation Biology. This is a program covering 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, embryology, entomology, genetics, hematology, immunology, microbiology, molecular biology, oncology, parasitology, pathology, physiology, and tissue culture.

Requirements for Admission: 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, nine quarter hours; potential candidates for the Doctor's degree, ditto, differential and integral calculus. (4) For the Ph.D. program, Graduate Record Examination scores.

Requirements for the Master of Science Degree: Course requirements shall include: (1) Zoology 5610. (2) Zoology 5620 or 5770 or 5780. (3) Zoology 5350 or Plant and Soil Science 3610. (4) Chemistry 3810 or Botany 5240. (5) Biochemistry 4110-20. (At least one-half of the student's program must be at the 5000 level.) A thesis is required of all students.

Requirements for the Doctor of Phi-

losophy Degree: (1) Courses: In addition to those required for the Master's degree, Chemistry 4110-20 or 3410-20-30; Physics 3710-20-30; (Chemistry 3810 may be substituted for Physics 3730); Zoology 5620. Additional courses are determined by the student's faculty committee. The special field of interest of the student and his 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 for the College of Liberal Arts

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.

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 course 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.
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.

School of Nursing

Sylvia E. Hart, Dean

4770 Comprehensive Health Assessment (4)
Principles and theories underlying health screening of children and adults, including health history, interviewing and physical examination. 20 hrs lecture and 80 hrs lab or practice.
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 United States Energy Research and Development Agency, 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 his 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 four research areas available for a Masters and Ph.D. thesis work are Biochemistry, Cellular, Developmental and Mammalian Biology, Biophysics, and Genetics. Included are such subjects as: Microbiology, Cell Physiology, Immunology, Protein and Enzyme Chemistry, Nucleic Acid Chemistry, Cytology, Radiation Biology, Virology, Developmental Biology, Carcinogenesis, Plant Physiology and Photosynthesis, Experimental Pathology, Microbial and Mammalian Genetics, Problems of Aging, and Chemical Mutagens and Carcinogens.

ADMISSION
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. The student will need previous training in biology, including general genetics, calculus, physics, and organic and physical chemistry. It is possible to remedy deficiencies in biology, general genetics and physical chemistry during the first year of residence. All other deficiencies in meeting entrance requirements should be eliminated prior to entrance.

Requests for application forms, information on admission, financial support, and housing, and completed applications for admission should be sent to: Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Biology Division, ORNL, Box Y, Oak Ridge, Tennessee 37830.

DOCTOR OF PHILOSOPHY DEGREE PROGRAM
Requirements for the Ph.D. degree are:
1. Satisfactory (B grade or better) completion of the following courses or their equivalent: Physical Chemistry (5070-80); Biochemistry (5110-20); Biophysics (5140); Advanced Genetics (5160); Molecular Genetics (5170); Cell Biology (5180-90); and Mammalian Physiology (5200).
2. One year of either Biomedical Sciences Laboratory (5310-20-30-40) or Graduate Research Participation (5430-60-90).
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.
5. Participation in at least three courses in the advanced area of the student’s interest.
6. Satisfactory performance on a written preliminary examination at the end of the student’s first academic year.

This examination will be given at the end of the student’s first academic year, unless other arrangements are made between the student and the Director of the Biomedical Graduate School. Such arrangements should be made during the student’s first quarter in attendance at the School.

The faculty of the Graduate School of Biomedical Sciences recognizes that all students must demonstrate proficiency in basic background and fundamental knowledge in biology; i.e., the scientific information covered, in part, by the Core Curriculum of the Graduate School of Biomedical Sciences and integration of this knowledge in a fashion necessary to conduct research in a planned and logical manner.

7. Satisfactory performance on an oral examination at the end of the student’s second academic year.
This includes the ability to formulate specific hypotheses and experiments and to present and defend these ideas orally before a selected group of scientists.

8. A dissertation reporting the results of original and significant scientific research.


10. A formal seminar presentation of the dissertation research.

SPECIAL MASTER OF SCIENCE DEGREE PROGRAM

The graduate faculty has designed a Master of Science program in Biomedical Sciences primarily to fill the need for such a degree within the Oak Ridge National Laboratory. However, a limited number of students from other institutions will be accepted if qualified and as space is available.

Requirements for the M.S. degree are:

1. Registration for a total of thirty-six (36) credit hours of graduate courses, three (3) of which must be taken at Oak Ridge National Laboratory.

2. A minimum grade point average of 3.0.

3. A passing grade in all courses included in the Master of Science program.

4. Approval for candidacy by the student's committee.

5. A dissertation reporting the results of research designed to fulfill the requirement of the program.

Courses

5000 Thesis

5070-80 Physical Chemistry for the Life Sciences (3, 3) Thermodynamics; phase equilibria; chemical equilibria; electronic transition; surface chemistry; electrolyte solutions; kinetics; convertance; viscosity; diffusion.


5140 Biophysics I (3) Energy levels and excited states of inorganic, organic, and macromolecular systems; concepts of thermodynamics, statistical mechanics, and quantum mechanics. Coreq: 5070-80.

5150 Biophysics II (3) Distribution functions and examples of their use; detection and measurement of radiations; effects of ionizing radiation on molecules and cells; photochemistry and photochemistry of repair mechanisms. Prereq: 5140.

5160 Advanced Genetics (3) Genetics of phage, bacteria, and eukaryotic organisms. Mapping; linkage; recombination; meiotic inheritance; mechanism of recombination; chromosome structure, replication, and segregation. Prereq: General Genetics.

5170 Molecular Genetics (3) Molecular biological techniques. Gene recombination; genetics of complex traits; genetic information. Prereq: 5160.


5190 Cell Biology II (3) Comparative biochemical approach to cell structure and function. Membrane systems and metabolism; development and function of cell organelles; ion transport; endocytosis, exocytosis, and other organelles as related to metabolism and regulation; transport processes in cell cycle. Prereq: 5110, 5180; Coreq: 5120.

5200 Mammalian Physiology (3) 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 and fundamental importance of these interactions in contemporary biological research. Prereq: 5190.

5230 Biochemical Concepts in Medical Sciences (3) Biochemical mechanisms involved in physiological conditions and pathological processes of human body. Dynamic functions of organ systems; biochemical pharmacology; hormone actions; neurobiochemistry. 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 biomedical science. Required of all first-year students.

5350-60 Biomedical Sciences Seminar (3, 3) 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.

5370 Biomedical Sciences Seminar (3) Basic principles of scientific writing. Research articles; grant and thesis proposals; abstracts; review articles; progress reports. Required of all first-year students.

5430-60-90 Special Graduate Research Participation (3, 6, 9) Special graduate research project area not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

5510-20-30 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; macromolecules and biophysics; cell biology; chemistry of macromolecules; 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 of protein synthesis that are pertinent to cellular differentiation. Prereq: 5120, 5170, 5200.

5740 Statistics for Biologists (3) Application and interpretation of statistical methods in data analysis. Random variations; normal, binomial, and Poisson distributions; statistical presentation of data; estimating means and variance; confidence intervals; tests of significance for comparing samples; analysis of variance; contingency tables; chi-square tests; 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.

5830 Physical Biochemistry (3) Methods and concepts relevant to the determination of size, shape, and molecular weight of biological macromolecules. Discussion of optical activity and light scattering by macromolecules in solution. Prereq: 5070-80, 5110-20, 5140.

5840 Bioorganic Reaction Mechanisms (3) Nature of the chemical bond, nucleophilic and electrophilic 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 and bacteria to 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, ecology, and cryosurgery. Prereq: 5070-80 or equivalent, and 5190.

6000 Doctoral Research and Dissertation.

6110 Seminar in Plant Physiology (1) May be repeated. Maximum 12 hrs. S/NC only.

6120 Seminar in 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/NC only.

6200 Nucleic Acid Chemistry (3) Chemistry of nucleotide-derived materials covering topics including alkylations, solvolysis, oxidation, deamination, 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, enzymic 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 maturation; alternations of host cell structure and function; host immunological responses; oncoviruses, pathogenesis; genetics; interferon. Prereq: 5110-20, 5180-90.

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.

MASTER 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 the course of study, students are exposed to various ideas about the role of 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 nine 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:

Associate Professors:
G. R. Purcell (Director), Ph.D. Case Western Reserve; G. E. Estes, M.L.S. Kent State.

Assistant Professors:
J. Knightly, Ph.D. Texas; W. Robinson, Ph.D. Illinois; G. M. Sinkankas, Ph.D. Pittsburgh; P. Wilson, Ph.D. Michigan.

Courses

4110 Libraries and Librarianship (3) Historical development of libraries in society and their role and significance in the twentieth century; career aspects of librarianship; professional ethics and associations.

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 Audiovisual Methods and Techniques (3)  
(Same as Curriculum and Instruction 4750.)

5000 Thesis

5110-29-30 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: 4530.

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; 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 catalog as a retrieval instrument, including indexing and subject analysis theory, comparative classification with emphasis on the Library of Congress system, and problems in reclassification. Prereq: 5270.

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 multi-unit public library service systems.

5320 Library and Information Networks (3)  
National and regional information systems will be examined. Emphasis will be given to the design and analysis of existing systems within the academic or special library sphere.

5330 Academic Libraries: Seminar (3)  
Discussion of persistent and current problems. Topics vary depending upon the needs and interests of the group.

5340 Public Libraries: Seminar (3)  
Discussion of persistent and current problems. Topics vary depending upon the needs and interests of the group. Prereq: 5370 or consent of instructor.

5350 School Libraries: Seminar (3)  
Discussion of persistent and current problems. Topics vary depending upon the needs and interests of the group.

5360 Technical Libraries and Information Centers: Seminar (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)  
Public library as a social agency; its role in the education and communication systems of the community.

5400 Library Facilities (3)  
Problems inherent in the planning and construction of library quarters. 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 non-book 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, organization, housing, preservation and utilization of rare books and archival materials.

5600 Reading Guidance for Children and Young People (3)  
Organization to meet needs, interest, abilities of different age and socio-economic groups. Prereq: 6640 or consent of instructor.

5610 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.

5620 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.

5630 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. 15th century to 1920.

5640 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.

5691 Production and Use of Audiovisual Materials (3)  
(Same as Curriculum and Instruction 5691.)

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.

5740 Information Processing on Computers (3)  
Use of the computer as a tool for information handling in information retrieval systems; basic understanding of programming and systems design with applications to IR systems; utilization of this understanding in practical problem solving.

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-hour core curriculum plus approval of the director.
MAJOR
Planning

DEGREE
M.S.P.

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, geography, sociology, 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 an individual thesis or through the thesis 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.

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. All 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 credit hours including at least 36 hours at the 5000 level or above.

Each student will be required to prepare a thesis (9 hours), except that any student who:
1. Has demonstrated an understanding of and ability to carry out independent research as evidenced by having a B+ grade or above in Research Methods II, and
2. Has a 3.5 grade point average or above after completing the first 36 hours (including 21 hours in planning)
may be permitted to select nine hours in a special concentration area in order to begin development of a specialty in lieu of a thesis. The student electing the non-thesis alternative shall submit a justification statement regarding the proposed courses to the G.S.P. faculty for their approval prior to taking the courses. In addition to the normal course work involved in the courses, the student must write a major paper drawing from and involving the content of the courses, and submit it to a faculty member designated by the G.S.P. faculty. Approval of the major paper shall be 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:

Assistant Professors:
G. E. Bowen, M.A. George Washington; Judith G. Stoloff, M.U.P. Hunter; Rebecca M. Dickenson, M.A. UCLA.

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) Graph, oral and written communication of information and recommendations.

5000 Thesis

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 presentation 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 5160.)

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: 5130.

5270 Planning and Transportation (3) (Same as Civil Engineering 5270.)

5280 Planning Methods (5) Tooling up studies; methods for preparation of land use plans. Facility elements of comprehensive development plans, including visual aspects. Prereq: 5130.

5290 Regional Planning (3) Making the planning process operative in an intergovernmental context. Theories of regions and analysis of metropolitan 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 (2) 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 national urbanization policy. 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 the 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: 5540.

5570 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
Robert C. Bonovich, Branch Director,
Nashville
Roger M. Nooe, Branch Director,
Knoxville
Kate Mullins, Branch Director,
Memphis

MAJOR DEGREE
Social Work M.S.S.W.

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, racism, 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 treatment, and social welfare administration and planning. The two-year or six-quarter program is 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 his commitment to the values and goals of the profession. He must be able to think independently and analytically in order to use his skills and knowledge for a 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 social treatment and at the administration and planning levels of intervention. The Core Curriculum also provides students in social treatment with knowledge and skill about administration 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, and (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 Treatment or 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 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 immediately 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 facilities, admission, fees, and degree requirements is obtainable from The School of Social Work, P.O. Box 8820, 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 MSSW degree in twelve consecutive months. The 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 UTSSW faculty.

The twelve-month program begins in June 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.

GENERAL REQUIREMENTS
FOR ADMISSION

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 failing below the average to be admitted on supplemental evidence of ability to perform at a satisfactory level.
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.

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 79 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 that he wishes to begin with part-time study on a planned basis.

TRANSFER CREDITS

Courses completed in another accredited school of social work are 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 Master’s program. Such work must have been taken for graduate resident credit and passed with a B average 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, Pass/Fail credit earned for the 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.

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<thead>
<tr>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
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<tr>
<td>5070 Social Work Research I</td>
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<tr>
<td>5110 Social Welfare Policy and Services I</td>
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<td>5210 Human Behavior and Social Environment I</td>
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<tr>
<td>5410 Social Work Practice I</td>
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<tr>
<td>5910 Field Practice</td>
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<td><strong>TOTAL QUARTER HOURS</strong></td>
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<td>Winter</td>
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<tr>
<td>5080 Social Work Research II</td>
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<tr>
<td>5120 Social Welfare Policy and Services II</td>
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<tr>
<td>5220 Human Behavior and Social Environment II</td>
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<td>5420 Social Work Practice II</td>
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<tr>
<td>5920 Field Practice</td>
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<tr>
<td><strong>TOTAL QUARTER HOURS</strong></td>
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</tbody>
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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 nine 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
Specialization Courses and Electives | 12 |

Winter Quarter, Second Year
5940 Field Practice | 8 |
Specialization Courses or Electives. 2 or 3 |
**TOTAL QUARTER HOURS** | **10 or 11**

Spring 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 Treatment

Social treatment deals with those individual, 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 varied individual, family, and group methods applicable in the social treatment of diverse client problems.

Social Work Administration and Planning

Social work administration and planning deals with the design, implementation, and continued operation of effective programs for client service. Specifically, the method deals 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.

Preparations 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 clinics; Mental retardation, including work with individuals and groups in clinics, schools, and hospitals; Public welfare services, including economic assistance and family services; Mental health services, work with individuals and 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 with 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:**

**Assistant Professors:**
- Josephine A. Allen, M.S.W.; William J. Bell, M.S.W.; Paul Campbell, M.S.S.W.; Jenny G. Collier, M.S.W.; James M. Crouchorn, Jr., D.P.A.; Irving G. Faust, Jr., M.S.S.W.; Anne R. Forgues, M.S.W.; Donald Gary Fry, M.S.S.W.; Ronald K. Green, M.S.; Hisashi Hiranuma, D.S.W.; Dong Soo Kin, M.S.W.; Nancy L. Longs, M.S.; Alice E. Moses, D.S.W.; Margaret Strong, M.S.S.A.; Josephine A. Paul, M.S.S.W.; Stephen A. Webster, M.S.S.W.; Harriette A. Wilson, M.S.S.A.

### Courses

#### 5000 Thesis

- **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)** Continuation of Social Work Research I.
- **5081 Evaluative Research in Social Work (2-3)** An advanced course in the evaluation of research methods and tools to assess social welfare programs. Prerequisites may be determined by the faculty, students, or a social welfare agency or organization. Prerequisite: Grade of B or better in Statistical Analysis I and II or equivalent knowledge as determined by the department. Prerequisite: Completion of core or consent of instructor.

#### 5082-5083 Practicum in Social Work Research (3-9)

- Practical work with individuals and 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 with children and their families concerning school-related problems; social gerontology, individual and group services to the aging in a variety of settings.

- **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 the student's program, under supervision of the major professor. May be repeated.

#### 5101-5102 Introduction to Social Work Practice (2-3)

- **5101 Social Welfare Policy and Services I (2)** The focus is on the interests of the social work profession in the development of contemporary social policy at the local, state, national, and international levels of organization. Examination of the contribution social work professionals can make 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 implemented. Prerequisite: Completion of core or consent of instructor.

- **5102 Social Welfare Policy and Services II (3)** An examination of theories of complex organizations as applied to social welfare services delivered in the community. The examination of collective social welfare resources into divisible and indivisible social welfare benefits through organization of social instrumental action of a professional nature.

#### 5120 Policy Analysis (2-3) "Policy science" techniques are considered for their appropriateness in assessing the social, political, and economic implications of social policy problems. Prerequisite: 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. May be repeated. Maximum 9 hrs. Prerequisite: Completion of core or consent of instructor.

#### 5120-20 Human Behavior and Social Environment (II) I (2) "Behavior science" techniques are considered for their appropriateness to the individual, family, and small group within the context of their functions, structures, roles and processes. Behavior of these systems is 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 interrelationship of biological, psychological, and social variables with emphasis on the implications of culture and ethnicity.

#### 5200 Special Accelerated Program in Social Work (15) A ten-week program providing qualified students with an intensive academic and field practice experience that qualifies them to enter into the second year of graduate study upon successful completion of this term. S/N/C only.

#### 5310 Human Behavior and Social Environment (2) Deepens and extends the student's knowledge of the range of adaptive behavior; combines field experience from optimum social functioning through pathology. Prerequisite: Second-year status may be repeated.

#### 5311 Imaginative Perspectives on the Human Condition (2) Examination of the usefulness to social work of literature, art, dance, and poetry, which may illuminate and expand the knowledge and appreciation of every person's humanness. Adaptive and maladaptive response to ordinary and extraordinary life situations and events, as portrayed by creative writers, are considered. The student's representation of the molding of the human personality and spirit through the interaction of persons with one another and with society are analyzed. Prerequisite: Completion of core or consent of instructor.

#### 5312 Psychopathology and Social Deviance (2-3) Deals with theories of and recent research in the etiology of psychoneurotic and social maladjustments. The categorical approach to psychopathology will be examined and differentiated from other approaches to human behavior. Prerequisite: Completion of core or consent of instructor.

#### 5313 Deviant Behavior of Children and Youth (2-3) An examination of deviant behavior and conduct disorders in children and youth, the etiology, symptoms, and methodology. Prerequisite: Completion of core or consent of instructor.

#### 5314 Comparative Theories of Personality (2-3) Examines those personality theories with the most relevance to practice with individuals, groups, or families. Prerequisite: Completion of core or consent of instructor. Taught twice per year only. Available UTC as Psychology 4510.

#### 5315 Human Sexual Problems (2-3) Desensitization and resensitization of personal and social attitudes toward sexual behavior, clinical problems and applications designed to help social workers better able to deal with clients with sexual problems. Prerequisite: Completion of core or consent of instructor.

#### 5316 Mental Health and Employment (2-3) Explores work as a major life task and value, attitudes toward work, social change, effect of changing technologies on individual and community, interdependence of individual and organization, meaning of work in assessing mental health. Prerequisite: Completion of core or consent of instructor.

#### 5400 Social Work Practice I (2) Basic theory, values and beginning skills development generic to social work intervention at various system levels. Combines classroom and skills laboratory experiences.

#### 5401 Social Work Practice II (3) Assessment, planning, methodology and skills development fundamental to social work intervention. Combines classroom and skills laboratory experiences.

#### 5440 Family Therapy in Social Work Practice (2-3) Application of practice theories designed to assist in the acquisition of skills in the treatment of the family as a unit. Prerequisite: Completion of core or consent of instructor.

#### 5441 Transactional Analysis (2-3) The philosophy, theory, and therapeutic techniques of transactional analysis. Lectures, discussions, and experiential methods. Computer-assisted analysis as a treatment modality. Prerequisite: Completion of core or consent of instructor.

#### 5442 Short-Term Treatment (2-3) Considers the theory and practice of short-term treatment focusing on the nature of methods, characteristics of clients responsive to this approach, and designs of programs providing short-term treatment services. Specific techniques of assessment and treatment applied to groups with individual cases. Prerequisite: Completion of core or consent of instructor.

#### 5443 Seminar on Behavior Therapy (2-3) Behavior modification methodology as applied to clinical assessment, diagnosis, short-term treatment, and case assessment. Techniques, case studies, and case analysis. Theoretical and practical aspects of treatment. Prerequisite: Completion of core or consent of instructor.
544 Social Work Practice with the Poor (2-3) Examines some of the problems, issues, and dilemmas of practice in social services with particular consideration of service-delivery systems which make that practice possible. Prereq: Completion of core or consent of instructor.

5450 Social Work Treatment with Individuals and Families (3) Draws primarily on social work literature and examines in detail 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. Prereq: Completion of core or consent of instructor. Forming the group, structuring group tasks and experiences, understanding and enhancing group functioning, solving problems, facilitating change, and evaluating individual change and group effectiveness. Prereq: Completion of core or consent of instructor.

5581 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-base, leadership, techniques and procedures, and research. Prereq: Completion of core or consent of instructor.

5581 Community Organization (2-3) Methods of organizing and planning for social action and developing and promoting public understanding of community problems. Study of a social action agency. Prereq: Consent of instructor.

5601 Social Work in Rural Communities (2-3) Focuses on the development of knowledge and skill in the use of group methods in social work. Prereq: Completion of core or consent of instructor.

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5620 Community and Field Placement (2-3) Emphasis on integration of theory and practice. Prereq: Second-year status or consent of instructor.

5641 Social Work Supervision (2) Dual roles of the supervisor in various settings, and supervision will be distinguished from consultation and from direct practice. Responsibility and accountability to client system, supervisee, and executive will be 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.

5740 Supervision and Consultation in Social Work (2) Analysis of components, principles, and methods of supervision and consultation as processes in social work. Prereq: Second-year status.

5741 Supervision in Social Work (2) Dual roles of the supervisor in various settings, and supervision will be distinguished from consultation and from direct practice. Responsibility and accountability to client system, supervisee, and executive will be 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) Constellation of roles, relationships, and behaviors required of a consultant. Consultation as distinguished from supervision, administration, and direct practice. Consultation is considered in relation to various settings and levels of responsibility. Processes and practices and centers and role definitions and pitfalls of the consultant's position. Prereq: Second-year status 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 and agencies. Topics include personnel recruitment and selection, salary and benefit programs, training and evaluation. Prereq: Second-year status 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 educational structures in the social work field. Topics include: distinctions between teaching and learning; education; unique aspects of teaching and learning; measurement; and models and styles of education. Prereq: Completion of core or consent of instructor.

5745 Professional Leadership in Social Work (2-3) Examination of leadership in social welfare organizations. Consideration is given to various theories of leadership; the complexity of leadership function, effectiveness, and satisfactions of leaders; leadership styles, values, motivation and morale; and leadership development and training. Prereq: Completion of core or consent of instructor.

5746 Seminar in Social Work Administration and Planning (3) Designed to assist students in acquiring specific administrative and planning skills necessary for social welfare delivery systems. Prereq: Completion of core or consent of instructor.

5747 Information Systems and Decision Making (2-3) Explores decision making in human service systems in terms of identification, analysis, formulation in policy formulation, delivery of services and evaluation of organizational performance. Information generation, collection, processing, storage, retrieval, and utilization are considered in relation to management control and evaluation. Prereq: Completion of core or consent of instructor.

5772 Financial Management for Social Welfare Administration (2-3) Focuses on centralized decision making related to the allocation of scarce resources. Issues of planning, budgeting, and evaluation are considered in light of the utility, parsimony, and feasibility. Prereq: Completion of core or consent of instructor.

5800 Management of Residential Settings (2-3) Issues and trends in management and planning in residential institutions for children, the aged, mentally ill, mentally retarded, juvenile and adult offenders, and other groups. Prereq: Completion of core or consent of instructor.

5812 Organizational Perspectives to Juvenile Justice (2) Aspects of the Juvenile Justice System: overview of juvenile delinquency, introduction to theories of causation, role of police in dealing with delinquency, major types of delinquent offenders, police procedures, role of the juvenile court, alternatives to institutions, connection institutions, aftercare programs, and preventive strategies. Prereq: Second-year standing.

5820 Social Aspects of Illness (2) Social, economic, and emotional problems arising from or related to illness and disability as they affect the individual, his family, and the community. Services needed to obtain optimum results from medical care. Lectures, discussion, illustrative case material.

5825 Drugs: Use and Abuse (2-3) Survey and analysis of the social, medical, and psychological factors underlying alcoholism and drug abuse, recent research and treatment innovations, and their use by the individual and his family. Prereq: Completion of core or consent of instructor.

5826 Social Work Treatment for Marital Adjustment (2-3) Focuses on theories regarding social and cultural values and personality processes which gain expression in marriage, concepts regarding contemporary marriage styles, problem areas in marriages, and appropriate treatment approaches. Prereq: Completion of core or consent of instructor.

5830 Law and Social Work (2-3) Basic principles of law which relate to social work practice; organization of courts; legal aid services; and legal aspects of problems of a legal nature that affect social work.

5850 Social Gerontology (2-3) Physical, psychological, and social aspects of aging; economic and health status of the aging; the older person and the family; community programs for aging; retirement—phenomenon of modern society.

5855 The Roles of Women (2) Roles and statuses of women, with emphasis on the changes in the role of the modern woman. Includes a study of empirical research as well as the popular literature. Ascribed and achieved facets of women's statuses are explored.

5910-20 Field Practice (3, 4) Instruction and supervised practice in social work with individuals, groups, and communities. Prereq: Admission to the School; 5410 concurrently prior to 5910. Required course. S/NC only.

5930-40 Field Practice (4, 5) Specialized instruction and supervised practice in methods of social work practice, supervision, and planning in community health and welfare programs 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 MSSW program; attention is given to current issues in the profession and to pressing social problems. Student participation in symposia, discussions, simulations, and gaming situations prepares the graduating student to assume positions of responsibility and leadership within the profession. The graduating student is helped to plan toward continuing his 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 public-making process, and models of policy analysis. May be repeated. Prereq: Social Work 5110 and consent of Instructor.