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

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

Agricultural Experiment Station

D. M. Gossett, Dean
Thomas J. Whatley, Associate Dean

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 pastures 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.

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, teaching, research, and extension. A County Agricultural Extension Committee represents county government among county, state, and federal governments.

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 teaching, research, and extension.

College of Agriculture

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 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 is shown on pages 8-9.

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

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

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 of which 24 hours must be at the 5000-level.
- 18 hours in agricultural economics.
- 8 hours of economic theory.
- 6 hours in quantitative methods in agricultural economics, statistics, or mathematical economics.

A comprehensive written and oral examination is provided to meet the needs of those who may pursue work with an emphasis in agricultural economics and economics related biological and physical sciences.

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 admissions, 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 competence in examinations in the following areas:

A. A major area of concentration to be selected from the following:
   1. General agricultural economics
   2. Agricultural marketing and price analysis
   3. Farm management and production economics
   4. Economics of agricultural development
B. The Core Areas:
   1. Agricultural economics
   2. Economic theory
   3. Mathematical and quantitative methods in agricultural economics

Course Requirements: A minimum of 108 quarter hours credit beyond 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 36 hours beyond the Bachelor's degree, exclusive of credit for Master's research, is 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 and economics combined must be in courses numbered 5000 and above.

Agricultural Engineering

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

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

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

Additional course requirements for the degree are:

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

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 106 quarter hours credit in courses beyond the Bachelor's degree, exclusive of credit for the Master's thesis. Of this number, students are required to complete a minimum of 36 quarter hours in 6000 Doctoral Research and Dissertation.  
2. At least 36 quarter hours credit in courses numbered 5000 and 6000, exclusive of Doctoral Research and Dissertation.  
3. A minimum of 24 quarter hours credit must be completed in related fields outside of animal science.

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

Plant and Soil Science

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

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

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

Some of the specific requirements for the degree are:

1. Minimum of 108 quarter hours credit beyond the Bachelor's degree exclusive of Master's thesis. Of this number, students are required to complete a minimum of 36 quarter hours in Doctoral Research and Dissertation.  
2. Minimum of 30 quarter hours credit in courses numbered 5000 and 6000 exclusive of Doctoral Research and Dissertation.

The specific program of a candidate for the degree of Doctor of Philosophy in Plant and Soil Science will depend upon the student's major and previous training. The program 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.

5410 Seminar (1) Review of literature and current research in plant pathology and economic entomology. May be repeated. Maximum 9 hrs.

Agricultural Biology

MAJOR DEGREE
Agricultural Biology M.S.

Professors:
C. J. Southards (head), Ph.D. North Carolina State; J. W. Bissett, Ph.D. Ohio State; L. F. Johnson, Ph.D. Louisiana State.

Associate Professors:
C. D. Pies, Ph.D. Clemson; H. E. Reed, Ph.D. Ohio State; J. L. Wilson, Ph.D. Tennessee.

Assistant Professors:
R. Garhardt, Ph.D., North Carolina State; P. L. Lambdin, Ph.D., VPI, and SU.

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.

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

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

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

5210 Plant Parasitic Nematodes (4) Morphology, physiology, taxonomy, and ecology of plant parasitic nematodes with emphasis on host-parasite relationships. Prereq: 9 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.

5260 Insect Pest Management (4) Principles and applications of biological, cultural, genetic, behavioral, and chemical methods of control to maintain pest populations below economic threshold levels. Prereq: 3210, Zoology 3110, or consent of instructor. 3 hrs and 1 lab.

5310 Special Problems in Plant Pathology or Economic Entomology (1-6) Comprehensive individual study of current problems in economic entomology or plant pathology. May be repeated. Maximum 9 hrs.
4250 Agricultural and Rural Program Planning (3) Decision-making concepts applied to design and implementation of local-action programs. Case examples from the U.S. and other countries. Prereq: Introduction to Social Sciences in Agriculture and Introductory Economics or consent of instructor.

4310 Agricultural Finance (3) Agricultural credit formation; problems of farmers; sources of farm capital; kinds and sources of farm credit. Agricultural insurance and appraisal of; kinds of insurance; importance of types of taxes to farmers.

4320 Agricultural Policies (3) Agricultural policy in democratic society; relationship of farm groups to public policy; problems giving rise to agricultural policy and appraisal of results; policy problems.

4330 Land Economics (3) Problems and policies of land use, conservation, development, taxation, and tenure; population growth and demand for land; principles and theories of rent, property, value, and income.

4610 Management of Farm Supply and Marketing Firms (3) Operation of firms selling farm supplies and merchandising agricultural products. Emphasis on accounting data and economic framework for managerial decision making.

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

4710 Agricultural Law (4) Survey of law and the market policies of agricultural processing and public policies concerned with agriculture and related industries. Analysis of current issues in U.S. and developing nations. Prereq: Consent of instructor.

5600 Doctoral Research and Dissertation 6120-30 Seminars in Agricultural Economics (3, 3) Topics will be selected from the areas of economics of production, consumption or distribution in agriculture and related industries and public policies concerned with agriculture and related industries.

5210 Agricultural and Rural Transformation Problems (3) Systematic evaluation of policy and development in agriculture related to agricultural modernization, food supply, and rural living. The decision-making process and useful roles of social scientists. Analysis of current issues in U.S. and developing nations. Prereq: Consent of instructor.

5410 Agricultural Supply Analysis (3) Estimating agricultural supply relationships using aggregate time series regression, production functions, linear programming, simulation and firm models with emphasis on correspondence between theoretical concepts and model attributes. Prereq: 5130 or consent of instructor.

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

5610 Quantitative Methods in Agricultural Economics (3) Study of analytical techniques useful in estimation of functions—supply, demand and production—and prediction of economic variables. Emphasis on the application of multiple regression: model specification, estimation technique using computer and interpretation of results. Prereq: Statistics 4310 or Economics 5510 or consent of instructor.

5710 Quantitative Methods in Agricultural Economics (3) Study of linear programming technique with empirical applications. Made to problems of maximizing profit, minimizing cost, firm growth, transportation, and location. Other topics include input-output analysis, recursive programming, game theory, and nonlinear programming. Prereq: Economics 4160 or consent of instructor.

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

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

5610 Quantitative Methods in Agricultural Economics (3) Study of analytical techniques useful in estimation of functions—supply, demand and production—and prediction of economic variables. Emphasis on the application of multiple regression: model specification, estimation technique using computer and interpretation of results. Prereq: Statistics 4310 or Economics 5510 or consent of instructor.

5710 Quantitative Methods in Agricultural Economics (3) Study of linear programming technique with empirical applications. Made to problems of maximizing profit, minimizing cost, firm growth, transportation, and location. Other topics include input-output analysis, recursive programming, game theory, and nonlinear programming. Prereq: Economics 4160 or consent of instructor.

5000 Thesis 5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses University facilities and/or faculty time. B.S. or B.Eng. degree only. May not be used toward degree requirements. May be repeated. S/N/G only.

5011 Special Problems in Lieu of Thesis (3) 5120 Agricultural Price Analysis (3) Analysis and interpretation of factors affecting agricultural prices; price trends and cycles; application of economic theory and statistical techniques to agricultural price research. Prereq: 3120 and Statistics 4310 or equivalent.

5130 Advanced Agricultural Production Economics (3) Development of economic concepts of agricultural resource allocation problems under conditions of uncertainty. Prereq: 4140 or equivalent.

5210 Seminar: Agricultural Policies (3) 5220 Seminar: Methodology of Research (3) 5230 Seminar: Adjustments to Industrialization (3) 5310 Research (3) Special research problems in agricultural economics and rural sociology. Graduate students must register in the semester prior to thesis work and must write a research report. Prereq: 4540 or equivalent. May be repeated. Maximum 9 hrs.

5410 Agricultural Marketing Analysis (3) Application of tools of economic analysis and measurement to problems at all levels of the marketing system for agricultural commodities. Prereq: 4630 or equivalent.

5430 Seminar in Rural Sociology (3) Current rural sociological literature and research; relevance of general sociological theory and methodological techniques. Prereq: 3420 or equivalent.

5450 Advanced Rural Sociology (3) The application of sociological concepts to analyzing the changing structure and function of rural life; rural social values, attitudes, and norms as they influence the division of labor by sex, age, and social class. Prereq: 3420 or equivalent.

5470 Research Problems in Rural Communities (3) Emphasis is given to problems that arise in survey research in rural areas. Problems arising from sampling procedures, questionnaire construction, interviewer selection, training, and control, and legitimation needs are covered. Prereq: Undergraduate course in statistics.

5490 Rural Population Analysis (3) Analysis of the U.S. and world population changes and the determinants of fertility, mortality, and migration with emphasis upon changes in the rural sector. Prereq: Sociology 4110 or equivalent.

Agricultural Engineering

MAJORS

DEGREES

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

Professors:


Associate Professors:

Z. H. Hovey, Ph.D. North Carolina State, P.E.; C. H. Shellen, M.S., Virginia Polytechnic Institute; L. R. Wilhelm, Ph.D. Tennessee, P.E.

Assistant Professors:

D. O. Baxter, M.S., Missouri; F. D. Tompkins, Ph.D., Tennessee.

Professional Agriculture Engineering

4230 Selected Topics in Agricultural Engineering (3) Develop new topics as required by current trends and problems in agricultural engineering.

4610 Design of Water Control and Waste Utilization Systems (3) Design of water control and waste utilization systems including earth dams, irrigation, drainage, land grading, hydraulics, and hydraulic transport of wastes, and application of wastes on agricultural land. Prereq: 3610 or permission of Instructor. 1 hr and 2 labs.

4620 Design of Structures for Production, Processing and Environmental Control (3) Functional planning and structural design of agricultural buildings; emphasis placed on complete design of structure or system; design to include functional, structural and environmental aspects. Prereq: 3610 and 3620. 1 hr and 2 labs.

4630 Design of Processes and Materials Handling Systems (3) Design of processing systems and components for integrated agricultural processing, including mass and energy balances, product characteristics, equipment specifications, storage, handling and economic merit. Prereq: 3630. 1 hr and 2 labs.

4640 Design of Agricultural Machinery (3) Functional requirements of agricultural machinery, design of component parts of agricultural equipment, design of complete machine design project. Prereq: 3040 or permission of instructor. 1 hr and 2 labs.

5000 Thesis
5240 Environmental Control in Agricultural Structures (3) Engineering analysis of factors as they relate to processes of animal and plant life; basis for development and design of facilities and structures for confined housing of animals; control of environment for plant growth, and storage facilities for plant and animal products. Prereq: Functional Design of Agricultural Structures; Applied Engineering Thermodynamics; Differential Equations; or consent of instructor. 2 hrs and 1 lab.

5340 Hydrology of Agricultural and Forest Lands (3) Analytical approach to problems involving water surplus, deficiency and time distribution as related to agricultural and forest purposes. Prereq: Drainage and Irrigation, and Water Resources 3330 or consent of instructor. 2 hrs and 1 lab. (Same as Water Resources Development 5340).

5440 Instrumentation in Agricultural Systems (3) Analysis of specific instrumentation needs in agricultural industry and research problems; principles and design in utilization of specialized instrumentation. Prereq: Electrical Engineering 3120 and Differential Equations or consent of instructor. 2 hrs and 1 lab.

5540 Engineering Properties of Agricultural Materials and Products (3) Fundamental engineering properties of agricultural products and materials as related to their handling, processing, and storage. Prereq: 5440 and Mechanics of Materials. 2 hrs and 1 lab.

5640 Research Problems in Agricultural Engineering (3) Theoretical and experimental studies relating to current problems in agricultural engineering. May be repeated. Maximum 9 hrs.

5710-20 Similitude in Design and Research (3, 3) Dimensional analysis in the development of similarity theory; and types of models, prediction equations; interpretation of data; applications to machinery, soil and water structures, agricultural buildings, and other agricultural engineering related problems. Prereq: 5440; Fluid Mechanics; and Mechanics of Materials. 2 hrs and 1 lab.

6000 Doctoral Research and Dissertation

6110 Seminar (1) Discussion of current research and literature related to engineering in agriculture. May be repeated. Maximum 3 hrs.

6310 Engineering Systems Analysis in Agriculture (3) Systems approach to the design of engineering experiments and applications to include: electrical, mechanical, computer applications, statistical evaluations, and feedback control in agricultural problems. Prereq: 5440; Mathematics 4710; Agricultural Plant and Soil Science 5310; or 6 hrs of approved statistics. 2 hrs and 1 lab.

6610 Selected Topics in Agricultural Engineering (3) Lecture, group discussion, and individual study on specialized developments in power and machinery, soil and water structures, and processing. May be repeated. Maximum 9 hrs.

Agricultural Mechanization

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

3510 Agricultural Utilities and Processing Equipment (4) Electrical equipment; controls; water supply, heating, and refrigeration systems; waste disposal systems. Prereq: Introduction to Agricultural Engineering; Introductory Physics (8 hrs). 3 hrs and 1 lab.

4160 Agricultural Waste Utilization and Disposal (3) Utilization and disposal 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 of Agricultural Chemicals (3) Equipment and techniques for application of liquid, solid, and gaseous chemicals; system components; operational characteristics; safety 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 (8 hrs). 3 hrs and 1 lab.

4210 Agricultural Machinery Systems Analysis (3) Analysis of current field machinery; adaptation planning for soil tillage operations; machinery for unique and alternate production and harvesting systems; operational management. Prereq: 4170. 2 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 environmental systems to plant and animal production, crop processing, and materials handling. Prereq: 5220 and 5310. 2 hrs and 1 lab.

5410 Agricultural Machinery Systems Analysis (3) Analysis of current field machinery; adaptation planning for soil tillage operations; machinery for unique and alternate production and harvesting systems; operational management. Prereq: 4170. 2 hrs and 1 lab.

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

Agricultural Extension Education

MAJOR DEGREE

Agricultural Extension M.S.

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

Associate Professor: C. E. Carter, Jr., Ph.D. Ohio State.

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

4110-20 Field Studies (3, 3) Supervised work experience with county extension agents in a designated county. Prereq: 3110, and permission of instructors. Repeatable 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 developments in agricultural extension methods. Prereq: 3110 or consent of instructor.

5230 Evaluation in Programs of Agricultural Extension (3) Principles, instruments, and techniques of identifying, gathering, analyzing and using data to appraise planning and teaching and to determine progress of clientele. Prereq: 3110 or consent of instructor.

5310 History, Philosophy and Objectives (3) Historical and philosophical foundation of informal Adult Education in American Agriculture from the Agricultural Societies (1765 to present) with attention to key figures, issues, legislative movements, farmer organizations, and programs. Emphasis on Agricultural Extension Service, its origin, 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 and 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: 5210 or 5220 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. Bliemer, Ph.D. Ohio State; C. C. Chamberlain, Ph.D. Iowa State; H. M. Jamison, Ph.D. Tennessee; J. B. McLaren, Ph.D. Auburn; G. M. Merriman, D.V.M. Michigan State; J. M. Montgomery, Ph.D. Wisconsin; R. L. Murphy, Ph.D. Wisconsin; D. D. Richardson, Ph.D. Ohio State. Associate Professors: R. D. Illinois; R. R. Shrode, Ph.D. Iowa State; E. W. Swanston, Ph.D. Missouri; R. L. Tugwell, Ph.D. Kansas State.


Assistant Professors: J. A. Corrick, Ph.D. Tennessee; D. C. Doyle, D.V.M., Ph.D. Cornell; J. P. Hitchcock, Ph.D. Michigan State; J. W. Holloway, Ph.D. Texas A & M; H. Eller, D.V.M., Ph.D. Oklahoma State; F. B. Masmuppe, Ph.D. Kansas State; J. W. Crockett, Ph.D. Purdue; M. Sims, Ph.D. Auburn; J. D. Smalling, Ph.D. Texas A & M.

3210 Anatomy and Physiology of Farm Animals (4) Skeletal and joints; functional anatomy of the respiratory, cardiovascular, and nervous systems; the muscular and nervous systems; and the integument. Prereq: 3110 or consent of instructor.

3220 Biology of Reproduction (3) Comparative anatomy and physiology of the reproductive system of higher vertebrates; gametogenesis, fertilization, implantation, prenatal
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growth, parturition and initiation of lactation; endocrine regulation of reproductive phenomena. Prereq: 3211 and consent of instructor. 2 hrs and 1 lab. (Same as Zoology 3220.)

3320 Animal Nutrition (3) Properties, functions, utilization and deficiency symptoms of essential nutrients; value determination and their use. Prereq: Animal Science for Agriculture and one quarter of organic chemistry. 3 hrs and 1 lab.

3330 Feeds and Ration Formulation (3) Feedstuffs, additives, feeding standards; nutrient requirements and ration formulation for beef and dairy animals, swine, poultry and laboratory animals. Prereq: 3320. 2 hrs and 1 lab.

3410 Heredity in Animals (5) 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.

3420 Principles of Animal Breeding (5) Genetic variation, genetic, selection, of economic species. Genetic basis of variation. Partitioning of variance according to various kinds of characters, genetic relationships to the environment. Selection and its consequences. Mating systems and their effects on populations. Prereq: 3410 or equivalent. 3 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 quarantines; herd health programs. Prereq: General Microbiology or consent of Instructor. 3 hrs and 1 lab.

3520 Avian Diseases (3) Major avian diseases; characteristics, prevention and treatment, management practices and systems for domestic birds, upland game birds and water fowl. 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: General Nutrition and consent of Instructor. 2 hrs and 1 lab.

4210 Physiology of Lactation (3) Development, anatomy, and function of mammary glands; endocrinology of mammary development and milk secretion; factors affecting yield and composition of milk. Prereq: 3211.

4220 Avian Physiology (3) Anatomy and physiology of avian species with emphasis on poultry. Prereq: 3211. 2 hrs and 1 lab.

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

4310 Feeding Systems for Ruminants and Horses (3) Nutrition and feeding principles in the production of meat, milk and other products. Feeding systems used 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 and basic nutrition concepts. Prereq: 3330. 2 hrs and 1 lab.

4410 Applied Animal Breeding (3) The principles studied in 3420 (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 the beef cattle management program. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production response and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4820 Dairy Cattle Production and Management (4) Principles of nutrition, physiology, and breeding in a complete dairy cattle management program. Topics will include the structure of 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: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4830 Pork Production and Management (4) Principles of nutrition, 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: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

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

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

4860 Sheep and Goat Production and Management (3) Integration of principles of nutrition, physiology and breeding into a sheep and goat management program. Structure of the industry, enterprise establishment, systems of production and production responses and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab.
4410 Food Crop Products (3) Food products from crops with emphasis on types, manufacturing systems, quality attributes and utility.

4810 Microbiology in Food Manufacturing (3) Relationship of growth of common food microorganisms in fermentative and enzymatic changes occurring during processing and manufacture of foods. Prereq: General Microbiology or equivalent. 1 hr and 2 labs.

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

4840 Meat Products Manufacturing (3) Prepared meat products with emphasis on sausage making and information relating to cost controls, inspection and meat science. Prereq: 3840 or consent of instructor. 1 hr and 2 labs.

4920 Physical Phenomena of Foods (4) Physical states of food materials, foams, emulsions, colloidal soils, hydrates, crystals, gels. Effects of manufacturing practices on these properties. Prereq: Consent of instructor. 3 hrs and 1 lab.

5000 Thesis

5100 Seminar (1) Reports and discussions of selected topics in food 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 native enzymes in manufacturing, processing, and spoilage of food. Prereq: Physiological Chemistry.

5140 Food Flavors (3) Food flavor maintenance and improvement. Natural and synthetic compounds in the manufacture of foods with predictable consumer acceptance. Technology of flavor production and flavor evaluation techniques for determining flavor profile. Prereq: 4210, 2 hrs and 1 lab.

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

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

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

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

5420 Advanced Food Quality Assurance (3) Applications of current instrumental methods used to control food manufacturing processes. Prereq: 4120. 2 hrs and 1 lab.

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

5520 Microorganisms Common in Food Products (3) Identification of desirable and undesirable microorganisms in food products and their relationship to manufacturing operations. Isolation and characterization of microorganisms from food processing facilities. Prereq: 4810 or Microbiology 3810. 3 labs.

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

Forestry

MAJORS

Wildlife and Fisheries Science

DEGREES

M.S.

Wildlife and Fisheries Science

M.S.

Wildlife and Fisheries Science

M.S.

Professors:

J. W. Barrett (Head), Ph.D. Syracuse; H. A. Core, Ph.D. Syracuse; E. Thor, Ph.D. North Carolina State; F. W. Woods, Ph.D. Tennessee.

Associate Professors:


Assistant Professor:

B. L. Daedean, Ph.D. Colorado State.

3020 Forest Environments and Ecology (3) Environments and ecology of forests and associated lands; emphasis on the application of ecological principles to contemporary problems. Prereq: 8 hrs of biology, botany, or zoology.

3040 Dendrology and Silvics of Woody Angiosperms (3) Classification, nomenclature, identification, and ecological significance of the more common woody angiosperms native to North America; native ranges, distribution patterns, and habitat requirements; regeneration requirements and life history, place in succession; ecological significance and commercial 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.

3050 Dendrology and Silvics of Gymnosperms (3) Classification, nomenclature, identification, and silvicultural characteristics of the major North American conifers. Distribution patterns, habitat, and community relationships including classification, life history, regeneration requirements, place in succession, and importance. Prereq: 8 hrs basic biology or botany. 2 hrs and 1 lab.

3110 Forest Measurements and Biometry (4) Measurements of individuals in animal and plant populations; linear regression; sampling of animal populations; growth and potential production. Prereq: Plant and Soil Science 3910 and Computer Programming, business-oriented or equivalent. 3 hrs and 1 lab.

3120 Wood Technology (4) Wood properties; identification of commercial woods by macro and micro characteristics. Prereq: 3040, 3050. (3050 may be taken concurrently.) 2 hrs and 2 labs.

3210 Forest Resource Economics (4) Allocation of forest resources via market and institutional systems. Application of economics to forest resource decision making in private and public sector. Prereq: Principles of Economics.

3230 Forest Products and Utilization (3) Harvesting, processing; marketing factors in stand conversion; intermediate and harvest cuts. Prereq: 3120.

3230 Wildlife Management (3) Important game species in the U.S.; factors influencing wildlife populations. Same as Wildlife and Fisheries Science 3320.
3040 Soils. Development, and character of forest vegetation; classification of forest structure; silvicultural laws. Prereq: 3020 or General Ecology. 3040; Soils.

3320 Principles of Silviculture (3) Influence state, nation, and world; forests in soil and water conservation; wildlife management and recreation; conservation programs.

4002 Utilization (3) Wood-using industries; processing forest products—sawmills, tree-lumber grading; pulpwood operations, flooring plants, treating plants; plant layout, flow diagrams. Prereq: 3120.

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

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

4006 Silvicultural Methods (4) Methods and application of intermediate and regeneration cuttings; site preparation, planting and seeding; modifications of cutting methods to obtain desired goals and benefits. Prereq: 4002, 4003.

4210 Field Methods of Timber Inventory (4) Field measurement of forest trees; timber cruising; determining appropriate sample design for specific purposes; tree and stand growth; site evaluation; field problems. Prereq: 3110.

4220 Forest Watershed Management (5) Water as a forest resource; role of forests in the hydrologic cycle; control of water quantity, quality, and regimen; watershed planning. Prereq: 4230 or consent of instructor. Two overnight field trips.

4210 Forest Organization and Administration (3) Forestry organization; planning concepts and types of plans; administration; decision making in forest-resource management. Prereq: Junior Field Session for majors in forest resources management or senior standing for majors in the recreation option and wildlife and fisheries science.

4220 Forest-Resource Management (4) The forest as an economic resource; role of forests in our economy; review of traditional timber-management concepts; the multiple-use concept; inventory of forest resources; resource management; taxation of the forest firm. Prereq: 4210.

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

4320 Forest Policy (3) The history of forestry in the United States with emphasis on the development of forest resource policies; current policies influencing the development and management of forest resources; survey of the policy implications of forest resource organizations in the public and private sectors. Prereq: 4004.

4340 Aerial Photography in Forest-Resource Management (3) Use of conventional aerial photographs in forest-resource management; interpretation of aerial photographs; preparation and analysis of cover-type maps; uses of other remotely sensed imagery. Prereq: Civil Engr. 4230 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; genetics of seed and source; variation, 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; problems associated with a forest in a region; physiography, geology, soils, climate, and weather; sites and sites types, ecology, problems in detection, and silvicultural 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 management activities; development and management of forest recreation areas; the socio-economic and political determinants of recreation development and management. Prereq: 6 credits in sociology and/or economics. 2 hrs and 1 lab.

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: 3330 or Botany 4310.

5230 Seminar in Forest Management (3) Newly developed systems in forest organization and regulation; financial and operational planning for 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 forest genetics research. Prereq: 4420, General Genetics and consent of Instructor.

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

5260 Industrial Forestry (3) Structure and analysis of wood-products firms and industries. Forest taxation, land tenure and wood procurement alternatives. Development and application of forest planning models. Prereq: 4530 or consent of instructor.

5270 Topics in Forest Industries Management (3) Current problems in industrial forestry are discussed and analyzed. Forestry executives from the public and private business sector (concerned with forest industry) are invited to conduct classes in selected topics. Prereq: 4530 or consent of instructor.

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

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.

5410 Wildlife and Fisheries Science (3) Neorex of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in the field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 year zoology, 1 quarter microbiology, pathology or parasitology, 4450 or 4460, or consent of instructor. 3 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

MAJOR

Ornamental Horticulture and Landscape Design

DEGREE

M.S.

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


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

3020 Plant Propagation (3) Physiology, methodology, and environmental requirements for propagation. Prereq: 8 hrs of biological science and 2 labs.

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

4120 Landscape Design (4) Design and development of properties; planning, organizing, structure, selection, and use of plant and structural materials; methods of presentation. Prerequisite: 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 plans. Prerequisite: 4120 or equivalent. 2 hrs and 2 labs.

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

4160 Retail Nursery Management (3) Essentials of good nursery management: location, layout and operation of landscape nurseries, garden centers and chain store outlets. 2 hrs and 1 lab.

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

4210 Advanced Turfgrass Management (4) Principles and scientific basis of turfgrass culture; adaptation, ecology, physiology, soil fertility and grass nutrition; climatic influences on grass culture; physiology of clipping and water management; traffic effects and compaction and the physiological influences of pest infestations and control measures. Prerequisite: Turfgrass Management. 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. Prerequisite: 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 growing plants in a very restricted environment. Control of temperature, light and greenhouse conditions. Prerequisite: greenhouse management, crop physiology, or equivalent. 2 hrs and 1 lab.

4400 Individual Problem Study (1-6) May be repeated. Maximum 10 hrs.

5000 Thesis

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

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, including placement 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. Prerequisite: 4210 and consent of instructor. 2 hrs and 2 labs.

5310 Park and Public Grounds Management Systems (4) Design criteria affecting management systems requirements. Protection and cultural care of trees, shrubs, and turf in parks and public grounds; use pressure modification and maintenance of park and recreation facilities. Resource management and performance analysis. Design criteria of maintenance systems and specifications. Maintenance programming. Prerequisite: 4180 or 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. Sceat* (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; J. N. Skoldt, M.S. Kansas State; M. E. Spring, Ph.D. California (Berkeley); H. D. Swingle, Ph.D. Louisiana State.

Associate Professors:

D. L. Coffey, Ph.D. Purdue; B. V. Conner, Ph.D. Washington State; L. S. Jeffery, Ph.D. North Dakota State; W. A. Krueger, Ph.D. Illinois; R. J. Smith, Ph.D. North Carolina State; V. A. Reich, Ph.D. Iowa State; H. H. S. F. Isbell, Ph.D. Wisconsin; H. C. Smith, M.S. Tennessee.

Assistant Professors:


5020 Crop Ecology (3) Crops and environment; geographic location; site, heat, light, water, and nutrient relationships as a basis for judgment of cultural practices used to modify environmental factors. Prerequisite: 8 hrs biological sciences. 2 hrs and 1 lab.

5040 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. Prerequisite: 8 hrs biological sciences. 2 hrs and 1 lab.

5110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability. Principles of soil fertility evaluation and principles of fertilizer use; manufacture and properties of fertilizers. 3 hrs and 1 lab.

5120 Grain and Oil Crops (3) Distribution, improvement, morphology, culture, harvesting, and utilization of corn, small grains, grain sorghum, soybeans and related crops. Prerequisite: Soils, 8 hrs biological sciences. 2 hrs and 1 lab.

5140 Forage Crops (4) Characteristics, adaptation, improvement, management, and utilization of grasses and legumes for pastures, hay, and silage. Prerequisite: Soils, 8 hrs biological sciences. 3 hrs and 1 lab.

5160 Cotton and Tobacco (4) Characteristics, adaptation, improvement, culture, harvesting, and marketing of cotton and tobacco. Prerequisite: Soils, 8 hrs biological science. 3 hrs and 1 lab.

5180 Fruit Crops Management (5) Soils, planting, cultivation, development of fruit crops plantations; pest control, harvesting, packing, storage, and pruning. Prerequisite: Agricultural Biology 3130 and 3210. 3 hrs and 1 lab.

5220 Soil Management (4) Soil management for crop production including cropping systems, fertilizer use, and tillage operations for specified soil and farming conditions. Prerequisite: Soils and Forestry 3320, 3 hrs and 1 lab.

* Clyde B. Austin Distinguished Professor.

5250 Soils in Forestry (3) Soils as a medium for tree growth; relation of physical, chemical, and biological properties of soils to tree growth and management. Prerequisite: Soils 2 hrs and 1 lab.

5310 Commercial Production of Cool Season Vegetables (3) Characteristics, economic importance, adaptability and production for fresh and processing markets; emphasis on greens, salad cole, root, bulb crops, perennials and Irish potatoes. Prerequisite: 8 hrs biological science. 2 hrs and 1 lab.

5320 Commercial Production of Warm Season Vegetables (3) Characteristics, economic importance, adaptability, and production for fresh and processing markets; emphasis on sweet potatoes, beans, tomatoes, pepper, cucurbits, sweet corn and okra. Need not have 3510 as prerequisite. Prerequisite: 8 hrs biological science. 2 hrs and 1 lab.

5350 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods and research results. Prerequisite: Introductory Calculus-General Mathematics.

5370 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. Prerequisite: 8 hrs biological sciences. 3 hrs and 1 lab.

5410 Soil Chemistry (4) Colloidal systems; properties and behavior of colloidal soil materials; relations of chemical properties to plant nutrient availability. Prerequisite: Soils and Introductory Physics. 3 hrs and 1 lab.

5412 Principles of Crop Breeding (4) Genetic principles and techniques. Prerequisite: 8 hrs biological science or permission of instructor. 3 hrs and 1 lab.

5430 Soil Analysis (3) Analytical techniques used in soil chemistry and soil fertility studies. Prerequisite: 4110 or concurrent. 3-5 hrs.

5450 Agricultural Chemicals and the Environment (4) Characteristic 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. Prerequisite: 1 year biological sciences and 1 year chemistry. 3 hrs and 1 lab.

5430 Soil Formation, Morphology, and Classification (4) Soil formation; properties, distribution, and classification of soils; interpretation of morphology; use of soil surveys. Prerequisite: Soils. 3 hrs and 1 lab.

5440 Problems in Plant and Soil Science (1-6) May be repeated. Maximum 9 hrs.

5500 Thesis

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

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

5210 Special Problems in Plant and Soil Science (1-6) May be repeated. Maximum 9 hrs.

5230 Special Problems in Crop and Soil 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 interactions affecting productivity; principles of soil management, cropping systems, water control and management, tillage and fertility management. Planning and evaluation of specific soil management programs. Prerequisite: 3220 and 4110 or consent of instructor.
Institute of Agriculture

5250  Pedology (4) Factors and processes of formation as related to the physical, chemical, and mineralogical properties of soils; soil in an ecosystem; classification of soils. Prereq: 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 experiments; problems dealing with the analysis of data. Prereq: 3610 or equivalent.

5340  Soil Physics (3) Chemical and physical relationships among the solid, liquid, and gaseous phases of the soil mass; their relation to plant growth and soil management. Prereq: 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 determining their physiochemical reactions, ion exchange, 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, effects of heterosis, inbreeding, hybridization and selection. Improvement of self and cross pollinated crops. Prereq: 5710. 3 hrs and 1 lab.

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

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

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

6000  Doctoral Research and Dissertation

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

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

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

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

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

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

Professors:

Associate Professors:

Assistant Professors:

Instructor:
J. C. Chen, M.S. Tennessee.

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

4025 Accelerated Historical Studies I (4)
Relationship of historical and cultural development of the man-made environment. Concepts of history, aesthetics and criticism along with methods of historical research and analysis are introduced as a means of studying the classical tradition of architecture. In addition to the regular lecture series of the first course in Historical Studies, students are required to independently research aspects of study area for presentation to the accelerated seminar supplement.

4026 Accelerated Historical Studies II (4)
Concentrated examination of development of twentieth-century design and architectural theory and products as derivative or counter point to examples of historical development. Events occurring in specific time frames of pre-industrial and industrial periods are contextualized to demonstrate potential developments in the emerging post-industrial era. In addition to the regular lecture series of 2005, students are required to independently research aspects of study area for presentation to the accelerated seminar supplement.

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

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


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

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

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

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

4920 Advanced Architectural Photography (4) Application of special photographic techniques with emphasis on color printing and processing. Prereq: Consent of instructor.
Graduate programs 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. 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 100.)

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
- Forest Industries
- Management
- Governmental
- Financial
- Administration
- Industrial
- Management
- Management Science
- Marketing
- Real Estate
- and Urban Development
- Statistics
- Transportation and Logistics
- 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 semeseter) of calculus or remove the deficiency by taking appropriate courses in mathematics. Specific requirements of the M.B.A. program are shown below. To qualify for the degree, a student must complete a minimum of 51 quarter hours of graduate course work in Groups B, C, and D, at least 42 hours of which must be at or above the 5000 level. Further, at least half of the credit hours taken in Group C (concentration area) must be at or above the 5000 level.
Group B—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 69.

Quarter Hours
Acctg. 5505-60 Financial Accounting: 6
Bus. Law 5505 Legal Environment of Management Science: 3
Econ. 5505-60 Economic Analysis, Problems and Policies: 6
Fin. 5505 Survey of Finance Functions of Business: 3
Ind. Mgt. 5505 Production Management: 3
Mktg. 5505 Survey of Marketing: 3
Off. Admin. 5505 Data Processing in Business: 3

Group B—Core for all Candidates.
Acctg. 5810, Accounting for Control: 3
Econ. 5507-80, The Firm and its Environment: 6
Fin. 5510 Theory of Financial Management: 3
Ind. Mgt. 5230, Human Problems in Administration: 3
Mktg. 5200, Marketing Management: 3
Stat. 5311, Probability Theory: 3
Quantitative Option (select one): Mgt. Sci. 5100, Introduction to Management Science: 3 or Stat. 5312, Statistical Methods: 3
Bus. Adm. 5310, Business Policy: 3
Total, Group B: 27

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. At least half of the credits used to satisfy this requirement must be earned in courses at or above the 5000 level. Any exception must be approved by the student's faculty committee. 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 prerequisites: 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 graduate 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 prerequisites: 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 prerequisites: Finance 5050 or equivalent; 5110 (core course). A minimum of three courses must be included in the following areas:

Financial Management: 5120, 5130, 5140, 5620, 5800, 5990
Investments: 5420, 5430, 5810
Monetary and Fiscal Policy: 5210, 5220, 5320, 5810, 5820, 5830
Forest Industries Management. Area prerequisites: B.S. degree in forestry, or equivalent.
Organization, planning and control: Ind. Mgt. 5110, 5120, 5130
Industrial forestry: Forestry 5260
Topics in Forest Industries Management: 5270

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

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 an A 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.

Joint J.D.-M.B.A. Program

The College of Business Administration and the College of Law offer a coordinated joint program leading to the conferral of
both Doctor of Jurisprudence and the Master of Business Administration degrees. A student pursuing the joint program may save up to two academic quarters (24 hours) of course work which would be required if the two degrees were to be earned separately.

Admissions. Applicants for the J.D.-M.B.A. program must make separate application to, and be competitively and independently accepted by, the College of Law for the J.D. degree and the Graduate School and College of Business Administration for the M.B.A. degree, and by the Joint Degree Committee. Application may be made at any time prior to, or after, matriculation in either college, but prior to completion of the second year of law school (84 quarter hours), and prior to registration for the M.B.A. degree, and by the School and College of Business Administration for the J.D. degree and the Graduate School for the M.B.A. program must make separate application to, and be competitively and independently accepted by, the College of Law for the J.D. degree and the Graduate School for the M.B.A. degree, and by the Joint Degree Committee. Application may be made at any time prior to, or after, matriculation in either college, but prior to completion of the second year of law school (84 quarter hours), and prior to registration for the M.B.A. degree.

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

The College of Law will award credit toward the J.D. degree for acceptable performance in a maximum of 12 quarter hours of approved graduate level courses offered by the College of Business Administration. The student must earn 9 of the 12 quarter hours in Accounting 5810 or a more advanced accounting course. If College of Law credit is given for such an accounting course, the joint program student may not receive College of Law credit for Legal Accounting (Law College Course 6590).

The College of Business Administration will award credit toward the M.B.A. degree for acceptable performance in a maximum of 12 quarter hours of approved graduate level courses offered by the College of Business Administration. The student must earn 9 of the 12 quarter hours in Accounting 5810 or a more advanced accounting course. If College of Law credit is given for such an accounting course, the joint program student may not receive College of Law credit for Legal Accounting (Law College Course 6590).

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

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

The DBA program is structured around four major features. First, it recognizes the interdisciplinary thrust of graduate education and provides the student with a sound foundation for expanding the body of knowledge related to business systems and their interactions with other 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 advanced economic theory and in both the behavioral and quantitative sciences coupled with an in-depth assessment of one of the three 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, and 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. All courses are part of a study of economic theory, behavioral science and quantitative analysis.

<table>
<thead>
<tr>
<th>Area</th>
<th>Course</th>
<th>Quarter Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting</td>
<td>Acct. 5810 Accounting for Control</td>
<td>3</td>
</tr>
<tr>
<td>Accounting</td>
<td>Acct. 5820 Corp. Reporting Prob.</td>
<td>3</td>
</tr>
<tr>
<td>Accounting</td>
<td>Econ. 5111-12 Microecon. Theory (3,3)</td>
<td>9</td>
</tr>
<tr>
<td>Accounting</td>
<td>Econ. 5121 Macroecon. Theory (3)</td>
<td></td>
</tr>
<tr>
<td>Accounting</td>
<td>Econ. 5111 Microecon. Theory (3)</td>
<td></td>
</tr>
<tr>
<td>Accounting</td>
<td>Econ. 5121-22 Macroecon. Theory (3,3)</td>
<td>3</td>
</tr>
<tr>
<td>Accounting</td>
<td>Fin. 5110 Theory of Financial Mgt.</td>
<td>3</td>
</tr>
<tr>
<td>Accounting</td>
<td>Ind. Mgt. 5110 Organizational Theory</td>
<td>3</td>
</tr>
<tr>
<td>Accounting</td>
<td>Ind. Mgt. 5610-20 Organizational Behavior</td>
<td>6</td>
</tr>
<tr>
<td>Marketing</td>
<td>Mkgt. 5200 Marketing Management</td>
<td>3</td>
</tr>
<tr>
<td>Marketing</td>
<td>Stat. 5311 Probability Theory</td>
<td>3</td>
</tr>
<tr>
<td>Marketing</td>
<td>Stat. 5312 Statistical Methods</td>
<td>3</td>
</tr>
<tr>
<td>Marketing</td>
<td>Trans. 5210 Business Logistics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total Core</td>
<td>42</td>
</tr>
</tbody>
</table>

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 18 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/her 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, economics, 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>Behavioral Science</th>
<th>Quarter Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ind. Mgt. 6250-60-70 Seminar in Ind. and Org. Psy. (select two courses)</td>
<td>6</td>
</tr>
<tr>
<td>Electives in Behavioral Science (6000 level)</td>
<td>6</td>
</tr>
</tbody>
</table>

Economics: A field in economics to be chosen from advanced economic theory, econometrics, or monetary economics to be approved by the student's academic committee.

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

<table>
<thead>
<tr>
<th>Quantitative Methods</th>
<th>Quarter Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (Core: Stat. 5050, 5060; Mgt. Sci. 5100) Statistics 5070, 6060, 6070 Elective in statistics, mathematics, management science or computer science</td>
<td>9</td>
</tr>
<tr>
<td>2. (Core: Stat. 5311 or 5110, 5312) Management Science 5310, 5330, 5340 Elective in statistics, mathematics, management science or computer science</td>
<td>9</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Research and Dissertation</th>
<th>Quarter Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Adm. 6900 Res. Meth. in Business</td>
<td>3</td>
</tr>
<tr>
<td>Business Adm. 5900 Academic Practicum</td>
<td>3</td>
</tr>
</tbody>
</table>

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 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.

Minimum Academic Performance Standards

A graduate student in the College of Business Administration will complete a grade point average at any point after 12 hours is below 3.0 shall be placed on probation. A student on probation shall be dropped from the program unless his or her cumulative grade point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next 12 quarter hours of course work attempted which is specified in the student's degree program. Exceptions to this policy may be made only with the approval of the Assistant Dean for Graduate Programs of The College of Business Administration upon recommendation of the student's faculty committee.

Admission Requirements

General admission requirements for the Graduate School are stated on pages 11-12. MBA and DBA applicants are required to take the Graduate Management Admission Test (GMAT). The GMAT is a standardized test in economics, management science, and statistics and measures a student's potential for graduate study. The student 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), MBA 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 leading graduate schools of business as a member of the Graduate Management Admission Council.

Fellowships and Assistantships

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

Assistantships. A limited number of graduate assistantships are available in each of the academic departments and in the Center for Business and Economic Research. Assistantships which carry remission of tuition and/or fees range up to $4500 per year, while others funded through various sources 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 March 15 for consideration of assistantships to be awarded for the following fall term.

Center for Business and Economic Research

The staff of the Center for Business and Economic Research engages in studies of the business and economic environment in Tennessee, the Southeast, and the Nation. The Center serves the business community, state government, individuals, and the University through dissemination of various kinds of economic and socio-economic information. It 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 socio-economic 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 is a member of the Association for 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 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, technical 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 and Business Law

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

ACCTOUGING

Professors:
N. E. Dittrich, Ph.D. Ohio State, C.P.A.;
R. W. Metcalf (visiting), D.B.A. Indiana, C.P.A.

Associate Professors:
J. E. Kiger, Ph.D. Missouri, C.P.A.;
G. E. Nichols, Ph.D. Louisiana State, C.P.A.;
I. A. Posey, M.S. Tennessee, C.P.A.;
W. L. Singleton, M.S. Tennessee, C.P.A.;
R. I. Townsley, Ph.D. Texas, C.P.A.;
F. W. Watkins, Ph.D. Louisiana State, C.P.A.

Assistant Professors:
H. C. Herring, III, Ph.D. Alabama, C.P.A.;
F. A. Jacobs, Ph.D. Georgia, C.P.A., C.M.A.;
M. C. Letsinger, M.S. Tennessee, C.P.A.

4120 Advanced Auditing (3) Legal and professional responsibilities of the auditor. Evaluation of internal control, utilization of EDPL and statistical techniques in auditing and auditing reports. Prereq: 4110 with C or better.


4650 Individual Research in Accounting (3) Special projects undertaken by majors in accounting under the direction of faculty members of professional rank. Prereq: Intermediate Accounting with C or better.

4990 Senior Seminar (3) Advanced problems in the financial accounting area are analyzed and discussed by students. Prereq: Intermediate Accounting with C or better.

5000 Thesis

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

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 35.)

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: Three quarters or two semesters of Intermediate Accounting.

5120 Seminar in Advanced Auditing (3) Standards and procedures of special investigations; audit reports and reports filed with the S.E.C. Auditing EDP systems and use of statistical sampling are emphasized. Prereq: A course in auditing concepts or equivalent.

5130 Seminar in Current Accounting Topics (3) Current controversial issues in financial accounting. Prereq: three quarters or two semesters of Intermediate Accounting.

5210 Seminar in Advanced Cost Accounting (3) Direct costing, return on investment, capital budgeting, cash-flow analysis, distribution costs, cost justification under the Robinson-Patman Act, and others. Prereq: Second quarter of Introductory Cost Accounting or equivalent.

5310 Auditing Concepts (3) Concepts and theory of auditing, the environment of internal and external auditing, nature of evidence, internal control evaluation, and reporting. Not intended for persons who have credit for an auditing course. Prereq: Intermediate Accounting, and proof of credit. Prereq: Statistical Sampling and 5630 or equivalent.


5430 Consolidations and Business Combinations (3) The concepts and practices of accounting for interrelated business entities—domestic and foreign. Not intended for persons who have credit for a course with similar content. Prereq: Intermediate Accounting.

5420 Seminar in Advanced Taxation (3) Income determination, tax planning organization of the Internal Revenue Service, administrative settlements in tax disputes. Prereq: A course in advanced income tax.

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. Not 9 hrs of accounting and consent of instructor.

5630 Accounting Systems and EDP Concepts and Control (3) Elements and operation of a computer in a business environment. The analysis, design, implementation, documentation, and control of accounting systems. Prereq: Introductory Cost Accounting and knowledge of a computer programming language.

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

5610 Accounting for Control (3) Funda- mentals, analysis of financial statements, budgets, responsibility accounting, impact of income taxes on control and decision making, and control techniques in management accounting. May not be taken for credit by students whose undergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5050-60 or equivalent.

5820 Corporate Reporting Problems (3) A user-oriented analysis of current corporate financial reporting problems and issues. May not be taken for credit by students whose un- dergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5810 or 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: 9 hrs of graduate credit in accounting and consent of instructor.

Business Law

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

Associate Professor:

Assistant Professor:
N. E. Shultz, 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 businessman; examines government regulation of business; explains basic legal notions and principles that pertain to businessmen. (Available only as stated on page 35.)

Business Administration

DEGREES

MAJOR
Business Administration
M.B.A., D.B.A.

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; emphasizes sizing up company's situation, determining objectives, developing sound policies, organizing and administering personal to reach company objectives, continuous administrative reappraisals. 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 interaction 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 promotion and business development 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

Economics

DEGREES

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

Professors:
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
  - Econometrics
- **Economics development**
  - Economics of centrally 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 or three 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**
- **5002 Non-Thesis Graduation Completion** (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
- **5011-12 Problems in Lieu of Thesis** (3, 3) May be repeated. S/NC only.
- **5101-12 Problems in Lieu of Thesis** (3, 3) May be repeated. S/NC only.
- **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, and short and long-run profit maximization under conditions of perfect and imperfect competition, and demand for factors of production and distribution. May be repeated. 5111 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, and on the one hand, and aggregate saving, investment, and liquidity preference on the other. Prereq: Intermediate economic theory or equivalent.
- **5160 History of Economic Thought** (3) Development of economic ideas from the mercantilists through Alfred Marshall; emphasis given to the classical and neo-classical tradition.
- **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 the applications of the theory of the firm, growth models, game theory, linear programming, and decision making under uncertainty. Prereq: 1 yr 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 demand analysis, production and cost analysis, 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.
- **5810 Financial Markets and Intermediaries** (3) (Same as Finance 5810)
- **5820 Monetary Theory and Policy** (3) (Same as Finance 5820)
- **5830 Commercial Bank Management** (3) (Same as Finance 5830)
- **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.
621 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.

6150-50 History of Economic Doctrines (3, 3) Important ideas of economic thinkers from the Middle Ages to the present.

6170-90-90 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 least squares regression model, extensions of the least squares regression model, and approaches to simultaneous equation models with application to current economic problems. Prereq: 5180-90 and 5510 or the equivalent.

INTERNATIONAL TRADE AND ECONOMIC DEVELOPMENT

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

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

4250 Economic Development of Europe (3) The beginnings of capitalism in medieval Europe, 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 centuries; two world wars and their economic consequences.

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

5210 Seminar in International Trade Theory (3) Studies in pure theory of international trade.

5220 Seminar in Economic Development (3) Study of the economic problems of developing countries.

5250 Economic History of Europe (3) Studies of the nature and functioning of economic systems and policies in the history of western civilization; examination of some major issues of methodology and interpretation.

5260 Economic History of the U.S. (3) Studies of major issues in the interpretation of American economic structure and policies from colonial times.

5610 Location and Regional Development Theory (3) Theory of industrial, agricultural, and residential location; the economic basis for large and small patterns of urban and rural systems; examination of regional inequalities and national assistance for regional economic development.

5820 Methods of Regional Analysis (3) Theory of regional structure and growth. Examination of regional models for impact analysis and economic forecasting. Methods of analysis include regional descriptive statistics, gravity and potential concepts, regional income and product processes, shift and share analyses, economic base studies, and regional input-output, linear programming, and econometric models.

6211-12, 6221-22 Seminar in International Economics (3, 3, 3) Theory of specialization and trade. The balance of payments, exchange rates, monetary problems, capital movements, and foreign trade policy.

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

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

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

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

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

6620 Regional Economics Workshop (3) Selected topics in applied regional research. Emphasis on student participation in model design and estimation, forecasting, simulation and mathematical and computer programming. May be repeated. Maximum 6 hrs.

INDUSTRIAL ORGANIZATION

4350 Industrial Organization Analysis (3) Monopoly and competition in the United States economy; market structure, business behavior, and economic performance and their interrelationships. Prereq: 9 hrs of introductory economics.

5240 Seminar in Private Enterprise and Public Policy (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.

5651-52, 5631-32 Seminar in Industrial Organization (3, 3, 3) 6351-52-Survey of the organization of industry in the American economy, with emphasis on the empirical and analytical techniques used in investigating structure, conduct and performance. 5651-52—Public Policy in the United States with respect to industrial structure and business conduct; examination, appraisal and proposals for change.

ECONOMICS OF CENTRALLY PLANNED ECONOMIES

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

5391 Theory and Practice of Economic Planning (3) Leading issues in imperative and indicative planning. Prereq: Consent of instructor. May be repeated with consent of department.

ECONOMICS OF LABOR AND MANPOWER


4430-40 Labor Legislation (3, 3) 4430—Economic background and effects of governmental regulation of labor relations, with emphasis on a detailed examination of the National Labor Relations Act as amended. 4440—Development and application of the Fair Labor Standards Act, the Social Security Act, workers’ compensation acts, and related legislation affecting labor relations.


5410 Seminar in Labor Manpower Economics (3) Intensive examination of the major topics contained in the labor-manpower economics literature. Emphasis on problems, analysis and possible solutions. Prereq: Consent of instructor.

5420 Seminar in Wage and Employment Theory (3) An examination of current and past theories of wage and employment determination. Prereq: 5410, equivalent or consent of instructor.

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

Finance

Professors:

Associate Professors:

Assistant Professors:
A. L. Auxier, Ph.D. Iowa; H. S. Banton, M.S. Auburn; M. Lindahl, Ph.D. Illinois (Champaign-Urbana); R. A. Weir, Ph.D. North Carolina.

5000 Thesis

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

6000 Doctoral Research and Dissertation

FINANCE AND INVESTMENTS

5050 Survey of Finance Functions in Business (3) The scope and nature of managerial finance: financial 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 fundamentals of financial accounting. (Available only as stated on page 35.)

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

5120 Quantitative Techniques in Financial Management (3) An introduction to the applications of mathematics, probability, and statistics for model building and testing in finance. Prereq: 5110 and Statistics 5311 or equivalent.

5130 Financial Administration (3) Cases and men's compensation acts, and related legislation affecting labor relations.
readings within the firm; refined techniques of analysis; optimal financing decisions; capital cost measurement; utilization of capital markets; general corporate financial theory. Prereq: 5110.

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

5420-30 Investments (3, 3) The investment decision process: factors influencing 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 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 are invited to 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 uncertainty and risk. 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.

MONErARY 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. Covers the process of saving, the partial institutionalization of these savings, the investments of financial intermediaries, and 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 of management of funds; current banking problems. Prereq: Consent of Instructor. (Same as Economics 5830.)

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

6810 Financial Institutions and Markets (3) The role of financial institutions, and analysis of market efficiency.

GOVERNMENTAL FINANCIAL ADMINISTRATION

5210-22 Public Finance (3, 3) Role of the public sector and the problem of social balance, collective and quasicollective goods and their financing under alternative tax programs. Must be taken in sequence. Prereq: Economics 5060 or equivalent.


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 fields of life, health, property, liability and social insurance. Emphasis is on the basis of issues touching upon the insurance mechanism and philosophy. Prereq: Consent of instructor.

REAL ESTATE AND URBAN DEVELOPMENT

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


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

5130 Housing and Urban Land Markets (3) Analysis of housing demand and supply and location. Segregation and housing discrimination, impact of urban renewal and public policy on urban 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

Professors:
A. H. Keally (Head); M.B.A., Pennsylvania; R. W. Balogun, Ph.D. Stanford; H. W. Henry, Ph.D., Michigan; J. M. Larsen, Ph.D., Purdue; S. K. Reed, Ph.D. Edinburg; S. C. Vance, Ph.D., Pennsylvania; G. H. Whitlock, Ph.D., Tennessee.

Associate Professors:

O. S. Fowler, Ph.D. Georgia; M. Gordon, Ph.D. Colorado; R. G. Maddox, Ph.D. Texas; C. W. Neel, Ph.D. Alabama.

Assistant Professors:
J. A. Bachmann, Ph.D. Virginia Polytechnic Institute; R. L. Dippeay, Ph.D. Purdue; R. L. Dippeay, Ph.D. Purdue; W. W. Williams, B.S. Pennsylvania State.

4801-02-03 Readings and Research in Personnel Management (1, 2, 3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5000 Thesis

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

5050 Production Management (3) Analysis of the production function with emphasis upon application of mathematical-statistical methods. (For M.B.A. students only. Available only as stated on page 35.)

5110 Organization Theory I (3) Analysis and design of organization structure.

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

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

5170-80-90 Proseminar in Industrial and Organizational Psychology (1, 2, 3) Introduction to the basic principles of human development and behavior required for graduate study in industrial and organizational psychology. Must be taken in sequence during the student's first year. (Same as Psychology 5170-80-90.)

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

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

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

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

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

5320 Management Problems in Industrial Research (3) Basic administrative problems encountered in the management of industrial technological research and engineering programs, and comparable situations in which professional personnel predominate.

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

5510-20 Organizational Behavior (3, 3) An examination of behavioral methodology and parameters, including a review of empirical behavior research in organizations. Must be taken in sequence.

5540 Seminar in Management Information Systems (3) (Same as Accounting 5640.)
Management Science

MAJOR DEGREES
Management Science
M.S., Ph.D.

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

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

Management Science Committee:
Members of the Management Science faculty and in addition: R. W. Boling, Industrial Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; D. H. Pike, Industrial Engineering; C. C. Thigpen, 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 an applied concentration in a field outside the College of Business Administration.

Applications are encouraged from all majors, but mathematical background equivalent to the completion of at least two years of college calculus and proficiency in a computer language (e.g., Computer Science 3150) is required. The program is designed to be completed in one calendar year of full-time study, but applications are also encouraged from prospective part-time students.

Course Requirements

<table>
<thead>
<tr>
<th>Quarter Hours</th>
<th>Management Science 5310-20-30-40</th>
<th>Applied Concentration Area (approved by advisor)</th>
<th>Statistics 5110</th>
<th>Statistics elective (5000-level or above)</th>
<th>Mathematics (4000-level or above)</th>
<th>Electives selected from mathematics, statistics, computer science, and/or management science</th>
<th>Electives in any area approved by advisor</th>
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<tr>
<td>12</td>
<td>12</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>8</td>
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<td>Total</td>
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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 in mathematics may be allowed to take six additional hours of electives in place of the mathematics requirement. On the other hand, a student lacking experience in rigorous senior-level mathematics courses will be asked to take additional courses to fulfill the six-hour mathematics requirement. The total course load will remain 48 hours for all non-thesis students and 45 hours for thesis students; however, the number of hours of electives can be reasonably expected to vary between six and 18 as a function of prior background.

MBA CONCENTRATION

Management Science 5310-20-30-30 forms the nucleus of a 12 to 18 hour concentration in Management Science for MBA students. See pages 34-35 for further MBA details.

DOCTORAL PROGRAM

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

1. to provide, through management science course work, a thorough knowledge of common Management Science/Operations Research mathematical models and their uses;
2. to provide sufficient advanced study in an applied concentration area to qualify the graduate for a joint faculty position in the concentration area as well as in management science. The candidate may choose from the business functional areas (accounting, finance, marketing, production management, and transportation and logistics) or other disciplines, e.g., forestry, ecology, and public administration;
3. to develop in the student, through course work in mathematics, statistics, and computer science, a high degree of mathematical maturity which will serve the graduate well throughout a life-long career, whether in management, research, or teaching.

Degree Requirements. General University requirements for the doctoral degree are stated on page 20.

Course Work. A minimum of 72 quarter hours of course work taken for graduate credit (exclusive of thesis or dissertation) is required. The candidate must complete a minimum of 36 quarter hours at The University of Tennessee, Knoxville, at least nine of which must be at the 6000 level. Entering students who have completed graduate studies in applicable fields will be granted course credits for work which is equivalent to required courses in the program. The program includes approximately 24 to 30 quarter hours of course work in the applied concentration area.

Qualifying Examinations. The student must demonstrate mastery of probability theory and statistical inference (Statistics 5110-20-30) by passing a written qualifying examination or by presenting other evidence of mastery of the material satisfactory to the faculty. Mastery of 18 quarter hours in mathematics courses must be demonstrated by passing a written qualifying examination or by presenting other evidence of mastery of the material satisfactory to the faculty. Topics normally include matrix methods (Mathematics/Computer Science 5650-86-76) and real analysis (Mathematics 4510-20-30). Other options may be approved.

There is no foreign language requirement.

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

Preliminary Examination. Prior to admission to candidacy for the degree, and normally after completion of the second year of the program, the student must pass a written preliminary examination covering the theory of deterministic and stochastic management science models. Topics included in this examination are determined on an individual basis. Students will be expected to demonstrate an integrative ability that goes beyond simple mastery of course content.
Research and Dissertation. The student must complete 36 quarter hours of Management Science 6300, Doctoral Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate. This effort, which is beyond the minimum 72 hours of course work, normally is completed in the third year of the program.

Prerequisites for Management Science Courses. The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose prior course work does not match the prerequisites are encouraged to seek the instructor's guidance and consent to enroll.

5000 Thesis

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

5100 Introduction to Management Science Techniques (3) Review of matrix algebra and an introduction to techniques such as mathematical programming, decision theory, and queuing theory. Prereq: Statistics 5311. May not be taken for credit by students who receive credit for 5310.


5340 Application of Management Science Methods (3). Application of methods from 5310-20-30 to large-scale management problems. 5350 may be taken concurrently.

5510 Topics in Optimization (3) In-depth study of one of the following: linear programming, dynamic programming, non-linear programming, optimization theory (convex analysis, optimality conditions, Lagrangean and other dual approaches). Prereq: Consent of instructor; course prerequisites vary with topic. May be repeated. Maximum 9 hrs.

5610 Markovian Decision Models (3) Formulation and analysis of Markov Chain models; Markov Chain models which incorporate decision-making application through policy iteration. Stochastic dynamic programming models in continuous time. Prereq: 5350.

5820 Queuing Models (3) Application and mathematical analysis of models of congestion. Basic birth-death process models, other Markovian models; non-Markovian models for systems with general service or arrival patterns, priority customers or other complicating as-

Market and Transportation

G. N. Dier (Head), D.B.A. Indiana

Marketing

1 Assistant Foundation Professor in Business Administration.

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

5910 Management Science Problems (1-3) Directed study on subject of mutual interest to student and staff member.

6000 Doctoral Research and Dissertation

6110-20-30 Models for Production Systems (3, 3, 3) A seminar and research practice to enhance the professional development of doctoral students. Includes investigation of existing mathematical models for production processes and opportunities for original research. Prereq: 5310 Special Topics (3) Prereq: 5310-20-30 and consent of instructor. May be repeated. Maximum 9 hrs.

6910-20-30 Management Science Seminar (1-3, 1-3) Subjects selected from current management science literature.

Marketing and Transportation

G. N. Dier (Head), D.B.A. Indiana

Marketing


5001 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5050 Survey of Marketing (3) Analysis of the marketing function; marketing models and marketing research. Current trends and developments. (Available only as stated on page 35.)

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, and evaluating the firm's promotional program. Social and economic role of persuasive communications. Prereq: 5200 or equivalent.

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

5300 Marketing Research (3) Investigation and solution of problems; application of research methods to functional areas of marketing. Research concepts, methods, and tech-
5120 Management and the Pricing Problem (3) A critical analysis of the application of economic theory and regulatory constraints to the pricing of carrier services.

5130 Transportation Management Problems (3) An analysis of significant transportation problems with a consideration of proposed solutions.

5210 Business Logistics (3) Development of concepts to guide the analysis and design of logistics systems. Scope and importance of transportation and spatial decisions in the total strategy. Emphasis on top management integration of physical distribution operations with marketing, production, and other decision areas.

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

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

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

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

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

6000 Doctoral Research and Dissertation

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

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

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

Office Administration

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


4320 Business Letter Writing (3) Modern business letters; types of letters studied; principles applied by solving letterwriting problems.

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

4410-20 Advanced Shorthand and Transcription (3, 3) Improvement of ability to take dictation and transcribe machine 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 efficiency, interviewing, 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.


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

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

5011 Problems in Lieu of Thesis (3)

5050 Data Processing in Business (3) Fundamentals of data processing, computer programming, and applications, systems design. (Available only as stated on page 35.)

Statistics

MAJOR

DEGREES

Statistics

M.S.

Professors: C. C. Thigpen (Head), Ph.D. Virginia Polytechnic Institute; D. S. Chambers, M.B.A. Texas; R. A. McLean, Ph.D. Purdue.

Associate Professors: H. A. Lasater, Ph.D. Rutgers; J. W. Philpot, Ph.D. Virginia Polytechnic Institute; R. D. Sanders, Ph.D. Texas; D. J. Wheeler, Ph.D. Southern Methodist.

Assistant Professors: H. W. Olson, Ph.D. Virginia Polytechnic Institute; G. B. Ranney, Ph.D. North Carolina; M. S. Younger, Ph.D. Virginia Polytechnic Institute.

MASTER OF SCIENCE PROGRAM

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

Statistics Major Area

Quarter Hours

Probability theory ............................ 3
Theory of statistical inference .................. 6
Theory of least squares ....................... 3
Supporting courses in applied statistics and mathematics as recommended by the student's committee .......................... 15

Minor Area

Selected with the approval of both the Department of Statistics and the department in which the work is to be taken .................. 9

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


4350 Statistics for Engineering (3) Survey of statistical methods with special application for engineering students; frequency distributions, selected sampling distributions, some tests of significance, introduction to linear regression. Prereq: Third quarter of calculus and analytic geometry.

4350 Non-Parametric Methods (3) Measures of association, two-sample tests, analysis of variance with ranked data; paired and multiple comparisons in preference testing; questionnaire evaluation. Prereq: Introduction to statistical analysis.

4310 Regression and Correlation (3) Techniques of linear regression and correlation, polynomial and multiple regression, multiple and partial correlation. Prereq: Second quarter of Introduction to statistical analysis or 3450.

4410 Design of Experiments (3) Principles and procedures for efficient experimental design. Randomization, choice of size and number of experimental units, utilization of block designs, arrangement of data and data analysis. Interpretation of experimental data. Prereq: 3450.

5000 Thesis

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


5110 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) An 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 available for credit in any College of Business Administration degree program.


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 T²; 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: 5060.

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

A graduate student in the College of Communications whose grade point average, not including incomplete grades, is below 3.0 at any time after the end of 12 hours of graduate credit shall be placed on probation. A student on probation shall be dropped from the program unless his or her cumulative grade point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next 12-quarter hours of graduate course work attempted which is specified in the student's degree program. Exceptions to this policy may be made only with the approval of the Associate Dean for Graduate Studies of the College of Communications upon recommendation of the student's faculty committee.

MASTER OF SCIENCE

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

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

Applicants must meet admission requirements of the University Graduate School. Those lacking approved credits in communications (advertising, broadcasting, and journalism) must complete at least 18 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. Students are admitted to the program only for summer and fall quarters each year. Applications for the graduate program, including all necessary materials that are not received at least six weeks before registration may not be processed in time for admission to full potential candidate status in the first quarter. In these cases, the student may still qualify for non-degree or 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, 5140, and 6100, at least 9 hours in one concentration area (advertising, broadcasting, journalism), and at least 15 hours at the 5000 level;

-9 hours of thesis work;

-at least 12 hours in a minor area approved by the major advisor, at least 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 9 hours of 5000-level communications courses approved by the committee.)

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

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

-33 hours of approved courses in communications, including Communications 5100, 5120, and 5140, at least 12 hours in one concentration area (advertising, broadcasting, journalism), and at least 15 hours at the 5000 level;

-at least 12 hours in a minor area approved by the major advisor, at least six of which must be at the 5000 level;

-completion of an approved communications project (no more than one inde-
pended 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-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 in the related social and behavioral sciences. The program is flexible and will accommodate a wide variety of career goals in communications.

For the Ph.D. degree, the dissertation 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 course work; (c) primary concentration in communications: 15-18 hours of course work; (d) second concentration in a cognate minor subject normally outside communications: 12 hours of course work; (e) technical competence area in either teaching, research, or administration: 15-18 hours of course work and, for those who lack appropriate professional experience, an internship the equivalent of 9 credit hours; (f) research tool: 12 hours of course work, e.g., statistics, foreign language, or computer science; (g) dissertation: 36 hours of Communications 6000.

The following courses represent the required core curriculum (beyond the Bachelor's degree):

- Communications 5100, Introduction to Graduate Studies
- Communications 5140, Communications Theory
- Communications 5210, Research Methods
- Communications 6100, Seminar in Communications Theory
- Communications 6200, Seminar in Communications Topics

One of the following: Communications 6310, Survey Research Methods in Communications; 6310, Experimental Research Methods in Communications; 6320, Seminar in Historical Research Methods in Communications. For the teaching or administrative 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 5450, Instruction in Higher Education. Industrial Personnel Management 5110-20, Organization Theory I and II (or equivalent courses approved by committee).

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

Communications Research Center

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

Departments of Instruction

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

Communications

MAJOR DEGREES

Communications

M.S., Ph.D.

Professors:
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:

5000 Thesis

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

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

5120 Research Methods (3) Communications research strategy and methodology. Scientific process, bases for derivation and verification of hypotheses, and 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 communication 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, personal, and mass communication systems. (Same as Speech and Theatre 5140.)

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

5970 Independent Study (5) Reading, research, or projects on special topics in mass communication. On an individual basis, under faculty direction, with consent. May be repeated.

6000 Doctoral Research and Dissertation

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

6200 Seminar in Communication Topics (3) Intensive analysis of special issues and problems in human communication. Repeatable; each form 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, and questionnaire construction, data gathering (personal, 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 inference from various research designs. Control, single-factor and multi-factor experimental 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. D. Fletcher, Ph.D., Illinois; S. K. Zeiger, Ph.D., Michigan State.

3530 Advertising Copy and Layout (4) Importance of layout, typography, and translation into persuasive words and pictures. Principles and techniques of writing copy and preparing advertising copy. Emphasis on creation for advertisers. Prereq: Advertising Principles, Marketing Communications II, or consent of instructor.

4000 Advanced Advertising Copy and Layout (4) Creative strategy and execution of advertising campaigns. Specialized lectures by commercial broadcasters. Prereq: 3630 or consent of instructor.

4360 Advertising Media (3) Study of media, markets, and audiences. Emphasis on advertising media selection; preparation of advertising copy. Prereq: 3630 or consent of instructor.

4450 Advertising Problems and Cases (3) Case approach to the study of advertising problems. Analysis of campaigns and trends. Prereq: 4000 and 4360 or consent of instructor.

4470 Advertising Campaigns (4) Practical application of advertising theory in planning and executing advertising campaigns. Emphasis on advertising media selection; preparation of advertising copy. Prereq: 4000 and 4360 or consent of instructor.


5330-20-30 Creative Projects (3, 3, 3) Creative or problem-solving interests related to advertising. Designed for the advanced student who wishes to study and practice specialized advertising projects. Prereq: 4460 or consent of instructor.

5510-20-30 Writing and Editing Projects (3, 3, 3) Writing and editing skills and knowledge to successful radio-television advertising; emphasis on media research, rate structure, programming, creativity; instruction in television commercials.

5650 Radio-Television Program Development (3) Planning basic program structures for broadcasting stations. Historical trends in program development and current programming practices of such fields as agriculture, business, industry and engineering, home economics.

5790 Independent Study (3) Seminal course of study in advertising and promotion. Emphasis on creation for advertisers. Lectures and labs. Prereq: 3630 or consent of instructor.

5970 Independent Study (3) Independent study in broadcasting. Emphasis on creative writing or production projects. Prereq: 4000 and 4450 or consent of instructor.

School of Journalism

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

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

Assistant Professors: F. A. Lester, M.A., Tennessee; M. K. Sidel, Ph.D., Northwestern.

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

3650 Radio-Television Writing (3) Theory and technique of writing all types of broadcasting scripts except news and dramatics. Special events, interviews, musical scripts, radio talk, and promotion material. Emphasis on commercials.

4010 Speech for Broadcasting (3) Fundamentals of today's broadcast conditions as they affect the broadcast student. Oral interpretation of General American Speech, Spanish, Italian, German, and French pronunciation. Prereq: Strongly recommended but not mandatory, Public Speaking.

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

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

4670 Radio-Television Management (3) Business policy and decision making in relation to broadcasting stations. Departmental functions, selling, and income figures, sales techniques, advertising agencies, and governmental regulations. Specialized lectures by commercial broadcasters. Prereq: Introduction to Broadcasting or consent of instructor.

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

5510-20-30 Creative Projects (3, 3, 3) For students who are considering a career in writing for radio and television. Emphasis on creative writing or production projects. Prereq: Introduction to Broadcasting or consent of instructor.

5530 Broadcast Law and Regulations (3) Sociopolitical control of broadcasting; effect of laws, regulations, and public pressures upon station policies. Particular emphasis upon the unique situation of broadcasting among the media in terms of regulations. Prereq: Journalism 4410 or consent of instructor.

5550 Broadcast Documentary Writing (3) Study of the role of the documentary in radio and television. Research, writing, and critique of documentary programs.

6500 Broadcast and Television Studies and Practices (3) Planning basic program structures for broadcasting stations. Historical trends in program development, and current programming practices of such fields as agriculture, business, industry and engineering, home economics.

6700 Broadcast Sales Management (3) Problems of sales management in the advertising field. Sales techniques, pricing, promotion, and other problems in advertising. Designed for the advanced student who wishes to apply theory and skills to specific problems in advertising. Lectures and labs. Prereq: 4000 and 4450 or consent of instructor.

7900 Independent Study (3) Independent study in advertising and promotion. Emphasis on creative writing or production projects. Prereq: 4000 and 4450 or consent of instructor.

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

3410 Communications Law (2) Statutory law and judicial precedents affecting mass communications media. Libel, contempt of court, invasion of privacy, copyright, broadcasting, advertising, and postal regulations.

5560 Investigative and Specialized Reporting (3) Investigative and interpretive reporting of complex or specialized subjects to place news in perspective or to clarify situations. Emphasis on writing for publication. Prereq: Reporting.

3710 Public Relations (3) Theories and principles of public relations. Overview of PR as a management tool of business, government, institutions, and organizations.

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

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

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

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 business operations. Current developments in newspaper management.

4430 Journalism in the High School (3) Functions and methods of high school publications. Staff organization, writing and editing techniques, editorial problems, and business management.

4450 News and Feature Photography (3) Advanced principles and methods in black-and-white photography, photojournalism, and feature photography, and picture stories. Prereq: Press photography or consent of instructor.

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

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

5210 Government and the Press (3) Historic and current problems in the relations of executive and legislative branches 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 formulation and how the press in turn is influenced by public opinion. Prereq: 4410 or consent of instructor.

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

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

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

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

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

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

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

The College of Education, through the Graduate School, offers programs leading to the Master of Arts in College Teaching, the Master of Science degree, the 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 instru-
work relating specifically to school planning is offered through the Department of Educational Administration and Supervision, while two-year graduate assistantships are under the administrative auspices of the Laboratory.

Departments of Instruction

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

Art and Music Education

Charles H. Ball, Head

Art Education

MAJOR

Art Education

DEGREE

M.S.

Professor:

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

Associate Professor:

H. N. Hull, Ed.S. Peabody.

Assistant Professor:

J. P. Watkins, M.S. Tennessee.

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

The thesis option requires 45 quarter hours as follows:

1. Art Education 5310, 5320, and electives .................................... 18 hrs
2. Education C & I 5710, and electives ...................................... 9 hrs
3. Minor (selected with committee) ........................................... 9 hrs
4. Thesis (Art Education 5000) ............................................... 9 hrs

The non-thesis option requires 45 quarter hours as follows:

1. Art Education 5210, 5310, 5320, and electives ....................... 21 hrs
2. Education C & I 5800, and electives ................................... 9 hrs
3. Minor (selected with committee) ......................................... 9 hrs
4. Electives ............................................................................ 6 hrs

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

Music Education

MAJOR

Music Education

DEGREE

M.S.

Professors:

C. H. Ball (Head), Ph.D. Peabody; A. W. Humphreys, Ed.D. Illinois; W. J. Julian, Ph.D. Northwestern.

Associate Professors:


Assistant Professor:

W. H. McDaniel, M.S. Tennessee.

Thesis and non-thesis programs lead to the Master of Science degree in music education. 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. Curriculum design:

   With the exception of the required courses listed below, with approval of the student's advisor, courses may be selected as described more fully below. This provides the flexibility necessary for the student to pursue in some depth specialized interests and needs in the following areas of music teaching: Elementary; Secondary (Junior and Senior High); Vocal (Choral); Instrumental (Band and Orchestra); and Supervision.

   (1) A major: at least 27 quarter hours in music education.
   (2) A minor: at least 15 quarter hours in music.

   (3) 9 quarter hours in professional education, including Educational Statistics 5610 and Educational Psychology 4760 or equivalents and a three-hour elective.

   4. Specific course requirements:

   A. Music Education Foundation (15 quarter hours)
   (1) One seminar (3 hours)
   (2) 5210, Psychological Foundations of Music
   (3) 5240, Evaluation Procedure in Music Education

   B. Music

   Six quarter hours in applied music (piano; voice; a band or orchestra instrument; or theory and composition).

   C. Education (limited elective of 6 quarter hours)

   Education 4760, Advanced Child Study; or 5050, Learning and Development in Children; 5320, Advanced Educational Psychology; or other appropriate course in educational psychology with three hours credit.

   5. Electives (with approval of advisor):
A. Music Education: 12 credit hours from courses numbered 5000.

B. Music: 9 credit hours from courses at the 3000-, 4000-, or 5000-levels. No courses required in the undergraduate curricula may be included.

C. Education: 3 credit hours, elected from other departments in Education.

6. Evaluation (in addition to routine examinations in courses):

A. Written comprehensive examination in major and minor fields.

B. The student shall elect one of the 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 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 education; 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 rehabilitation programs of atypical children. Study of the use and values of specific activities with emotionally disturbed, brain-injured, speech defective, physically disabled, and mentally retarded children. For majors in Special Education. Prereq: Teaching in the Intermediate or Upper Grades.

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

5000 Thesis

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

5150 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 (2) 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) Primarily to improvement of the teacher-learning, child-learning process in music education. Problems of supervision, research, and in-service education, teacher preparation and guidance given careful consideration and study.

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

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

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

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

5290 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 chorals works. Prereq: Undergraduate degree with a major in music or music education; choral and instrumental conducting, choral methods and materials or equivalent.

5350-60-70 Special Problems in Music Education (3, 3, 3) Individual identification and study of current problems in music education at all levels of instruction and in the various specialized areas of the music curriculum. Prereq: 5250, or the equivalent and consent of instructor.

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

Continuing and Higher Education

MAJOR

DEGREE

Adult Education

M.S.

Professors:


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. The thesis option requires satisfactory completion of a final oral examination, and the non-thesis option requires satisfactory completion of a final written examination.

5000 Thesis

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

5060 Adult Education: A General Survey (3) Surveys the historical development of the field, philosophies of adult education, agencies, programs, current issues, and the literature of adult education.

5110 Seminar in College Teaching (3) Effectiveness of college teaching; testing and measurement; recent research in college instruction; major problems and issues in higher education. Preparation of candidates for the M.A.T.G. certificate. 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 of public and private colleges and universities.

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

5890-79 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 problems of secondary school opportunities for adults.

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

Curriculum and Instruction

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

Professors:
- J. J. BeYion (Head), Ed.D. California
- C. B. Allison, Ph.D. Oklahoma
- R. S. Thurman, Ph.D. Iowa; J. N. Chiles
- A. M. Johnston, Ed.D. Georgia
- L. O. Haaby, Ed.D. Columbia
- M. J. Donaldson, Ed.D. Illinois
- C. L. Cagle, Ed.D. Missouri

Assistant Professors:
- G. G. A. Christiansen, Ph.D. Missouri
- R. S. Thurman, Ph.D. Illinois
- L. M. Knight, Ed.D. Tennessee
- J. C. Fairlie, Ph.D. Texas
- R. E. Huff, Ph.D. Ohio State
- W. P. N. Terwilliger, Ed.D.

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 major areas: curricular, elementary education, English education, foreign language education, instructional materials, mathematics education, science education, or social science education.

The non-thesis option requires the completion of 51 quarter hours of course work.

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

- Curriculum
- Elementary 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 completed the Master's degree, a maximum of 45 hours of his Master's work may be credited to the 90 hour Ed.S. requirement. (45 hours of 5000-level courses are required.) The program must also include:

1. A minimum of 12 hours taken in one of the eight areas listed above.
2. A minimum of 12 hours taken within the College of Education in areas other than the student's major area.
3. A minimum of 12 hours taken outside of the College of Education.
4. A minimum of nine hours earned through the writing of a thesis. (Students who have written a thesis for the Master's degree may be exempted from a thesis in the Ed.S. program provided, in the judgment of the student's committee, the thesis meets the standards of research appropriate for the Ed.S. degree.)
5. A minimum of 45 elective hours taken according to a plan jointly developed by the student and the major professor in terms of the student's professional goals.

DOCTORAL PROGRAM
The doctoral major in Curriculum and Instruction may include emphasis upon the following fields: comparative education, curriculum, educational philosophy, educational research, elementary education, English education, foreign language education, mathematics education, science education, social science education.

For further information, write the Department of Curriculum and Instruction.

4010 International Education: Europe and the Americas (3) Historical, philosophical, and sociological foundations; special reference to England, USSR, France, and Germany.

4110 Philosophies of Education in Cultural Perspective (3) Education in relation to the liberal, conservative, reactionary, and radical currents of thought in American culture.

4150 School Library Administration (3) (Same as L.I.S. 4150)

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

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

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

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 Development 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.

4280 Diagnosis and Correction of Classroom Reading Problems (3) Prereq: Teaching of Reading in the Elementary School or equivalent.

4300 Developmental Reading in the Secondary School (3)

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

4340 The Junior High School and Middle Schools (3) To identify and analyze the dis-
tinguishing characteristics of the Junior High and Middle School curriculums.

4359-60-70 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 Instructional Materials (3, 3, 3)

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

4358-68-78 Problems in Teaching Conservation (3, 3, 3)

4380-90-400 Problems in the Improvement of Practice. Prereq: At least one course in history or philosophy of education.


5140 Comparative Philosofies of Education (3) A systematic study of research and theory related to elementary science 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.

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 reconciling intrinsic human diversity with a demand for social conformity in public education. Prereq: At least one course in history or philosophy of education.

5143 Supervised Readings in Philosophy or Educational Sociology (3) A systematic study of research and theory related to elementary science education. Emphasis on individual student presentations, projects, and investigations. Prereq: Teaching Science in the Elementary School or equivalent, or consent of Instructor. At least one year teaching experience (K-9).

520 The Teaching of Mathematics in the Elementary School (3) Trends, issues, and research in content and method for the mathematics program, grades 1-8. Prereq: Teaching Arithmetic in the Elementary School and 9 hrs Structure of the Number System or consent of instructor.

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

5292 Seminar in Research and Theory in Teaching Mathematics in the Elementary School (3) Special readings and special instructional aids associated with the language arts. Prereq: Teaching Arithmetic in the Elementary School or equivalent, consent of instructor, and one year of teaching experience.

5362 Psychology of Reading (3) Presents a deeper understanding of the reading act, a more accurate insight into the relationship between learning theory and reading, and a greater knowledge of the role of reading in the child's overall intellectual development. Prereq: An undergraduate reading course or consent of instructor.

5364 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 4500 or consent of instructor.

5367 and 5424 Creative Thinking and Expression in the Elementary School (3) Designed to give students the opportunity to examine the development of creative potential across the academic curriculum of the elementary school. Prereq: Consent of instructor.

5250 Secondary School Curriculum (3) Theoretical background and experimental approaches.

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 in 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 5700.

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

5002 Thesis

5004 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).

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

5283 Programs and Materials in Teaching Elementary Science (3) In-depth analysis of new and innovative science program materials, as well as instructional strategies inherent in teaching 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 equivalent, or consent of Instructor. At least one year teaching experience (K-9).

5301 Remediation of Remedial Reading Problems (3) Prereq: 4280.

5290 Seminar in Elementary School Language Arts (3) Recent trends, issues, and research in content and method for the language arts program, grades 1-8. Prereq: Teaching Arithmetic in the Elementary School and 9 hrs Structure of the Number System or consent of instructor.

5300 Curriculum Development and Evaluation (3)
5382 Developmental Reading Practicum (3) Diagnosis 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)

5630 Practicum in the Individualization of Instruction (3) Prereq: 4260. To experience the elementary school or directed learning in the elementary school and advanced teaching in the elementary school.

5640 Newer Trends in Elementary Education (3) Trends in classroom procedures, equipment, and materials of instruction; problems involving improvement of instruction.

5650-60 Curriculum Laboratory for Elementary Schools (3, 3) Study and production of syllabi, courses of study, source units, and other materials.

5670 Curriculum Laboratory for Early Childhood Education (3)

5691 Production and Use of Audiovisual Materials (3) Practical graphics, adapted to the needs of the teacher. Production and use of picture montages, 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 objective observation and analysis skills, examination of existing observation systems.

5800 Seminar in Cooperative Curriculum Research (1) 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 use of teaching aids, developing structure of mathematical concepts as well as strategies, methods, and materials for teaching. Materials suitable for 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 individualized projects and investigations.

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

5841 Trends and Issues in Early Childhood (3) Historical background, trends, and issues as basic for the design of programs, materials and techniques of teaching.

5842 Problems in Education: Early Childhood Education (3) Prereq: 5710 or 5850 or equivalent.

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

5845 Social Studies and Science in Early Childhood Education (3) Systematic examination of integrative approaches to and substantive classification systems of the content areas of social studies and science for 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, programs 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.

5850-57-70 Problems in Education: English (3, 3, 3)

5851-57-71 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)

5864-64-74 Problems in Education: Language Arts (3, 3, 3)

5865-65-75 Problems in Education: General Curriculum (3, 3, 3)

5866-66-76 Problems in Education: Instructional Materials (3, 3, 3)

5877-67-77 Problems in Education: Foreign Languages (3, 3, 3)

5889-69-79 Problems in Education: Conservation (3, 3, 3)

5900 Seminar in the Teaching of the English Language (3) Prereq: Two 5000-level courses in reading.

5901 Seminar in the Teaching of the English Language in the Secondary School (3)

5902 Seminar in the Teaching of the English Language in the Elementary School (3)

5903 Seminar in Teaching the English Language in the Secondary School (3)

5904 Seminar in Teaching the English Language in the Elementary School (3)

5911 Directing the Forensic Program (4) (Same as Speech 5911.)

5912 Play Production in Secondary Schools (4) (Same as Theatre 5912.)

5950 The Function of the Thinking Process in Education (3) Emphasis on 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 in 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)

5980 Projects, Programs, and Materials in Social Studies (3) Examination of projects and aids associated with each of the social science disciplines.

6000 Doctoral Research and Dissertation

6010 Studies in English Education (3) Reading and study in various areas of the teaching of English: composition, language, and literature.

6020 Seminar in Teaching the Social Sciences (3) Problems associated with classroom instruction in junior and senior high schools.

6030 Research and Theory in Teaching Reading (3) A systematic study of research and theory in their application to the teaching of reading. Attention will be given to research design as it applies to reading investigations. Prereq: Two 5000-level courses in reading.

6031 Seminar in Reading and Language Arts (3) A critical review of topics new to the broad area of language arts. Two topics each term chosen by the need of the class 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.

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

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

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

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

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

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

5911-60-70 Problems in Lieu of Thesis (3, 3, 3)

5912-61-71 Problems in Lieu of Thesis (3, 3, 3)

5913-62-72 Problems in Lieu of Thesis (3, 3, 3)

5914-63-73 Problems in Lieu of Thesis (3, 3, 3)

5915-64-74 Problems in Lieu of Thesis (3, 3, 3)

5916-65-75 Problems in Lieu of Thesis (3, 3, 3)

5917-66-76 Problems in Lieu of Thesis (3, 3, 3)

5918-67-77 Problems in Lieu of Thesis (3, 3, 3)

5919-68-78 Problems in Lieu of Thesis (3, 3, 3)

5920-69-79 Problems in Lieu of Thesis (3, 3, 3)
tical 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 Edu-
cation (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) Educa-
tion 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 Sciences Research (3) Survey of current research in elementary social studies, the status of research methods, and recent research related to other fields. Prereq: An undergraduate course and one graduate course in social studies, or equivalent.

6230 Programs for Curriculum Improvement (3) May be repeated with consent of instructor.

6282 Advanced Studies in Elementary School Language Arts (3) Critical research analysis and writing. Prereq: At least 2 courses in history or philosophy of education.

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 Curriculum (3) Critical research analysis of some selected issues in elementary school language arts. Prereq: 5260 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 disciplines in elementary and secondary school programs. Prereq: 5270 or 5410 or equivalent.

6740 Curriculum Workshops in Instructional Improvement (3) Observation and participation in workshops sponsored by the College of Education; evaluation of workshop approaches to classroom education and instructional improvement.

6750-60-70 Problems in Curriculum and Instruction (3, 3, 3)

6830 Studies in Mathematics Education (3) Reading and study related to historical trends and issues in mathematics education in the United States for the purpose of providing a broad perspective on current curricular problems and trends. Prereq: 5630 or con-
sent of instructor.

6850 Principles of Educational Leadership (3) Conflicting concepts, with application to major problems in instruction, supervision, and admin-
istration.

Educational Administration and Supervision

MAJOR

DEGREES

Educational Administration and Supervision

Educational Administration

M.S., Ed.S.

and Supervision

Ed.D.

Professors:


Associate Professors:


Assistant Professor:

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

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

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

5130 Introduction to Educational Administra-
tion (3)

5180-99-260 Educational Specialist Research and Thesis (3, 3, 3)

5220 Philosophy and Theory in Educational Administration (3)

1 Distinguished Service Professor.

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 edu-
cation.

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 Person-
nel Administration (3) Principles, methods, and techniques of leadership.

5490 Administration of Community Education (3) Examines 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 Edu-
cational Administrators (3)

5711-21-31 Problems in Educational Adminis-
tration and Supervision: School Operation (3, 3, 3)

5712-22-32 Problems in Educational Adminis-
tration and Supervision: Higher Education (3, 3, 3)

5713-23-33 Problems in Educational Adminis-
tration and Supervision: State School Admin-
istration (3, 3, 3)

5714-24-34 Problems in Educational Adminis-
tration and Supervision: Preparation Programs (3, 3, 3)

5715-25-35 Problems in Educational Adminis-
tration and Supervision: Community Education (3, 3, 3) Investigations of administrative problems through independent study.

5720 Seminar in Urban School Administration (2) 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 Adminis-
tration and Supervision: Theory (3, 3, 3)

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

5753-53-73 Problems in Educational Adminis-
tration and Supervision: Business Management (3, 3, 3)

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

5755-65-75 Problems in Educational Adminis-
tration and Supervision: Personnel (3, 3, 3)
Ed. D. Indiana.


Graduate programs (thesis or non-thesis 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; the interplay between changes in sex role definitions 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: hrs in Child Study or equivalent.

4554-55-56 Student Leadership Workshops (1, 1, 1) Series of small group and individualized experiences to develop knowledge and skills in leadership roles. Sections are designed for Resident Assistants, Student Government leaders, student activities, and other student organizations. Prereq: Consent of Instructor.

4640 Standardized Testing (3) Use and interpretation of standardized group instruments in the assessment of intelligence, aptitude, achievement, vocational interests and personality adjustment.

4650 The Construction of Classroom Tests (3) Concerned with teacher-made classroom tests: instructional, principles of test construction, item analysis, evaluating a test's reliability and validity, the interpretation of test scores, the relationship between testing and grading.

4760 Advanced Child Study (3) Prereq: 3 hrs in Child Study, Adolescence or consent of Instructor.

4800 Psychology of the Culturally Disadvantaged Child (3) Significant behavioral differences and their causes; appropriate intervention approaches.

4890 Differential Psychology (3) Nature and sources of individual differences in behavioral characteristics, sex differences, between racial, ethnic, socio-economic, sex, and other groups.

4910 Diagnostic and Corrective Teaching (3)

5000 Thesis

5602 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty facilities before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
Development, and Learning of Children and Adolescents (3)

Children and Adolescents (3) Mental, social, physical, and emotional growth, development, and learning of children and adolescents; prevention, identification, and remediation of learning problems.

Group Approaches with Students (3) Knowledge and skills appropriate to functioning in group counseling; psychological and parent education.

Seminar in Elementary School Guidance (3) Trends, role, function, and administration of guidance in the elementary school.

Field Work in School Psychology (2) Supervision of on-the-job training in school psychology for students admitted to a master's level program in school psychology. May be repeated. Maximum 6 hrs. S/NC only.

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

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 and sex differences. Were developed and current theories and research focusing on women and/or sex differences. Prereq: 4130 or basic course in personality theory.

Seminar in Current Issues in School Psychology (1, 1, 1)

Psychoeducational Assessment (3, 3, 3) (Same as Psychology 5140-50-56.)

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

Educational Specialist Research and Thesis (3, 3, 3)

Interpreting Published Articles: Statistics (3) Emphasis on descriptive and experimental research in educational psychology, guidance and counseling, and college student personnel. Prereq: Non-thesis option students only or consent of instructor.

Interpreting Published Articles: Research Design (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.

Field Work in School Psychology: Level I (2)

Advanced Classroom Behavior Modification (3) Current research in psychology and its application to educational problems.

Theory and Research in Human Learning (3) Influence upon school practice. Prereq: Consent of instructor. (Same as Cont. and Higher Educ. 5300.)

Current Developments in Human Learning (3)

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.)

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

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

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

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

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

Career Development: Theory and Research (3)

Career Development: Program Development Implementation and Evaluation (3) A study of career development and prevocational programs and projects. K-adult with emphasis on their development, implementation and evaluation. Prereq: 5780 or equivalent, or consent of instructor.

Career Development: Workshop (1-6) Primarily designed for in-service training of school personnel. Developments, problems, and programs and trends related to career development. May be repeated. Maximum 6 hrs.

Student Appraisal (3) Gathering, interpreting, and using data for development of guidance programs and individual counseling. Prereq: Ed.D. or equivalent degree or consent of instructor.

Counseling Theories and Techniques (3) Interviewing and counseling procedures; dynamic factors; interpretation of diagnostic materials. Prereq: 4130, 4640 or consent of instructor. (Same as Psychology 5890.)

Pre-Practicum (3) Didactic experiences and counseling simulations in a learning laboratory. Coreq: 5890.

In Lieu of Thesis (3, 3, 3)

Counseling Practicum (3) Supervised practice in counseling in elementary or secondary school guidance and/or student personnel work. Prereq: 5060 (or 5340), 5890, 5897 or consent of instructor. May be repeated with permission of department. Maximum 6 hrs.

Group Counseling Practicum (3) Supervised practice in group counseling with children and/or adults. May be repeated. Maximum 6 hrs with consent of department. Prereq: 5340, 5890, 5897, and 5940 and consent of instructor.

Consultation in Human Development Settings (3, 3, 3) (Same as Psychology 5505-60-70.)

Practicum in School Psychology II (2, 2, 2) S/NC only. (Same as Psychology 5589-69-79.)

Organization and Administration of Counseling Programs (3) Basic principles, procedures, and policies. Prereq: 4130, 4640 or consent of instructor.

Practicum in College Student Personnel (3) Prereq: 5550-60-70 or consent of instructor.

Doctoral Research and Dissertation

Seminar in Educational Psychology and Guidance Required 3 quarters.

Application of Research Design in Educational Psychology and Guidance (3) Major types of research design and statistical analysis unique to educational psychology, counseling, and college student personnel. Although several types of designs are discussed, emphasis is on those designs that are “experimental” in nature. Prereq: 2 courses in statistics or consent of instructor.

Application of Experimental Research Design in Educational Psychology and Guidance (3) Major types of experimental designs used by researchers in educational psychology, counseling, and college student personnel. Prereq: 6110 or equivalent course.

Field Work in School Psychology: Level II (2) (Same as Psych. 6319.)

Seminar in College Student Personnel (2, 2, 2) Contemporary issues in the area of college student personnel, college counseling, student development, etc. Prereq: Consent of instructor, admission to the doctoral program. S/NC only.

Seminar in Advanced Educational Psychology (3, 3, 3) Prereq: 5300-30; to be taken during final year of doctoral program.

Systems Approaches in Psychological Services II (3, 3, 3) (Same as Psychology 6650-60-70.)

Psychology in Practice III (2, 2, 2) S/NC only. (Same as Psychology 6659-69-79.)

Problems in Educational Psychology and Guidance (3, 3, 3) S/NC only.

Seminar in Counseling (3) Prereq: 5890 or consent of instructor.

Practicum in Guidance, Counseling, and Personnel Services (3, 3, 3) Supervised practice in application of guidance tools and techniques. Minimum: 90 clock hours each quarter. Prereq: 5890 and consent of instructor.

Teaching Practicum in Educational Psychology and Guidance (3, 3, 3) Acceptance in doctoral program and consent of instructor.

Counseling Supervision (3) May be repeated with consent of advisor. Prereq: 5940, 6810, 6941. S/NC only.

Special Education and Rehabilitation

MAJORS

Special Education

M.S.

Vocational Rehabilitation Counseling

M.S.

 Professors:


Associate Professors:


Assistant Professors:


Lecturers:

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

DEGREES
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 relative to 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 Speech with 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 institute 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 of the brain-injured child, skills for identifying educational, physical, and emotional characteristics; special educational techniques.

4150 Education of Hospitalized and Home-bound Children (3) School and home responsibilities 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; evaluation 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) Evaluation of the philosophy and programs of disability insurance under Social Security; study of disability claims actions; the case evaluation process; 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, the criteria by which they should be evaluated for disability insurance purposes; emphasis on the study of written medical reports for the purpose of demonstrating evidence 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 evaluation. 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 to disability insurance 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; emphasis on problems of disability evaluation process or structures; emphasis on innovation, exploration of alternatives, and sharing experience within the group. Prereq: 5730 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 Handicapped

4000 Rehabilitation Practicum (3) Evaluation of client data practicing rehabilitation program. Prereq: 4230.

4190 Speech Development of the Hearing Impaired (3) Anatomy and physiology of the speech system. Relationship of hearing to speech development. Theories and techniques of speech development and improvement for hearing impaired children. Prereq: Audiology 3050. (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 with 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: 4210 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; speech and language 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 the language.)

4240 Nature of Hearing Impairments (3) Basic principles required by the hearing impaired person; speech and language development; evaluation of hearing level; instrumentation; audiograms; selection and use of hearing aids; relation of audiologic services to medical and other rehabilitative disciplines. Observations and practicum.
cuation of new curriculum options in the education of these children. Implementation of current education theories and programs for hearing impaired children. Prereq: C & 5580 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 other. Relationships with respect to personality characteristics and developmental factors interpreted through behavioral and psychological theory as well as practical situations in which learning and behavior disorders may occur.

4620 Education of the Emotionally Disturbed Child (3) Managing behaviors, models for instruction, teaching techniques and materials, and teacher-pupil family interpersonal relationships as basic to academic achievement for the pupil. Prereq: 4610.

4630 Practicum in Residential Settings Serving Children with Disturbing Behavior (3) Practice in scientifically identifying, observing, and recording disturbing behaviors, initiating behavior change programs, and evaluating academic and social behaviors. Performance in a tutorial capacity within a residential classroom, and participation 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 evaluation 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) Individual tutoring and classroom observation and teaching. Prereq or Coreq: Student Teaching Grades 1-12. S/NC only.

EDUCATION OF THE MENTALLY RETARDED

4110 The Nature and Concept of Mental Retardation (3) Identification, description, and study.

4120 Education of the Mentally Retarded Child (3) Philosophy and rationale underlying the teaching and guidance of the mentally retarded; methods and materials in special and regular classes. Prereq or Coreq: 4110.

4440 High School Programs for the Mentally Retarded (3) Trends, issues and research relating to core and work study programs.

4810 Student Teaching Mental Retardation (3) Prereq: Major in educable mentally retarded. S/NC only.

4811 Student Teaching Mental Retardation (9) S/NC only.

4922 Student Teaching of the Educable Mentally Retarded (3) Observation and supervised practicum. S/NC only.

5111 Psychology of Mental Retardation (3) Intellectual, emotional, and social factors of mental retardation. Psychological theories and learning interrelations and their theoretical and educational implications emphasized. Prereq: 4110.

5112 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.

5113 Advanced Curriculum for the Mentally Retarded (3) Investigation and analysis of educational models, methodologies and curriculum in the education of mentally retarded children and adults. Emphasis on the varied curriculum alternatives to the retarded child's education.

EDUCATION OF THE VISUALLY HANDICAPPED

4160 Education of Partially Sighted Children (3) Curricular adjustments and materials; home visits for parents' cooperation in medical care and special needs.

4850 Eye Problems Encountered by the Teacher (3) Eye anatomy and hygiene; common diseases and defects; testing and treatment; educational adjustments for specific eye conditions; related service resources.

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

SCHOOL SPEECH AND HEARING THERAPY

4630 The Public School Speech and Hearing Program (3) Organization, administration, and procedures.

4640 Appraisal of Speech and Language Disorders (4) (Same as Audiology and Speech Pathology 4640.)

4310 Stuttering (4) (Same as Audiology and Speech Pathology 4310.)

4230-30-40 Clinical Practice in Speech Pathology (1-4, 1-6) (Same as Audiology and Speech Pathology 4230-30-40.)

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


4400 Voice Disorders (4) Prereq: Speech Science II. S/NC only.

4450-60-70 Clinical Practice in Audiology (1-4, 1-6, 1-6) (Same as Audiology and Speech Pathology 4450-60-70.)

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

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

4939 Laboratory in Aural Rehabilitation (1) (Same as Audiology and Speech Pathology 4939.)

4940 Advanced Aural Rehabilitation (4) (Same as Audiology and Speech Pathology 4940.)

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

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

5390 Cleft Palate (3) (Same as Audiology and Speech Pathology 5390.)

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 rehabilitation implications of major disabilities; rehabilitation processes including implications of family and community.

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

5123 Psychosocial Aspects of Disability (3) Medical aspects and psychological impact of major disabilities; rehabilitation processes including implications of family and community.

5139-40 Seminar in Rehabilitation (3, 3)

5159-60 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) Professional characteristics of the mentally retarded, learning disabled, multiple handicapped, emotionally disturbed, hearing impaired children. Prereq: C & 15580 or other. S/NC only.

5392 Language-Speech Handicapped Child in the Classroom (3) Identifying 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.

4359-60-70 Problems in the Education of Exceptional Children (3, 3, 3) Prereq: Consent of instructor.

4740 Diagnostic and Remedial Approaches in Special Education and Rehabilitation (3) A critical examination of standardized tests and methods employed in measurement of educational needs of children and adults who are mentally retarded, learning disabled, multiple handicapped or physically handicapped.

5000 Thesis

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

5260 Education of Gifted Children (3) Curriculum and social adjustments.

5400 Assessment and Remediation of Learning Disabilities (3) Theoretical and practical identification and remediation of learning problems: neurological and medical aspects; task analysis of cognitive, affective, and psycho-motor skills and use of formal diagnostic testing material emphasizing cognitive development. Research dealing with optimizing teaching instruction combined with a prescriptive teaching approach to learning disabilities.

5401 Prescriptive Teaching for Children with Learning Disabilities (3) Diagnostic test materials to assess functional levels of ability followed by specific remedial recommendation consistent with functional ability levels. Env
phasis on reading and mathematics skill development. Materials designed for ethnic populations in instruction, as well as sensory, linguistic, and motor development.

5403 Resource Teachers for the Handicapped
(3) To help students acquire the skill to maintain mildly handicapped children in regular public education environments; includes observation and evaluation of learning abilities, integration of curriculum content, and applied teaching methodologies.

5450-60-70 Experience in Teaching and Supervision
of Exceptional Children (1-6, 1-6, 1-6)

5510-20-30 Administrative Practicum on Problems
in Institutional Care of Children (3, 3, 3)
Physical and social development; business and personnel management. Prereq: Training and experience in institutions for children, or consent of instructor.

5550-60-70 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.

5630 Psychology of the Exceptional Child
(3) Survey of the entire field of exceptional children, their characteristics, needs, and scope of each group. Educational provisions. Importance of public attitude. Social guidance and personality development. Consideration of vocational problems. Opportunity to expand study upon a particular group of exceptional children.

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

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

5970 Juvenile Delinquency and the School
(3) Responsibilities of the school in studying delinquency and its effect on the child. Educational, social, and psychological formulations, methods and sociological conceptions, theories in crime and delinquency.

Vocational-Technical Education

MAJORS
Agricultural Education
Business Education
Distributive Education
Home Economics Education
Industrial Education
Vocational-Technical Education

DEGREES
B.S., M.A.C.T.
M.S.
Ed.D.

Professors:
G. A. Rice, Ph.D., Ohio State.

Assistant Professors:
W. A. Cameron, Ph.D., Ohio State.

Instructor:

MATERIALS PROGRAM

Each vocational service area (agricultural education, business education, distributive education, home economics education and industrial education) offers similar programs and requires the same 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 economics, 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: proficiency core, 15 quarter hours; area of concentration—basic, 3 hours; service area, 18 hours; vocational-technical education, 18-27 hours; cognate fields, 9-18 hours; research techniques, 6-12 hours; and dissertation, 36 hours. A minimum of 120 hours above the baccalaureate is required.

4750 Audiovisual Methods and Techniques (3) (Same as Curriculum and Instruction 4750.)

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

5010 History and Organization of Vocational-Technical Education (3) Development of vocational and technical education in the public schools. Historical background of social forces, legislation and organizational models.

5200 Competency Based Vocational Education (3) Introductory, comparative, and practical approaches to competency based curricula and materials in vocational and technical education.

5404 Guidance and Pupil Personnel Services in Education (3) (Same as Educational Psychology 5440.)

5410-90-200 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) Improvement of the educator's objectives, historical development, psychological and sociological formulations, methods and techniques, research, and evaluation.

5270 Placement, Follow-up and Evaluation Procedures in Occupational Education (3) A comprehensive course to explore the methods and procedures in establishing placement programs, follow-up procedures, evaluation, and curriculum revision in occupational education.

5300 Occupational Program Development for Disadvantaged Persons (3) Emphasis will be on problems of the academic, socioeconomic, cultural, and/or other handicaps that prevent individuals from succeeding in regular vocational education programs.

5310 Supervision of Vocational-Technical Education (3) Principles and practices of supervision. Program planning, coordination and instruction. Roles and functions of supervisors.

5950-5070 Problems in Vocational-Technical Education (1-4, 1-6, 1-6) May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation

6040 Seminar in Vocational-Technical Education (1, 1, 1) Required 3 consecutive quarters during residency. S/NC only.

6210 Curriculum Planning in Vocational-Technical Education (3) Prereq: Curr. 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 Agri-business Education (1, 1, 1, 1) 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

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5011-21-31 Problems in Lieu of Thesis (3, 3, 3)
5110-20-30 Current Literature (1, 1, 1)
5320-30 Agricultural Education in Off-Farm Agricultural Occupations (3, 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.
5750-60-70 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
5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5011 Problems in Lieu of Thesis (3)
5110 Graduate Seminar in Current Problems (3)
5111-12-13 Graduate Seminar: Current Problems in Business Education (1, 1, 1)
5120 Graduate Seminar in Tests and Measurement (3)
5130 Graduate Seminar in Guidance (3)
5140 Organization and Operation of Area Vocational-Technical Schools (3) (Same as Industrial Education 5140)
5410-20-30 Practicum in Business Education (2, 2, 2)
5510 Evaluation of Research in Business Education (3) Prereq: Curriculum and Instruction 5610 or equivalent.
5611-21-31 Problems in Business Education: Typing (3, 3, 3)
5612-22-32 Problems in Business Education: Shorthand (3, 3, 3)
5613-23-33 Problems in Business Education: Bookkeeping and Accounting (3, 3, 3)
5614-24 Problems in Business Education: Clerical Practice (3)
5615-25-35 Problems in Business Education: General Business (3, 3, 3)
5617 Problems in Business Education: Business Law (3)

5618-28-38 Problems in Business Education: Administration (3, 3, 3)
5619 Problems in Business Education: Psychology and Skill Building (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.
4330 Coordination Techniques in Distributive Education (3) Selecting training agencies; job analysis; selecting and briefing the training supervisors; advisory committees; adult and other community services. Prereq: 4310, 4320.
4510-20-30 Problems in Distributive Education (3, 3, 3) Selected research problems in teaching and coordinating distributive education programs.
5000 Thesis
5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5110 Administration and Supervision of Distributive Education (3) Operation of a distributive education program and the work of the city or county supervisor. Understanding and appreciating the problems from the high school principal's and the department head's point of view. Trends in distributive education, including curriculum development, 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 trade 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.
5616-26-36 Problems in Distributive Education: Retailing (3, 3, 3)

Home Economics Education
5000 Thesis
5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5110 Advanced Methods of Teaching Home-Making Classes for Adults (3)
5130 Furthering Good Human Relationships in the Classroom (3) Relationships between problems in human relations, basic needs of individuals, techniques of interpersonal relations and social values in developing more effective teacher education programs.
5220 Evaluating in Home Economics Education (3) Purpose of evaluation in development of home economics programs; analysis of techniques used in evaluation. Development of techniques for determining progress of students; emphasis on individual problems of evaluation.
5310 The Problem Method of Teaching Home Economics (3) Underlying philosophy; skills and techniques. Observation and discussion.
5440 Curriculum Development and Implementation in Family Relationships Instruction (3) Review and organization of content for teaching family relationships. Analysis and evaluation of selected materials and methods in terms of their appropriateness for teaching curriculum objectives in family relationships.
5520 Teaching Home Economics in College (3) Methods, organization, and evaluation.
5530 Organization of the Homemaking Curriculum in Secondary Schools (3) Critical review of recent advances in home economics education. Consideration will be given to the development of teaching material in relation to total homemaking program in the secondary school—day-school, adults, home experience, and Future Homemakers of America.
5610 Supervision of Home Economics in the Public Schools (3) For teachers with successful experience in vocational home economics who are preparing for supervisory positions in vocational education. Program planning, organization, and administration. Field contacts with urban and rural programs.
5620 Wage Earning Programs in Home Economics (3) Planning, establishing and implementing wage earning programs in home economics.
5710-20-30 Special Problems for Non-Thesis Students (3, 3, 3)
5810-20-30 Problems in Home Economics Education (1, 3, 1, 3) May be repeated. Maximum 3 hrs per course.
5910-20 Seminar in Home Economics Education (3, 3) Research literature and techniques. Prereq: Consent of instructor.

Industrial Education
5110 History and Philosophy of Industrial Education (3)
5210-20-30 Part-Time Programs in Cooperative Industrial Training (3, 3, 3) Principles of organization, methods and materials.
5310 Shop Organization and Management (3)
5320-30 Materials and Methods for Shop and Related-Subjects Teachers (3, 3)
5340 School Shop Safety (3)
5360 Development and Utilization of Advisory Committees (3) Philosophy and rationale for use of craft advisory committees. Their selection, organization, implementation and utilization.
4110 Foremanship Training by the Conference Method (3)
Faculty time before degree is completed. May be registered during any quarter when such problems, and recent trends in the field of practices, instructional methods.

4120-30 Job Analysis (3, 3) Principles, practices, instructional methods.

4310-29 Curriculum Building in Trade and Industrial Subjects (3, 3) Prereq or coreq: 4120.

5410-11-12 Seminar in Industrial Education (3, 3, 3) Educational innovations, current events, problems, and other topics associated with the field of industrial education.

5420-21-22 New Developments in Industrial Education (3, 3, 3) Developments, pressing problems, and trends in the field of industrial education as presented by a coordinating instructor in conjunction with knowledgeable resource personnel.

4621 Special Topics in Drafting (3) Industrial practices in specialized areas of drafting selected for the individual student. Prereq: B hrs drafting.


4671 Materials and Processes (3) Organic and inorganic materials and processes used to produce finished products. Content, curriculum and techniques of laboratory operation. Prereq: Consent of instructor.

4682 Power and Energy (3) Development, control, transmission, conversion, interrelationship of power sources; content, curriculum and techniques of laboratory operation. Prereq: Consent of instructor.

5000 Thesis

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

5110-20-30 Administration and Supervision of Industrial Education (3, 3, 3) Principles of vocational education; relationships with general education, business, trade, and labor organizations; special problems in administering and supervising various types of schools and classes under the federal vocational education acts.

5140 Organization and Operation of Area Vocational-Technical Schools (3) Understanding of the area vocational-technical school concept; administration and supervision of vocational and technical education programs in area schools. (Same as Bus. Ed. 5140.)

5210-20-30 Special Problems in Industrial Education (3, 3, 3)

5310 Methods of Research in Industrial Education (3)

5410 Improving Teachers in Service (3) Problems of coordinating in part-time and apprentice training programs.

5420 Advisory Committees and Apprentice Training (3)

5430 Vocational School Administration and Management (3)

5440 Advanced Methods of Teaching Skills and Technical Information (3) Proper selection and effective application of contemporary methods and techniques in the teaching of specialized skills and technical related information.

5510-20-30 Seminar in Industrial Technical Education (3, 3, 3) Ramifications of vocational and technical innovations in trade and industry in relation to an increasingly technically oriented society. Prereq: B.S. in Industrial Education and teaching experience.

5540 New Developments in Industrial Technical Education (3) Prereq: B.S. in Industrial Education plus teaching experience.

School of Health, Physical Education and Recreation

Madge M. Phillips, Director

Graduate programs are available to students preparing for (1) teaching and research positions in colleges, high schools and elementary schools; (2) administrative and supervisory work in athletic and health education, physical education, and recreation; (3) recreation specialist positions in various public, voluntary, private, and commercial agencies and institutions; and (4) public health positions in community health education, health planning and administration, and environmental health.

MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: physical education, recreation, safety education, and school health education. Forty-five quarter hours are required for the M.S. Approximately 23 quarter hours of work selected from courses numbered 5000 and above are included in the M.S. requirement. Course selection shall be made according to each student's professional interests in health, physical education, safety, or recreation with the approval of the major professor. Non-thesis options are available in all M.S. degree programs. A three-quarter hour course in research techniques and/or statistics and/or a seminar in research will be required. Each non-thesis degree candidate will take a final comprehensive examination.

Programs leading to the Master of Public Health are also available in community health education, occupational health, environmental health, industrial safety, and health planning. Fifty-four quarter hours are required for the M.P.H. degree. One full quarter of field practice is required. During field practice, no student shall hold a full-time job except by special permission of the division chairman. Students may be placed in all parts of this country.

DOCTORAL PROGRAMS

The Doctor of Education and the Doctor of Philosophy degrees are offered in Health Education. See further description under Health Education.

The Doctor of Education degree is offered with a major in Physical Education 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; also 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.

e. 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, supervising recreation field work students, and/or directing a training or management program. Students interested in these opportunities should file their applications before February 1. Applicants 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 majoring in Community Health Education. These are provided by the United Public Health Service. Applicants 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

Health Education
Public Health Education
Safety Education and Service
School Health Education

DEGREES

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

Professors:

Associate Professors:
I. A. Ahmed, D.D.S.; G. B. Hamilton, Dr. P. H. Oklahoma; J. Gorski, Dr. P. H. U.C.L.A.

Assistant Professors:

Lecturers:
M. Duff, M.D. Pennsylvania; H. P. Hopkins, Ph.D. North Carolina; S. King, M.D. Emory; C. P. McCammon, M.D. Temple.

The Health and Safety Division offers the following degree programs:

Master of Public Health degree with a major in Public Health Education.

Option in Community 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 Education degree in Health Education.

Doctor of Philosophy degree in Health Education.

Public Health

3000 Foundations of Health Science (3) In-depth study of the several content areas relating health to modern day living. Addresses contemporary health problems, i.e., mood modifying products, consumer health, international health, personal health practices, reciprocal relationships involving man, disease, and environment.

3210 First Aid and Emergency Care (4) Theory and practice of first aid and emergency care. Instruction in medical self-help. Course leads to Red Cross Certification in Advanced First Aid and Emergency Care. (Applicant must be at least 18 years of age for certification. Same as School Health 3315.)

3310 Communicable and Non-communicable Diseases (3) Modern concepts of diseases: etiology of common communicable and chronic disease problems including prevention and control. Prerequisite: 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 public health problem. Various types of educational programs to control the disease covered.

4130 Community Health Problems—Suicide (3) Explores problems of suicide regarding overall health of community.

4140 Community Health Problems—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 urban population and the megapolis; 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 useful information to practitioners, communications among members of the modern health teams, among health agencies, and the use of mass media for transmitting health information.

4410 Consumer Health and Safety Education (3) Survey of major consumer health and safety problems; selecting, purchasing, and financing of safety and medical services.

4411 Instructor’s Advanced First Aid and Emergency Care (3) Designed to teach First Aid. Satisfactory completion qualifies one for American National Red Cross Certification as an Advanced First Aid and Emergency Care Instructor. (Applicant must be at least 21 years of age.) Prerequisite: First Aid and Emergency Care or valid Advanced First Aid and Emergency Care Certificate.

4420 Drug Abuse Education (3) The drug abuse problem and suspected causes; the pharmacology of drugs and their effects on society and methods of drug abuse education.

4700-10-20 Field Practice in Public Health (3, 3, 3) Field practice in public health under supervision of public health professional. S/NC only.

5000 Workshop in Public Health Education (3-6) For teachers, nurses, case workers, sanitarians, and other voluntary and public health agencies personnel. Emphasizes the problem solving approach through small group interaction, case method and critical incident technique. May be repeated.

5410 Epidemiology (3) The study of the incidence and prevalence of disease in man.

5440 Methods and Materials in Public Health Education (3) The history, philosophy, and methods of teaching health education. 4 hrs and 2 labs.

5510 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. 5 hrs and 2 labs.

5100-30 Occupational Health and Safety (5, 5) Two-quarter in-depth study of occupational health and safety theory and practice related to overall improvement of community health and safety. Lecture, demonstrations and field practice. Prerequisite: Consent of instructor.

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. Prerequisite: Consent of instructor.

5210 The Ecosystem of Public Health Education (5) Investigates living and non-living environments, groups and communities therein, and factors resulting from or intervening in health status. Understandings of human development, behavior, and learning in terms of public 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 context of various types of sickness afflicting individuals and groups. 1 hr and 2 labs.

5410 Epidemiology (3) The study of the incidence and prevalence of disease in man.

5420 Administration of Public Health (3) Administrative considerations of public health agencies including governmental aspects, legal bases, organizational principles, personnel factors, fiscal management, and public relations.

5430 Vital and Medical Statistics (4) Application of basic statistical principles to living things.

5450 Environmental Health (4) Theory and practice in the use of communication techniques and materials in public health education. 3 hrs and 2 labs.

5540 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 differences between health education service and health education program for community health education. 1 two-hr lecture-seminar session per week.

5550 The Physical Education Educator in Community Organization and Development (4) An overview of health organizations and agencies in the community prefaces exploration of conflicting theories and divergent styles of practical community organization and development. Laboratory to delineate a community near the campus and to practice, 2 hrs and 4 labs.

5580 Physical Activity and Health (5) (Same as Physical Education 5580.)

5705-65 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)
The page contains a list of courses and their descriptions, along with some personal information about faculty members. The courses are categorized under different sections such as Health, Safety, Education, and Research. The text is dense and requires careful reading to understand the full context of each course and its requirements. The courses range from introductory to advanced levels, covering various aspects of health, safety, and education. The faculty information includes degrees and specialties of the members, indicating their expertise in their respective fields.
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 (2) A 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, supervision, and field trips.

3710 Camping (2) Theory and practice in leadership with practical experience in campcraft skills. Not for graduate credit for physical education majors.

3880 Social Recreation (2) 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.)

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

4020 Practicum in Dance Production (2) Prereq: Consent of instructor.

4050 Advanced Dance Composition (2) Creation and development of ideas, themes, and dance forms; solo and group work. Prereq: Beginning Dance Composition.

4070 Stagecraft for Dance Production (2) Equipment, light design, properties, sets, and stage management. Lab.

4110 Adaptive Physical Education (3) Classification of atypical students who require modified programs in physical education; activities and class organization suitable for required or special physical education classes.

4150 Creative Rhythms for Children (3) Methods and materials for grades 1-6, 3 hrs and 1 lab.

5000 Thesis

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

5110 Administrative Problems in Health and Physical Education (3)

5120 Problems of the Curriculum in Physical Education (3)

5130 Methods in Physical Education (3) Characteristics of different school age levels, and applications of learning procedures in physical activities at these levels.

5210 Principles and Philosophy of Physical Education (3)

5220 Readings in Physical Education (3) A comprehensive review of literature in physical education and related areas.

5230 Supervisory Problems in Physical Education (3) For students interested in supervision of physical education teachers.

5310 Analysis of Basic Motor Skills (3) Mechanical analysis of basic motor skills, emphasizing application of these skills to physical education and athletics.

5320 Seminar in Research Techniques in Physical Education (3) An evaluation of appropriate research techniques in physical education.

5410-20-30 Specialization Study in a Selected Physical Education Area (1-3, 1-3, 1-3) Advanced comprehensive study in a selected specialized area within the general fields of physical education. Prereq: Consent of instructor.

5500 Advanced Kinesiology (3) Action of muscles involved in fundamental movements, calisthenics, sports, and gymnastics. Prereq: Applied Anatomy and Physiology or equivalent.

5510 Selected Topics in Anatomy (3) Intensive study of various systems of the human body. Prereq: 5000 and 5100. 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 (3) 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.)

5600 Applied Physiology (3) Principles of physiology with special emphasis on the application of physiological findings to practical problems related to human function. Prereq: one year 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: Science and Mathematics, 15 hrs.

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, 1, 1) 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 (1-3, 1-3, 1-3) Problems of professional interest and value to the individual student, selected by the student and approved by the major professor. S/NC only.

6000 Doctoral Research and Dissertation

6120 Independent Research (3) Selection of a topic; development of a procedure and conduct of a study including the final writing of a research paper. S/NC only.

6140 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: first quarter Elements in Physics or equivalent. May be repeated with consent of instructor. S/NC only.

6510-20 Issues and Problems in Physical Education (3) Critical examination and evaluation of current issues and problems in the area of physical education.

6510 Seminar in Exercise Physiology (2) Prereq: 5310. 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 research area coincides with interests of the student. Prereq: Consent of instructor. May be repeated with consent of instructor. S/NC only.

6810-20 Practicum (2, 2) Intern experience in areas of major interest. S/NC only.

Division of Recreation

MAJOR DEGREE

Recreation M.S.

Associate Professor:

M. L. Peters (Chairman), Ph.D. Illinois.

Assistant Professors:

P. A. Borovich, M.S. Tennessee; C. J. Johnson, M.S. Kansas; K. Krick, Ph.D. Indiana.

The Recreation Division offers the following degree programs:

Master of Science degree in Recreation (thesis and non-thesis programs)

3100 Recreation Leadership Procedures (3) Principles and practice of recreation leadership; techniques and methods of working with individuals and groups in leisure activity.

3140 Philosophical Foundations of Recreation (3) Examination of recreation as personal experience; theories of play; philosophies of leisure and relationship to economy, ecology, 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 professions to minority groups whose leisure opportunities and needs may require special services.

4500 Specialized Study in a Selected Area of Recreation (1-9) Comprehensive study in a selected specialized area within the broad field of recreation. For recreation students only. May be repeated with consent of the division. Maximum 9 hrs.

5000 Thesis

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

5110 Administrative Problems in Health and Physical Education (3)

5120 Problems of the Curriculum in Physical Education (3)

5130 Methods in Physical Education (3) Characteristics of different school age levels, and applications of learning procedures in physical activities at these levels.

5210 Principles and Philosophy of Physical Education (3)
a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated S/NC only.

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.
Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science degree, the Master of Engineering degree, and the Doctor of Philosophy degree. For a listing, consult majors and degrees available on page 8.

OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEO TAPE-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 a degree from UTK while carrying out research work at a Japanese university. The program requires approximately two years, one year being spent in Japan and the remaining period being spent at UTK to fulfill the course requirements and to write the thesis or project report, as appropriate to the particular department. The program is administered in the framework of each department’s regular graduate program 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 from Industrial Engineering 4150, 5110, 5520, and 5710, and a complement of engineering courses normally selected from the student’s undergraduate major department or from courses of other departments pertinent to the program.

2. A Business Administration Core, 15 hours of graduate credit consisting of Accounting 5810, Finance 5050, Marketing 5050, Industrial Management 5130 and Transportation 5210.

3. General Electives, nine to 18 hours of graduate credit chosen from computer science, economics, engineering, management science, mathematics, psychology, statistics, and other program-related disciplines. These electives shall not include courses in business administration, other than economics, management science and statistics.

The program requirement totals 51 hours of graduate course credit. No thesis is required. A final oral and written examination must be passed on the work offered for the degree. Course prerequisites for the program are Accounting 5809 (or 2110), Computer Science 3150, Industrial Engineering 4520, and Statistics 3450 or their equivalents. None of these prerequisites may be counted as part of the 51 hours of credit offered for the degree. These course prerequisites will be waived upon presentation of evidence of competency in the course subjects. Other prerequisite courses may be required, depending upon the student’s background and the electives chosen.

5002 Non-Thesis Graduation Completion (3)

Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5900 Project Engineering Administration (3)

An in-depth study and formal report of an engineering administration topic, normally performed during the last quarter of work toward degree for M.S. Engineering Administration candidates only. May be repeated. Maximum of 3 hrs credit to be applied toward degree. Must register for 5900 until project is complete. S/NC only.

Departments of Instruction

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

Chemical and Metallurgical Engineering

<table>
<thead>
<tr>
<th>MAJORS</th>
<th>DEGREES</th>
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<tbody>
<tr>
<td>Chemical Engineering</td>
<td>M.S., Ph.D</td>
</tr>
<tr>
<td>Metallurgical Engineering</td>
<td>M.S., Ph.D</td>
</tr>
<tr>
<td>Polymer Engineering</td>
<td>M.S., Ph.D</td>
</tr>
</tbody>
</table>

Professors:
- H. E. Johnson (Head), D. Eng, Yale
- D. C. Bogue, Ph.D, Delaware
- B. S. Bower, Ph.D, Massachusetts Institute of Technology
- C. R. Brooks, Ph.D, Tennessee
- E. S. Clark, Ph.D, California (Berkeley)
- L. W. Crawford, Ph.D, Cincinnati
- D. L. Culbertson, Ph.D, Texas
- J. M. Holmes, Ph.D, Tennessee
- H. W. Hsu, Ph.D, Wisconsin
- S. H. Jury, Ph.D, Cincinnati
- C. J. McHargue, Ph.D, Kentucky
- G. E. Moore, Ph.D, Louisiana State
- B. F. Oliver, Ph.D, Pennsylvania State
- J. J. Parona, Ph.D, Northwestern
- J. W. Prados, Ph.D, Tennessee
- J. E. Spruiell, Ph.D, Tennessee
- E. Stamsbury, Ph.D, Cincinnati
- C. O. Thomas, Ph.D, Tennessee
- R. A. Vandeaver, Ph.D, Illinois Institute of Technology
- J. S. Watson, Ph.D, Tennessee
- J. L. White, Ph.D, Delaware
- M. A. Wright, Ph.D, Wales

Associate Professors:
- W. T. Becker, Ph.D, Illinois
- J. F. Fellers, Ph.D, Akron
- G. C. Frazier, Ph.D, Johns Hopkins
- J. M. Mescher, Ph.D, Pennsylvania

Lecturers:
- L. Drenner, Ph.D, Princeton
- H. W. Hoffman, D. Eng
- John Hopkins, R. N. Lyon, Ph.D

Michigan:
- D. L. McEwly, Ph.D, Tennessee
- T. D. Parish, Ph.D, Rice
- W. H. Seaton, Ph.D, Ohio State
- E. von Hoffman, Ph.D, Tennessee
- M. E. Whiteley, Ph.D, Iowa State

M.S. Major in the field, completion of Poly. Engr. 4920, 5110, 5520, and 5130 and 5150.

One or two minors or collateral work:

1. Alumni Distinguished Service Professor.
2. May be substituted for by students with significant experience in polymer research.

DOCTORAL PROGRAM

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

Department requirements consist essentially of the satisfactory completion of:

1. Graduate courses in chemical engineering, metallurgical engineering, or polymer engineering, amounting to approximately 36 quarter hours, at least 12 of which must be in 6000 series courses.

2. The preliminary examination, usually given in two parts, and covering such material as chemical, metallurgical, and polymer engineering operations and processes, thermodynamics, technology, mathematics, physics, chemistry, and other related fields.

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

4. 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. Appropriate languages are German, Italian, Japanese, Russian.

PROGRAM OPTIONS IN POLYMER SCIENCE AND ENGINEERING

M.S. and Ph.D. degrees with specialization in polymer science and engineering are possible through two routes—one in the department (through chemical or metallurgical engineering) with an engineering emphasis and a second in a joint program with the Chemistry department having a chemical emphasis.

The specialization program in this department requires four to six M.S. degree, a thesis in the field, completion of Poly. Engr. 4910, 4920, 5110, 5150, and either 5230 or 5210 plus active participation in the Polymer Seminar. The Ph.D. candidate must meet the above requirements, pass a
special written examination in polymer science and engineering, and complete an additional academic program to be specified by the student's committee. M.S. and Ph.D. degrees in the joint specialization program with the chemistry department require a thesis or dissertation in the field. Chemical and metallurgical engineering departmental requirements include completion of Poly. Engr. 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.

Chemical Engineering

5010 Graduate Seminar (3) 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 packed beds; metering devices, 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 fluids and heat exchangers; condensation and boiling; radiation. Prereq: 3410, Thermodynamics of Phase Equilibrium. 3 hrs and 1 lab.

3440 Stagewise Operations (3) Analytical and graphical methods applied to stagewise separation operations. Prereq: Thermodynamics of Phase Equilibrium.

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

3510 Introduction to Process Dynamics and Control (3) Introduction to concepts of process dynamics and control. Steady-state analysis of chemical process control systems. Unsteady state nature of chemical processes. Laplace transform techniques, block diagram algebra and transfer functions. Mathematical models for several processes are 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, feedforward control, stability analysis, frequency response, Survey of modern control of typical industrial unit operations. Prereq: 3610.

4100 Chemical Engineering Data Analysis (3) Analytical and experimental identification of system parameters; statistical properties of samples and source systems; empirical modeling of states of system. Prereq: Statistical process control. Prereq: 3420 and Math 3150.


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


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 of Chemical Processes (3) Extension of 4420 for student participation in the A.I. Ch.E. annual contest problem; other advanced design projects. Prereq: 4420.

4450 Hydrocarbon Processing (3) Study of specialized characterization of physical properties of fossil fuel raw materials and products, and of processes for conversion of fossil fuel raw materials into products needed in industrial energy, industrial raw material and consumer markets. Prereq: 4440.

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, Chemistry 3430, Thermodynamics of Chemical Equilibrium.

4540 Fluid-Solid Operations (3) Heat and mass transport in fixed and fluidized beds: applications including absorption, ion exchange, cryocrystallization, sorption, fluidization. Advanced control concepts. Prereq: 3620 or equivalent background in basic control theory and differential equations.

4730 Mass and Energy Flow in Biological Systems (3) Basic biochemical and organizational principles applicable to biological systems. Derivations of general equations of bio-mass and energy transfer. Thermodynamics of transport and equilibrium in biological systems. Discussion of Volterra's equation and biological clocks, etc. Prereq: Consent of instructor.

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 associated with food processing and pharmaceutical processes. Prereq: 3440, 3450 or consent of instructor.

4760 Principles of Biochemical Separation (3) Fundamental aspects and similarities of modern biochemical separation methods; classroom demonstrations, design of production and analytical systems. Prereq: Consent of instructor.

4781-82-83 Topics in Biochemical Engineering (3, 3, 3) Problems of current interest in bio-chemical engineering. Prereq: Consent of instructor.

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

5000 Thesis


5120 Heat Convection (3) Analysis of heat convection in fluids under viscous and turbulent flow conditions; integral and differential approaches; simultaneous diffusion of momentum and heat. Prereq: 5111.

5130 Methods of Optimization (3) Principles and applications of various mathematical programming techniques to chemical process design and control; variational method, maximum principle, dynamic programming, and geometric programming. Prereq: 5110, 4430.

5210 Process Dynamics (3) Generalized analysis of recycle operations, steady state simulation and optimization of typical processes.

5250 Chemical Process Industry Economics (3) Analysis of the economic components of chemical processes, the economic analysis of the chemical enterprise, and of decision making for investment in capital facilities. Prereq: 4120-30, 4430.

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

5320 Statistical Thermodynamics (3) Basic concepts of statistical mechanics and applications to evaluation of thermophysical properties. Prereq: 5310.

5410-20-30 Research and Design in Chemical Engineering (3, 3, 3) Selected desirable areas of research and design in chemical engineering. Prereq: 3420.

5510 Chemical Reactor Design (3) Non-isothermal flow processes in chemical reactors; design and reaction in two phase systems; introduction to heterogeneous catalysis and reactor stability. Prereq: 4530.

5610 Stagewise Mass Transfer Operations (3) Energetic stagewise operations, prevention of non-isothermal and multicomponent system.

5620 Differential Mass Transfer Operations (3) Differential mass transfer operations, falling film, packed tower and bubble contacting devices; non-isothermal and multicomponent systems; current theories of mass transfer; mass heat and momentum transfer analogies. Prereq: Differential Equations.

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

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6130 Process Optimization (3) Optimization of chemical process equipment and systems by various techniques; static and dynamic systems. Prereq: 5130.

6210 Advanced Diffusional Operations (3) A study of fixed and fluidized bed operations utilizing the stagewise and differential mass transfer bed concepts. Prereq: Consent of instructor.

6250 Venture Analysis in the Process Industries (3) The interactions among the line functions of a typical chemical company in the application of modern decision theory and mathematical models to achieve an optimum product investment decision in the face of external competition. Prereq: 5250.

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

6320 Statistical Thermodynamics of Non-Equilibrium Systems (3) A review of elementary kinetic theory, introduction to modern kinetic theory, development of kinetic theory, transport theory, thermodynamics of irreversible processes, etc., with special emphasis on topics and methods of interest to engineering and bioengineering students. Prereq: 5310.

6420 Stability Phenomena in Chemical Engineering: Continuous Systems (3) Hydrometallurgy and chemical reactions in continuous systems. Emphasis on formulation of models, associated conservation equations, and methods of solution. Typical applications include stability of jets and formation of emulsions, Benard instability, Maragoni turbulence. Prereq: 5810 and 5620 or equivalent.

6510 Applied Chemical Reaction Kinetics (3) Chemical reactions in both gas and liquid phases as well as heterogeneous catalysis, catalyst effectiveness and the role of transport in kinetics. Emphasis is on development of a phenomenological description although mechanistic models are discussed. Prereq: 5510.

6520 Catalytic Reactor Design (3) Principles of kinetics, heat and mass transfer applied to the design and analysis of heterogeneous catalytic reactors. Prereq: 5510.

6510 Special Topics in Chemical Engineering (2) Advanced problems of current interest to chemical engineers. Prereq: Consent of instructor.

6710 Process Dynamics (3) Development of dynamic models of process equipment control of systems of models by frequency, step, and pulse response methods. Prereq: Consent of instructor.

Metallurgical Engineering

3110 Engineering Materials I (4) Introductory course correlating the atomic, crystal, and micro-structure of solids with mechanical, physical, 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 deformation or heat treatment; correlation of resultant properties with service performance. Suggested for chemical, civil, and industrial engineering students.


3150 Engineering Materials V (3) Extension of 3110 with emphasis on the mechanics and control of reactions of engineering materials with aqueous, non-aqueous, and gaseous environment. Prereq: 3110 or Engineering Materials I or Process Principles and Materials III.


3220 Diffusion and Annealing (3) Introduction to solid state kinetics; point defects, solid solutions, diffusion equations and mechanisms, annealing of cold worked structures. Prereq: 3210. Coreq: Introduction to Differential Equations.

3230 Phase Transformations (4) Thermodynamic and structural factors governing b.c.c. and f.c.c. 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; metals, polymers and ceramics; methods of fabrication of components; corrosion applications of prosthetic devices and dental materials. Prereq: General Chemistry or equivalent.

3520 Materials Behavior and Chemical Process Design (3) Principles of materials behavior and chemical processing. Prereq: Process 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, heat treatment. Prereq: Engineering Mechanics I or equivalent.

4240-50 Design and Analysis (3, 3) Design and laboratory sessions on the analysis of materials requirements and performance in engineering structures and components. Coreq: 4740. 3 labs.

4510-20 X-Ray Diffraction and Crystallography (3, 3) Lecture and laboratory work in crystallography, projections, x-rays, diffraction phenomena and techniques, introduction to structure determinations. The first quarter serves as an introduction to the subject. 2 hrs and 1 lab.

4540 Fracture-Safe Design (3) (Same as Engineering Mechanics 4540).

4610 Physical Properties of Materials (3) Introduction to electron theory of solids, types of bonding in solids; thermal, electrical and mechanical properties of materials; relationship between metallurgical structure and properties. Prereq: Physical Metallurgy II. 3 hrs or 2 hrs and 1 lab.

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

4720 Mechanical Metallurgy I (3) Elastic behavior. Description of stress, strain and strain-elastic constants. 3 hrs, 2 hrs and 1 lab.

4730 Mechanical Metallurgy II (3) Ductile and brittle fracture, creep and stress rupture, fatigue, and residual stresses. Effects of state of stress, loading rate, time, temperature and metallurgical structure. Prereq: 3120 or 3320, and 4730 or 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.

4750 Casting and Welding (3) Principles and processes of casting and welding: Heat transfer, solidification, segregation, gas-metal slags and inclusions, welding degradation, residual stresses, associated stresses. Prereq: 3230, 3 hrs or 2 hrs and 1 lab.

4770 Mechanical Metallurgy III (3) Finite plastic strain. Plastic-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 defects in metals. Prereq: 4730 or consent of instructor.

5120 Plastic Deformation I (3) Geometry and mechanics of plastic deformation of single crystals, slip and twinning; work hardening; effects of dislocation and alloying on short-term loading. Prereq: 5110.

5130 Plastic Deformation II (3) Plastic deformation of polycrystalline materials; theoretical and experimental treatment of deformation resulting from deformation and annealing. Prereq: 5120.

5140 Diffusion and Annealing in Solids (3) Analysis of models and experimental observations relating to diffusion in solids. Suggested 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.


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; for both simple and complex alloys. 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 of crystallography, 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 fundamentals of X-ray diffraction theory and applications of development of diffraction theory, analysis of scattered intensity in reciprocal space; relationship of scattered intensity to thermal motion, order-disorder, particle size and lattice faults. Introduction to crystal symmetry, space group theory, and crystal structure problems; some laboratory work. Prereq: 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, thermodynamics and thermodynamics of solid reactions, diffusion.

5540-50 Electron Microscopy I and II (3, 3) Kinematical and dynamical diffraction theories are developed with their application to electron diffraction patterns and contrast effects in transmission electron microscopy are discussed. Special attention is devoted to special applications such as plastic deformation, fracture, precipitation, and phase transformations. Prereq: 4730-20.

5610-20 Radiation Effects on Materials (3, 3) Interaction of radiation with solid matter, radiation-induced changes in physical and mechanical properties, theory and experiment.
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The effect of radiation on solid state reactions. Phenomena associated with the use of engineering materials in radiation environments. Prereq: Math 4840, Physics 3730 or consent of instructor.

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.

5810-20-30 Special Topics in Metallurgy (3, 3, 3) Lectures and recitation on more recent advances in metalurgy and related fields.

5840-50 Metallurgy of Deformation and Fracture (3, 3) Theoretical and engineering analysis of the effect of stress state, strain rate, environment, temperature, and metallurgical structure on mechanical behavior in service, testing, and fabrication.

5910-20-30 Metallurgical Thermodynamics (3, 3, 3) Application of thermodynamic and physicochemical methods to metals and deformation reactions. Relation of theory and experiment to the structure of liquid and solid solutions, and to alloy systems.

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6110-20-30 Theoretical Metallurgy (3, 3, 3) Study of those phases of solid state physics applicable to metalurgy: magnetic property, introductory quantum theory, specific heats, electron theory, electrical and thermal conductivity, magnetic properties. Prereq: alloy formation. Pre: 4610 or Physics 3720; Math 4550 and consent of instructor.


6410-20 Thermodynamics of Solids (3, 3) Classical and statistical thermodynamical analysis of the stability of solid solutions, components and ordered structures. 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. Property classification according to transformation behavior. Prereq: Core curriculum in Met. Eng. and Math 4050 or 4710 or consent of instructor.

6820 Mechanical and Physical Properties of Crystals II (3) Continuation of Metallurgical Engineering 6610 with emphasis on transport phenomena and irreversible thermodynamics. Prereq: 6810 or consent of instructor.

6830 Seminar in Anisotropic Properties of Crystals (3) Selected topics of current interest in the area of anisotropic behavior of crystalline materials. May be repeated. Prereq: 6810 or 6820, or consent of instructor.

Polymer Engineering

4910 Applied Polymer Science (3) A first course in the physical properties of polymers. Polymer structure, crystallinity and glass transition, physical properties of amorphous and crystalline polymers, crystallization kinetics and mechanism of crystallization are discussed. Prereq: Senior standing in engineering or science.

4920 Polymer Processing (3) Rheological properties of polymer melts and solutions, viscometry, unit operations of fiber, plastics and rubber industries: dimensional analysis and scale-up, flow through dies and pipelines, screw extruders and localized core and skin effects. Prereq: Senior standing in engineering or science.

4930 Principles of Fiber and Textile Engineering (3) Chemical and structural characteristics of important fibers; melt and dry spinning of man-made fibers; drawing and texturizing; preparation of yarn; dyeing, weaving and knitting. Emphasis on textile chemistry and properties. Prereq: Senior standing in engineering or science.

4940 Plastics Fabrication Operations (3) Lecture and laboratory course treating unit operations of the plastics industry. Types and 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: Senior standing in engineering or science.

5000 Thesis

5110 Structural Characterization of Polymers (3) Experimental methods of determining the nature of translational and orientational characteristics of polymers most pertinent to plastics, fibers, and rubber applications. Methods of determination of tacticity, crystalline structure, orientation, and morphology, etc., including x-ray diffraction, nuclear magnetic resonance, and electron microscopy.

5210 Non-Newtonian Fluid Mechanics (3) Tensor analysis, generalized equations of motion; survey of non-Newtonian theory. Prereq: 4920 or Fluid Mechanics. (Same as Engr. Sci. and Mech. 5230.)

5230 Mechanical Behavior of Solid Polymers (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. Experimental methods of determining properties. Prereq: Mechanics of Materials.

5240 Yarn and Fabric Mechanics (3) Mechanical behavior of single fibers, deformation mechanics of continuous filament and staple yarns, researches of Hare's deformation mechanics of woven and knit fabrics.

5510 Polymer Solution Properties and Characterization (3) Molecular weight determination, chromatography, solution thermodynamics, phase separation; application to synthetic and naturally occurring macromolecules. Prereq: Undergraduate physical chemistry.

5510 Modern Research Tools and Instruments for Polymer Science (3) Laboratory course in methods of characterization of polymers; includes gel permeation chromatography, intrinsic viscosity, spectral analysis, measurement of melt flow properties, calorimetry, and dynamic mechanical measurements. Coreq: 5310.

5710 Phase Transformations in Polymer Systems (3) Analysis of nucleation and growth of phases polymer systems, solidification, physical and chemical decomposition, application to crystallization from the melt, precipitation from solution.

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

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6110 Optical Properties of Polymers (3) Maxwell's equations and the electromagnetic theory of light, optical properties of isotropic and anisotropic dielectrics including theory of birefringence, applications to spherulitic structures and fibers studies of Stein, light scattering from polymer films.

6150 Advanced X-Ray Diffraction Methods for Characterization of Macromolecules (3) Classical methods of crystal structure determination; Patterson and Fourier functions; helical nets and Bessel function techniques; levels of order, thermal motions, defects, order-disorder transitions and paracrystallinity. Experimental methods including precision and Weissenberg photography of single crystal and powder diffractometry with applications to synthetic and biological macromolecules.

6210 Advanced Continuum Mechanics (3) A survey of the theoretical foundations of continuum mechanics, with special emphasis on comparing the classical mechanics of fluids and of elastic solids; classification and comparison of polymer constitutive equations: selected applications, especially in fluid viscoelasticity. Prereq: 5210 or Engr. Sci. & Mech. 5410 or Met. Eng. 5840 or consent of instructor. (Same as Engr. Sci. & Mech. 6800.)

6220 Advanced Methods in Polymer Processing (3) Application of theories of rheological properties and structures formation to analysis of polymer process operations. Prereq: 5210.

6230 Advanced Mechanical Behavior of Polymers (3, 3, 3) Survey of the forces and stresses with an emphasis on developing constitutive equations for the yielding behavior of solid polymers, failure analysis and the general deformation mechanics of solid polymers. Relation of microscopic properties to molecular structure.

6610 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: Consent of instructor.

6910-20-30 Recent Advances in Polymer Science and Engineering (3, 3, 3) Treatment of latest developments in science and technology of polymer science: include topology, morphology, structure, characterization, etc. Prereq: Consent of instructor.

Civil Engineering

MAJORS

DEGREES

Civil Engineering

M.E., M.S., Ph.D.

Emeritus Professors:

W. B. Hodge, Ph.D., University of California, Santa Barbara; D. W. Goodpasture, Ph.D., Illinois, P.E.; E. C. Shreve, MSCE, Ohio State, P.E.; and others.

Associate Professors:

W. L. Grecco, Head, Ph.D., Michigan State, P.E.; E. G. Burdette, Ph.D., Illinois, P.E.; J. K. Forrester, Doctorate, Université de Toulouse (France); F. A. Gifford, Ph.D., Pennsylvania State; D. W. Goodpasture, Ph.D., Illinois, P.E.; A. B. Moore, Ph.D., University of California, Los Angeles, P.E.; and others.

Prereq: Consent of instructor.
A minor may be selected but is not necessarily required. Courses other than civil engineering may be 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 to candidacy 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. The special problem will culminate in a written report which must be approved by the student’s major professor.

**Option II:**
A minimum of 48 quarter hours, including a three-quarter-hour special problem, is required. The Department of Civil Engineering offers both thesis and non-thesis options for work toward the Master of Science degree in Environmental Engineering.

**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.

**Masters of Engineering 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 to candidacy for the Master of Science in Civil Engineering.

**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.

**Masters of Engineering Program**

Graduate programs in civil engineering and in environmental engineering leading to the degree of Master of Engineering are available to qualified graduates of ECPD accredited undergraduate curricula in civil engineering or environmental engineering. At least one-third of the program of study must be classified as engineering design. The student's advisor will assist in planning the program of study to ensure that it includes the necessary design content. The thesis and non-thesis options noted under the Master of Science Programs are also available under these programs.

**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 beams, columns, floor slabs, footings, and retaining walls. Prerequisite: Concrete Design and Deflections and Statistically Indeterminate Structures.

**4220 Foundations and Substructures (3)** Foundation explorations; principles of design of dry and submerged foundations. Prerequisite: Engnr. Properties of Soils.

**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.

**4240 Structural Design (3)** Plastic theory, eccentric connections, industrial building design, timber design. Prerequisite: Design of Framed Structures and Deflections and Statistically Indeterminate Structures.

**4260 Photogrammetry (3)** Methods of plotting maps from aerial photographs; stereoscopic plotting instruments; applications. Prerequisite: Surveys, or Forestry Summer Camp for forestry majors.

**4420 Analysis of Framed Structures (3)** Maximum stresses due to moving loads; uses of influence lines; lateral forces due to earthquakes and wind; analysis of portals, building frames and space frames.

**4430 Construction Methods and Equipment (3)** Fundamentals of science and engineering of selection of equipment; production rates, balancing of equipment, and cost estimates.

**4510 Advanced Structural Design (3, 3)** Plastic design in steel in 4510; design of typical short span highway bridges in 4520. Prerequisite: Design of Framed Structures for 4510; and Concrete Design for 4520.

**4530 Cost Comparison in Design and Construction (3)** The cost of engineering and construction. The cost comparison of alternate designs with emphasis on applications to civil engineering problems. Prerequisite: 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. Prerequisite: Design of Framed Structures.

**4550 Engineering Behavior of Soils (3)** Plastic and elastic behavior of soils, determination and use of engineering properties of in-situ soils. Prerequisite: 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. Prerequisite: 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, geometry, and lighting; on the land side are included terminal layout and design, and ground access systems and parking. Prerequisite: Transportation Planning and Transportation Engineering.

**4640 Traffic Engineering (3)** Study of the characteristics of the driver, vehicle, and roadway and their interrelationship; traffic studies; basic considerations of traffic circulation and control; elements of urban transportation planning studies.

**4660 Airport Planning and Design II (3)** Integration and applications 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. Prerequisite: 4620. 1 hr and 2 labs.

**4710 Portland Cement Concrete Mix Design**
techniques; other uses of asphalt products.  
5320 Asphalt and Bituminous Concrete (3) Properties and tests of asphalts and asphaltic mixes, mix design of bituminous concrete. Emphasis on use in transportation and construction projects. Prereq: Materials of Construction, 2 hrs and 1 lab.

4850 Elementary Structural Method (3) Same as Engr. Sci. 4560 and Arch. 4650.

5000 Thesis

5002 Non-Thesis Graduation Completion (2) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110 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 rigidly jointed and frame frames and space frames. Prereq: 5110 and 5120.

5150 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, statistical methods of analysis and finite element method. Analytical and computational analysis of plane trusses, general members and structures composed of general members. Prereq: 4540 or consent of instructor.

5160 Analysis and Design of Plate Structures (3) Theoretical and practical considerations of the characteristics of the plate-vehicle-roadway system; level-of-service concept of capacity. Coreq: Stat. 3450 or 5111. 2 hrs and one 2-hr lab.

5170 Introduction to Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; elasto-plastic behavior considered for structural systems; approximate design methods developed. Prereq: 5120, 5150.

5180 Finite Element Structural Analysis (3) Applications of the finite element method to structural analysis; plane stress, plane strain, axisymmetric, and three-dimensional elements; use of typical computer programs. Prereq: 5150, and Engr. Mech. 5820 or 5860. (Same as Engr. Mech. 5810.)

5220 Pavement Design (3) Characteristics of pavement loads; theory of pavement design; design of asphalt pavements; construction, and maintenance. Prereq: Engr. Properties of Soils.

5240 Advanced Properties of Materials: Cement and Concrete (3) Permeability and durability; volume changes and creep; elastic and thermal properties of concrete; special types of concrete; causes of failure. Prereq: 4710.

5250 Advanced Properties of Materials: Bituminous Substances and Mixes (3) Serviceability of bituminous materials; failure analysis and remedies; bituminous pavement maintenance techniques; other uses of asphalt products. Prereq: 4720.

5270 Planning and Transportation (3) Methods for presentation of transportation elements of comprehensive development plans. Analysis of relationships between various transportation modes and factors that affect modal split, trip distribution, and trip assignment. Prereq: 4820 or 4822.

5310 Engineering Practice 1 (3) Values and feasibility studies; depreciation and useful life; engineering economics.

5320-30 Engineering Practice Applied to Administration of Engineering Projects (3, 3) Factors affecting project planning of governmental and industrial projects; cost estimates and methods of financing.

5420 Structural Model Analysis (3) Experimental methods of shear, moment, and stress analysis.

5550 Soil Mechanics—Plastic Equilibrium (3) Review of failure theories; earth pressure analysis, bearing capacity analysis, and slope stability analysis. Prereq: Physical Properties of Soils or consent of instructor.

5560 Soil Mechanics—Elastic Behavior (3) Stress-deformation characteristics, theory of consolidation, theories of settlement analysis. Prereq: Physical Properties of Soils or consent of instructor.

5570 Soil Mechanics—Seepage (3) Saturated flow through embankments, filter design criteria, seepage forces and velocities, subdrains, and embankment failures. Prereq: Physical Properties of Soils or consent of instructor.

5610 Behavior of Steel Structures (3) Behavior of structural steel members due to static and dynamic loading; relation between research results and current specifications for design. Prereq: Design of Framed Structures.

5730 Prestressed Concrete (3) Properties of prestressing materials and anchorage systems; methods of stress transfer and post-tensioning; analysis and design of members and continuous structures.

5740 Behavior of Reinforced Concrete Members (3) Ultimate strength and behavior of reinforced concrete members; relation between research results and current specifications for design. Prereq: 4120.

5800 Urban Systems: Engineering and Management (3) The special problem requirement in the non-thesis program. Emphasis on the social, political, economic and environmental aspects of the urban environment; the freeway, frontage road, surface street system; level-of-service concept of capacity. Coreq: Stat. 3450 or 5111. 2hrs and one 2-hr lab.

5820 Traffic Engineering—Operations (3) Fixed-time and volume-density controllers; progression systems; one-way operations; reversible flows; systems for control of possible real-time computerized networks; legal aspects of operational controls. Prereq: 5810. 2 hrs and one 2-hr lab.

5840 Geometric Design (3) Advanced theory and practical applications of road design for highways. Prereq: Highway Engineering I.

5850 Functional Design of City Streets and Urban Freeways (3) The effect of street systems upon urban growth and development; classification and function of streets; design features, including cross-section, intersections, utility considerations, parking, effect of mass transportation; channelization; marketing; lighting; the freeway, frontage road, surface street system. Prereq: Consent of instructor.

5860 Urban Transportation Planning (3) The use of various models for the prediction of traffic demands and vehicular flows; land use planning; parking needs. Prereq: 5810.

5870 Public Transit Planning (3) The planning process is required for the study of person movement by bus and taxicab transit. Also includes the nature of public transit; its various methods, and the contribution of the community’s need; user preferences; modal split models; and the total social, political, economic and historical impacts of public transit. Prereq: Highway Engineering I or graduate standing.

5890 Traffic Accident Reconstruction (3) The investigation of traffic conflict data collection and analysis is discussed as a basis for designing accident prevention or control programs. Emphasis on examining the many contributing factors to an accident. Proximate and secondary accident causes will be discussed and may make the roadway improvement. Prereq: 4640 or 5810 or consent of instructor.

5900 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. Repeatable to 6 units. Prereq: May be repeated. Maximum 9 hrs. S/NC only. Prereq: Consent of instructor.

5910-20-30 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.

6000 Doctoral Research and Dissertation

6610 Behavior of Steel Beams and Buildings (3) Behavior, analysis, and design of plate girders, columns and composite members subjected to static and dynamic loading. Prereq: 5170 and 5610.

6740 Behavior of Reinforced Concrete Beams and Frames (3) Ultimate strength and behavior of statically indeterminate concrete structures; applicability of elastic analysis to framed structures, limit analysis. Prereq: 5120 and 5150.

6750 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 EM 6310.

6830 Traffic Flow Theory (3) Special problems in traffic engineering, using queuing theory, Markov processes, Monte Carlo methods, and simulations of various conditions and/or designs. Prereq: 4540 or Math 5150; 5820.

6850 Statewide Passenger Transportation Planning (3) Preparation of comprehensive multi-modal transportation plan, intercity traffic models, functional classification, programming and scheduling. Emphasis on government policy decisions, especially as they affect air and highway investments. Prereq: 5690.

6870 Future Transit Technology and Research (3) New transit systems and new technology are identified and evaluated. Also considered are the identified research needs and areas in both technology and the planning process and possible research designs. Prereq: 5820.

6880 Planning Models for Transportation Systems 1 (3) An analytical analysis of trip generation employing mathematical, statistical, and computer science techniques. Also an introduction to modal split, trip distribution, and trip assignment will be made. These statistical procedures are integrated into the urban transportation planning process. State-of-the-art and new modeling techniques are investigated. Prereq: 5560 or 5270, Math 3150 and Stat. 3450.

6890 Planning Models for Transportation Systems 2 (3) An analytical analysis of modal split, trip distribution, and trip assignment. Mathematical, statistical, and computer science techniques are used in the modelling process. These models are integrated for use in the urban transportation planning process. Prereq: 5870.

6910-20-30 Special Topics in Civil Engineering (3, 3, 3) Selected advanced problems of current interest to civil engineering. Prereq: Consent of instructor.

NOTE: Not all of the above courses will be offered in any one year.
Environmental Engineering

3000 Introduction to Environmental Engineering (3) Introduction to man's interaction with the air, water, and land environment in which he lives; role of engineering in environmental control.


4150 Urban Water Management (3) Introduction to urban water modeling; evaluation of optimum urban water policies; formulation of system constraints and analysis of decision-making process; management of storm water for beneficial use. Prereq: 3000 and Elementary Hydrology.

4210 Water Resources Engineering Design (3) Elements of water resource structures and systems, including reservoirs, dams, control works, and open channel design. Dam safety. Environmental impact of reservoir projects. Prereq: Consent of Instructor.

4220 Water Resources Engineering Development (3) Application of resource development and single or multipurpose planning; economics in alternative decisions; principal water use; multipurpose evaluation procedures for water and resource projects; Tennessee water law principles; special topics of current interest. Prereq: Consent of Instructor.

4330 Hydrologic Design (3) Application of frequency and regression analysis to hydrologic design of water resource 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.


4520 Elements of Water and Wastewater Treatment Systems Design (3) An introduction to the unit operations and processes employed in the physical, chemical, and biological treatment of water and wastewater. Application to unit operations and processes in design of water and wastewater treatment plants. Prereq: Elementary Hydrology.

4530 Sanitary Engineering Laboratory (3) Physical, chemical, and bacteriological analysis of water and wastewater. Prereq: 4030. 3 labs.

4600 Solid Waste Management (3) Quantities and characteristics of solid wastes; collection methods and equipment; disposal and recycling 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 emissions sources; meteorology and topographic factors; 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

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise satisfied by required coursework. This option is available to all students. Students who do not complete this course will not be considered for graduation. Prereq: Consent of Instructor.

5150 Water and Urban Warfare (3) Evaluation of social, environmental, and economic impact on planning and management of urban water systems. Emphasis upon conflict and choice, reconciliation of water and urban development values, measurement of social well-being and quality of life parameters. Procedures for analyzing multi-objective policy alternatives with selected case studies. Prereq: Consent of Instructor.

5160 Planning and Utilities (3) Planning for adequate water and sewage waste disposal in the urban environment. The impact of utility patterns on area development, and the flowing water: 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 areas. (Same as Water Res. Development 5200.)

5210 Advanced Water Resources Engineering (3) Complex problems encountered in water resources engineering such as water management, survey design, computer simulation, etc. Analysis of such problems preliminary to design of complex water resources structures.

5230 Surface Water Transport Processes (3) Dynamics of surface water; rivers, 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 transport measurements; bed load and suspended load movement; erosion, scour, transportation and deposition of sediments by flowing waters; suspended load of rivers and related topics. Prereq: 5230.

5234 Flood Damage Reduction (3) Survey of national, regional, local flood problems; hydrologic design criteria; traditional flood control measures; land-use controls and adjustments; floodproofing, flood insurance, and other flood damage reduction elements; interdisciplinary approaches to floodplain management; case studies. Prereq: Consent of instructor.

5251 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 geometrical optics, the interaction of EM radiation and matter; current data handling technology. Prereq: Consent of instructor.

5261 Remote Sensing Data Acquisition (3) Theory of active and passive sensors, their use of advanced remote sensing systems. Prereq: Consent of instructor.


5301 Stormwater Modeling (3) Interpretation of hydrologic data using methods of systems analysis. Hydrologic components are analyzed as linear or non-linear systems and integrated into mathematical models. Computerized model response. Methods are presented for optimizing model parameters with illustrative examples. Prereq: Consent of Instructor.

5302 Stormwater Modeling II (3) Continuous streamflow records are interpreted using methods of statistical hydrology, including flow frequency and time series analysis. Hydrologic design of water resources systems using streamflow statistics. Hydrological processes including autoregressive and fractional gaussian noise models. Prereq: Consent of Instructor.

5310 Groundwater Transport Processes (3) Dynamics of flow in porous media with emphasis on multi-layered systems. Theories of flow in porous media. Prereq: Consent of Instructor.

5330 Descriptive Hydrology (3) Occurrence and description of elements of the hydrologic cycle and 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 practice. Prereq: 4530.

5502 Water and Wastewater Treatment Theory II (3) Theory of physical, chemical, and biological processes employed in sanitary engineering practice. Prereq: 5501.

5513 Advanced Water and Waste Treatment Systems I (3) Course centers about the relationship between environmental engineer-
includ ed in other c ourses. Prereq: Consent of instructor. May be repeated. Maximum 5 credits limited to environmental engineering and its equivalent.

5600 Industrial Waste Treatability and Process Control (6) Sources and characteristics of industrial wastes; treatment alternatives related to ultimate disposal. Includes process control studies of physical, chemical, and biological processes using laboratory bench-scale treatment units, field trips, 2 hrs and 4 labs. Prereq: 5513 and 5593.


5610-20-30 Special Topics in Environmental Engineering (3, 3, 3) Selected advanced problems of current interest in environmental engineering. Prereq: Consent of instructor. Note: Not all of the above graduate courses will be given in any one year. Prerequisite to all graduate courses: Consent of instructor.

Electrical Engineering

MAJOR DEGREES

Electrical Engineering M.E., M.S., Ph.D.

Professors:


Associate Professors:


Assistant Professors:

D. W. Bouldin, Ph.D. Vanderbilt; T. W. Reddock, Ph.D. Louisiana State; J. W. Waller, Ph.D. Tennessee.

MASTER OF SCIENCE PROGRAM

Graduate work leading to the Master of Science degree in Electrical Engineering may be completed during one academic year of full-time study, or the degree may be obtained in two or three years of study in the event that all 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 5100. Elec. Engr. 5170 is normally available in both fall and spring quarters. Students electing courses such as 5650-60, 5720-30, or 5750-60 which require 5710 as a prerequisite should register for 5710 in the fall quarter.

2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics 4710, 4550, and 4250, or 4510-20-30. Other approved 4000-5000 level mathematics courses must be substituted for any of the above course material covered in undergraduate work.

3. An additional 18 quarter hours of 5000-level work in electrical engineering or nine quarter hours of 5000-level work in electrical engineering and nine quarter hours in 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.

MASTER OF ENGINEERING PROGRAM

A graduate program leading to the Master of Engineering degree is available to qualified graduates of ECPD accredited undergraduate curricula in electrical engineering or its equivalent.

Specific degree requirements which must be met include:

1. Electrical Engineering 5070-80 and 5710.

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 submitted for any of the above course material covered in undergraduate work.

3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in electrical engineering and 9 quarter hours in another approved area.

4. Master's thesis, totaling 9 quarter hours or more.

5. A final oral examination covering the thesis and related course work.

A minimum of one-third of the program must be in electrical engineering design, and one-third in one of, or a combination of, advanced math, computer sciences, basic sciences, or engineering sciences.

DOCTORAL PROGRAM

The Ph.D. degree with a major in Electrical Engineering may be pursued in the areas of circuit theory, computers, electronics, communication theory, 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. SAT or ACT scores satisfactory on both a written and an oral preliminary examination.
5. Participation in departmental seminars.

The 72 quarter hours of course work must satisfy the following requirements:

a. A minimum of 36 quarter hours of work in electrical engineering at the 5000-6000-levels.

b. A minimum of 12 quarter hours of 6000-level course work. At least three of these hours must be in the student's major area.

c. 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.

Departmental graduate programs providing special opportunities for academic and research work in areas pertinent to atmospheric and space flight are also available at the Space Institute, Tullahoma.

3010 Transient Analysis (3) Analysis of transient response of networks and systems; Laplace transform method and classical differential equation methods for system analysis; complex frequency concept and pole-zero concepts; applications to engineering problems.

Prereq: Circuits III.


Prereq: Multivariable calculus and linear algebra.

3050 Basic Field Theory (3) Forces between charges, electric and magnetic fields, Gauss' law, 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. machinery.

Prereq: 3040. 4 labs.

3090 Energy System Operation (3) Synchronous machines, transmission systems, and transformers as power system elements; power system representations, per unit calculation, symmetrical components, and fault studies.

Prereq: 3080. 4 labs.


3110 Basic Electrical Engineering-Circuits and Fields (3) For non-electrical engineering majors. 4 labs.

3120 Basic Electrical Engineering-Electronics (3) For non-electrical engineering majors.

Prereq: 3110. 4 labs.

3130 Basic Electrical Engineering-Machinery (3) For non-electrical engineering majors.

Prereq: 3110. 4 labs.

3180 Logic Design of Digital Systems (3) Introduction to boolean algebra and design of combinational circuits. Presents gate and flip-flop characteristics. Design of clocked sequential circuits and other systems containing memory. Introduction to minicomputer architecture and system components to include basic structure and function of Arithmetic, Storage, Input/Output, and Control Systems. Instruction set capabilities and machine language, programming.

Prereq: 3010, Computer Science 3160. 4 labs.

3190 Plasma I (3) Engineering applications of physical electronics, plasma effects and devices. Topics include electron, ion, and plasma light sources, laser operation and applications (electro-optics), and MHD, controlled thermonuclear and other techniques for advanced power production. Prereq: Fundamentals of Physics: Electricity, Waves and Optics, Modern Physics. 4 labs.

3720 Linear Systems Analysis (3) Review of steady-state linear circuits; steady-state response; load-control, frequency, gain-phase, and polar plots; block diagram transformation; signal flow graphs; analog computers; properties of second-order systems; introduction to feedback theory; stability criteria.


3810 Electronics I—Basic Electronic Processes (3) Current conduction in semiconductors and high vacuum; theory of p-n junctions, characteristics of diodes; rectifiers and diode switches.

Prereq: Circuits III, 3940 concurrently. 4 labs.

3820 Electronics II—Basic Electronic Devices (3) Characteristics and equivalent circuits of vacuum tubes and transistors with application to amplifier and control circuits.

Prereq: 3810. 4 labs.

3830 Electronics III—Basic Electronic Amplifiers (3) Vacuum tube and transistor R-C coupled amplifier circuits; basic power amplifiers; bias stability; feedback.

Prereq: 3010 and 3820. Coreq: 3720. 4 labs.

4020 Direct Electrical Energy Conversion (3) Basic principles, typical devices and applications for the production of electrical energy by thermoelectric effects, thermionic conversion, magnetohydrodynamics, solar cells, and fuel cells. Laboratory demonstrations.

Prereq: 3050, 3190, 3810, and ME 3530.

4080 Microwave Circuits and Electronics (3) Circuits represented by wave shattering, isolators, gyrators, couplers, microwave vacuum diode detectors and devices, parametric amplifiers, power generator semiconductors, varactor semiconductors.

Prereq: 3060, 3190, and ME 3530.

4090 Propagation (3) Metal tube, dielectric rod, and stripline waveguides. Waveguide resonators and other loading components. Design of structures utilized for microwave power transmission, and microwave waveguide integrated circuits.

Prereq: 3060. 4 labs.


4200 Electromagnetic Field Transients (3) Pulse propagation on lines, reflection of pulses, time-domain display of pulses from antennas.

Prereq: 3060. 4 labs.


4370 Introduction to Feedback System Design (3) Mathematical formulation of control systems; steady-state error and error constants; root-locus method; optimum gain adjustments; compensation networks; introduction to compensation.

Prereq: 3720. Lab optional.

4410 Power System Components and Control (3) Analysis of power system components and their interconnection. Studies in control of power and frequency as well as voltage and reactive power.

Prereq: 3090.

4420 Power Systems Analysis (3) System studies including load flow, faults, and stability.

Prereq: 3090.

4430 Transmission, Distribution, and Protection (3) Studies in underground and above-ground transmission; consideration of over-voltages 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 and electrical engineering analogies. Consideration of practical devices and applications.

4470 Plasma II (3) Magnetohydrodynamics.

Prereq: 3190.

4480 Plasma III (3) Introduction to macroscopic plasma equations, particle orbits, interactions, oscillations, and waves.

Prereq: 3190.


4500 Electro-Optic Detection and Instrumentation (3) Sensitivity, resolution (frequency response) and noise concepts of practical engineering detectors and electro-optic measurement techniques (e.g. photographic emulsions and temporal detectors (e.g. photodiodes) will be given. The last third of the course will be devoted to selected electro-optic instrumentation systems (e.g. laser light scattering, optical data processing, holographic interferometry).

4540 Antennas and Propagation (3) Dipole and linear antennas, arrays and other simple antennas. Antenna gain, impedance and other parameters. Wave propagation in free space, earth's troposphere and ionosphere. Wave reflections from earth.

Prereq: 3060.

4570 Electro-Acoustics (3) Reproduction of monophonic and stereophonic sound, microphones, loudspeakers, disc recording, magnetic recording, film recording, acoustics of studios, auditoriums.

4590 Instrumental Transducers and Signal-Conditioning Electronics (3) Various sensors and transducers utilized for parameter measurement. Use of the operational amplifier in signal-conditioning design; examples such as active filters, amplifying devices, and function generators. Analysis of interfacing problems between the transducer and the signal-conditioned output as to its suitability to environmental monitoring instrumentation.

Prereq: 3120 or 3830.
5370 Advanced Direct Electrical Energy Conversion I (3) Theory, latest devices and applications for production of electrical energy by the solid state means of thermoelectric and photovoltaic effects. Prereq: 4202 or ME 4150 or equivalent, 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 thermionic, magnetohydrodynamic, and electrodynamic effects. Prereq: 4202 or ME 4150, or equivalent, or consent of instructor.

5390 Advanced Direct Electrical Energy Conversion III (3) Prereq: 5370 and 5380, or equivalent.

540 Power System Networks (3) Sequence impedances for transmission lines, machines, and transformers. Formation of system network characteristics such as voltage, frequency, and power flows. Computer methods are emphasized. Graduate standing or consent of instructor.

5402 Fault and Load Flow Studies (3) Analysis of a power system under both shunt and series fault conditions. Computer methods and fault studies are included. The load flow problem is formulated with computer methods emphasized. Prereq: 5410 or consent of instructor.


5440 Distribution Systems (3) Electric power distribution for service to residential, commercial, and industrial systems. Power system protection. Prereq: 4410, 4420, 4430 or equivalent.

5460 Selected Topics in Power Systems (3) Courses will be offered to meet special needs of students. Possible topics: (1) power system reliability, (2) interconnected system theory, (3) power plant operation, (4) electric transients in power systems, and (5) power system relaying. Prereq: Consent of instructor may be repeated with consent of department.

5510-20-30 Linear Active Circuits (3, 3, 3) Analysis and design of linear amplifiers; includes a mathematical treatment of active device operation, circuit elements, sources of distortion, wide-band and pulse amplifiers, and a detailed treatment of feedback amplifiers utilizing hole-zero and root-locus techniques; types include audio, video, pulse, driver, operational, and distributed amplifiers. Coreq: Math 4510 or 4710.

5570-80-90 Electronic Switching Circuits (3, 3, 3) Switching circuits using active devices; includes clipping circuits, clamping circuits, comparator circuits, logic circuits, multivibrators, negative-resistance-circuit techniques, pulse 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 Logic Design and Finite Automata Theory (3, 3) Review of design considerations for combinational and sequential circuits, iterative networks, fault diagnosis of logic circuits. State identification and structure realizations of high-speed sequential circuits. Two-valued logic is placed on the transient response and high-speed operation. Coreq: Math 4510 or 4710.

5615-25 Introduction to Switching Theory and Logic Design (3, 3) Boolean algebra and applications. Combinational switching circuits. Sequential machines. Information structures and sub-systems. For computer science majors and those without prior experience in hardware and logic design. Prereq: Elementary linear algebra and basic knowledge of set theory and Boolean variables. Includes a laboratory (4 labs/quarter).


5650-60 Electronic Communication Systems (3, 3) Theory of information transmission in communications systems; mathematical treatment of modulation and demodulation in analog and pulse-type systems. Bandwidth requirements, noise, system performance in noise. All modern systems are considered and compared with emphasis on digital data systems. Prereq: 5615-25.

5670-90 Introduction to Pattern Recognition (3, 3) (Same as Computer Science 5840-50).

5690 Introduction to Artificial Intelligence (3) (Same as Computer Science 5210).

5710 Random Process Theory for Engineers (3) Probability and random variables as approaches by set theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions, and temporal analysis, power spectrum and spectral analysis as applied to response of systems to random signals.


5740 Digital Processing of Signals (3) Analysis of discrete signals; sampling theorem and its implication; frequency domain design of digital filters; quantization effects; processing of digital signals; discrete Fourier transform. Prereq: 4190 or 4610.


5770 System Identification (3) Presentation of various identification schemes including deterministic, stochastic, and hierarchical methods. This course has particular applications in all areas of engineering and science. Prereq: Consent of instructor.

5800 Power Transmission Lines (3) New and unclassified power transmission systems. Transmission line parameters for overhead and underground lines. Corona and radio interference. Performance of high voltage transmission. Influence of line on generation, coordination and protection. Design procedures for high voltage transmission. Prereq: 4410-20-30 or equivalent.

5810-20 Electromagnetic Fields (3, 3) Vector analysis and field theory, special relativity, plane waves, reflections, waves in anisotropic media, guided waves, rectangular and cylindrical coordinates, applications of integral equations, and current elements. Coreq: Math 4510 or 4710.

5830 Linear Antennas and Antenna Arrays (3) The Hertzian dipole, linear antennas, impedance, loop antennas, receiving antennas, linear arrays. Prereq: 5820.

5840 Aperture Antennas (3) Huygens principle, equivalent currents, Fourier transform and integral transformation, dipole, horn, lens and reflector antennas. Prereq: 5820.

5850 Microwave Electronics (3) Space charge waves on electron beams, coupling between beams and waveguides, waves, Klystrons, magnetrons, traveling wave amplifiers and backward wave oscillators. Prereq: 5820.

5860 Electromagnetic Wave Propagation (3) Supplementary studies in wave propagation in isotropic and anisotropic media, transmission, power, stored energies, propagating and nonpropagating modes, orthogonality properties, bound and radiation conditions, sources. Prereq: 5820.

5870 Introductory Microwave Networks (3) Circuit equivalents for n-port, junctions, obstacles, loading and fillings. One way and two way devices, directional devices, parameter measurements, reflection charts. Prereq: 5810. Coreq: 5820.

5940-50-60 Advanced Small Computer Systems (3, 3) Real-time applications, memory and CPU organization, interface software, and peripheral devices of minicomputer and microprocessor system are studied. Courses are project-oriented and supported by hardware and software interface design. Prereq: 4850 or equivalent and consent of instructor. (Same as Computer Science 5940-50.)

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6240 Advanced Systems Theory (3) Advanced analytical methods for systems with deterministic inputs; treatment of discrete-data, nonstationary and nonlinear systems. Prereq: 5070-80 or equivalent.

6250 Stochastic Processes in Engineering Systems (3) Analysis and design of systems with stochastic inputs. Methods of batch and sequential estimation; time domain and frequency domain methods of optimum filter design. Prereq: 5090 or equivalent.

6280 Modern Control System Design (3) Design of optimum control systems via variational calculus, maximum principle, 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 in a controlled systems, including some 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).

6510-20 Microwave Networks (3, 3, 3) Multipactor, Scattering and transfer representations, the synthesis problem, reciprocity and nonreciprocal devices. Resonators, directional couplers, junctions, Symmetrical and asymmetrical waveguide, Application of measurement data. Prereq: 5810-20. Coreq: Math 5610.

6550 Advanced Antenna Theory (3) Theory of the cylindrical dipole, Hallet's equation, King's integral equations, antenna gain, directivity, terminal impedance, and mutual impedance between several dipoles. Prereq: 5610-20 and Math 4520 and 4550.
6850 Electromagnetic Diffraction and Scattering (3) Diffraction of electromagnetic waves by spheres and cylinders, the ground wave propagation problem, introduction to modern approximate methods, creeping waves. Prereq: 5810-20 and Math 4250 and 4550.


6760 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: 5050 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.


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, mechanics, or one of the physical or biological sciences. Program options include solid mechanics, fluid mechanics, biomedical engineering, and other engineering sciences. In the biomedical and engineering science option, interdisciplinary programs are arranged to meet individual needs or interests. Each applicant will be advised as to any prerequisite courses before entering a program; the student's program of study must be approved by his/her advisory committee, and must comply with the requirements of the Graduate School. The student's major professor may be selected from a department other than the Department of Engineering Science and Mechanics.

The flexibility and interdisciplinary aspects of the program options are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering, or can best be met by interdisciplinary study in engineering. The department's course offerings and research activities are also intended to meet the needs of students who seek preparation in employment in engineering areas requiring specialization in mechanics, or in related interdisciplinary studies such as biomechanics.

THE MASTER'S PROGRAM

Two M.S. plans are offered: Plan I requires a thesis, while Plan II does not. The second plan is offered to meet the needs of engineers employed in industry, or those who plan to teach in community colleges and technical institutes. It will be available, however, to any student who, in the opinion of his/her advisory committee, can benefit from additional course work more than from a thesis. In Plan I a minimum of 45 quarter hours, including the thesis, is required. In Plan II a minimum of 48 hours is required. The requirements include the following: Hours Credit

Mathematics 9 9

Engineering courses (Major 18 27

Plan I Plan II

option: may include but is not restricted to courses offered by the engineering science and mechanics department.)

Related courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.)

Thesis 9 9

*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 Bachelor's 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 6000 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 improvement of his/her advisory committee.

3. A minimum of 18 quarter hours in mathematics or computer science in courses numbered 4000 and above, exclusive of first course in ordinary differential equations.

4. A minimum of 9 quarter hours of courses numbered 5000 and above, offered in departments other than mathematics, computer science, and the student's major department and which are not included in the areas of concentration covered under item 2.

5. Active participation in graduate seminars and colloquia.

6. Preliminary examination consisting of a written qualifying examination and an advanced examination. The qualifying examination covers areas of engineering science and mathematics in the most part at a level and scope expected of well-qualified recipients of a Bachelor's degree in engineering. The advanced examination requires demonstration of special competence in the areas of concentration selected by each student under item 2.

7. Submission of a written proposal for dissertation research to the student's advisory committee. Oral defense of the proposal is normally required when the student takes the advanced portion of the preliminary examination.

8. Submission of a dissertation which meets the requirements of the Graduate School, the department, and the student's advisory committee.


4310 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, bio-
materials, mathematical models of body sys-
tems. Course satisfies fundamentals of linear algebra or consent of instructor.

4320 Introduction to Clinical Engineering (3)
Designed to train students in life sciences, health and medical engineering. Focus on use and applications of medical instruments. Body systems are introduced, and instruments used in each of those systems are explained and demonstrated. Demonstrates results of combined efforts of physician and biomedical engineer. Audio-
visual aids and models are used to reinforce topic discussion.

PreReq: 3410 and Engineering Materials I.

4349 Medical Ceramics Laboratory (1) Surgical and observations and laboratory ex-
periments to illustrate design and application parameters. Design project or paper required.
Coreq: 3430.

5320 Materials Behavior and Chemical Pro-
cess Engineering (3) (Same as Metallurgical Engineering 3320.)

3700 Dynamics (4) Kinematics of rigid bodies; mass moments of inertia; coelomb friction; kinetics of rigid bodies using force, mass, acceleration, and momentum-augmented formalism. Not for departmental graduate credit.
PreReq: Elementary Statics and Dynamics or Basic Mechanics II Coreq: Math-multiplicative 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 sys-
tems; LaGrange's equations. PreReq: Dynamics and 2nd quarter Elementary Linear Algebra and Calculus of Several Variables.

4420 Engineering Aspects of Infection Con-

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 bacteri-
ological and mycological tests will be demon-
strated. Course identifies new and critical role for biomedical engineering in health care systems, and includes analysis of hospital failure and measuring systems. PreReq: 3410 or consent of instructor.

4430 Orthopaedic Biomechanics (3) Introduc-
tion to engineering principles and applications in orthopaedics and rehabilitation. Topics in-
clude statics, Newton's laws of motion, stresses in simple sections, engineering ma-
terials and biophysical materials. PreReq: Consent of instructor.

4500 Applied Mechanics for Life Scientists
(4) Concise and broad coverage of basic prin-
ciples and concepts of mechanics. Funda-
mental concepts, statics, vibrations, con-
tinuum 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 de-
velopments in biomedical fluid mechanics. Properties of human blood and blood vessels, determinants of cardiac performance, analysis and measurement of flow and pressure in arteries, nontraumatic study of circulatory sys-
tems. Discusses blood rheocirculation. Applica-
tions to areas of hemolysis, thrombosis, and fluid dynamics of heart assist devices. PreReq: 4529 Biomedical Fluid Mechanics or consent of instructor.

4529 Biomedical Fluid Mechanics Laboratory (2) Measurement and recording of flow char-

actistics of various systems. Project and/or term paper required. Coreq: 4520.

4530 Biomechanics (3) Discusses objectives, re-
view foundations and present developments in areas of mechanics of living tissues, biomechanics of injury and prosthesis, material compatibility of prosthetic devices and biomechanical problems related to impact. PreReq: 4500 or consent of instructor.

4540 Fracture-Safe Design (3) A critical re-
view of mechanical properties of materials that are indicative of fracture resistance, including transition temperature, R-curves, stress in-
tensity factors, and J-integrals; the use of these properties in fracture. PreReq: Mechanics of Materials and Engineering Materials I, 3 hrs or 2 hrs and 1 lab.

4610 Experimental Stress Analysis (3) Basic concepts; theory, techniques, and instrumen-
tation of resistance strain gauges; theory and techniques of the brittle coating method; in-
troduction to other stress analysis methods. PreReq: Mechanics of Materials or Basic Electrical Engineering-Circuits and Fields. 2 hrs and a 3-hr lab.

4620 Dynamic Data Acquisition (4) Instru-
mentation of measuring systems for dynamic events and responses; signal conditioning; oscillographs, oscilloscopes, and magnetic tape recording; telemetry and data transmis-
sion; data acquisition systems. 3710, 5300, Elec. Engr. 3120. 3 hrs and a 1-hr lab.

4630 Introductory Photomechanics (3) Intro-

4710 Fundamentals of Vibrations (3) Free and
forced vibrations of damped and undamped lumped parameter systems; energy methods. PreReq: Dynamic Systems I, Elementary Linear Algebra and Calculus of Several Varia-
bles.

4780 Engineering Acoustics (3) Fundamental concepts of acoustics. Measures of sound and their units. Noise control principles and applica-
tions. Materials and procedures for noise abatement. PreReq: Introductory course in vibrations or acoustics.

4810-20 Engineering Analysis (4, 3) Integra-
tion of fundamental methods of analysis with emphasis on applications to real engineer-


4850 Elementary Structural Matrix Methods
(4) PreReq: Mechanics of Materials. Deflections and Statically Indeterminate Structures, Math 3150. (Same as CE 4850 and Arch 4850.)

4910 Special Engineering Science Topics (3) Problems related to recent developments and practice. Open to juniors or seniors with consent of instructor. May be repeated. Maxi-
mum 6 hrs.

5000 Thesis

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

5110 Fluid Dynamics (3, 3) Kinematics of fluids, vorticity, rate deformation, plane and axially symmetric stream functions; Navier-
Stokes Equations and their solutions; exact solutions; potential flow; boundary-layer approximations; nonviscous flow, potential theory, complex potentials, con-
formal mapping. PreReq: 5900.

5130 Introduction to Turbulence (3) Macro-
scopic concepts, analogies, statistical treatments, correlation functions, energy spectra, diffusion;
application of turbulent jets and pipe flow. PreReq: 5800.

5189 Finite Element Structural Analysis (3) (Same as CE 5180.)

5220 Mechanics of Viscous Flow (3) Role of vorticity and viscosity in mechanical and flow phenomena; applications of the Navier-Stokes equations; emphasis on numerical methods of solutions; introduction to sono-optic methods of laminar flow analysis. PreReq: Math 4610. (Same as Chem. Engr. 5610.)

5320 Non-Newtonian Fluid Mechanics (3) (Same as Poly. Engr. 5230.)

5310-20-30 Advanced Mechanics of Materials (3, 3) Advanced topics in mechanics of ma-
terials; elementary theory of elasticity. Pre-
Req: Mechanics of Materials and Math 4610.

5410-20 Theory of Elasticity (3, 3) Stress, strain in three dimensions; torsion and bending of prismatical bars; axisymmetric stress dis-

tribution; stress concentration; plane stress, plane strain. PreReq: 5600.

5430 Thermal Stresses (3) Review of heat conduction; viscoelastic equations; thermal stresses in beams, rings, plates, and shells; thermal buckling problems. PreReq: 5410 or 5010-20-30, and Heat Transfer.

5440 Theory of Linear Viscoelasticity (3) Int.
roduction to the concept of linear visco-
elasticity of solids, quasi-static problems; vibra-
tions problems; dynamic problems; stability problems. Advanced methods for four-dimen-
sional linear viscoelasticity. PreReq: 5800.

5550 Fracture Mechanics (3) Theories of equi-

librium cracks and crack propagation. Application of mathematical methods for deter-

5630-40 Photoleasticity (3, 3) Introduction to physically polarized light, analysis of stresses, strains, and stress vectors in isotropic, anisotropic, elastic, and plastic solids. Topics include intensity, orientation, and distribution of field sizes. PreReq: Math 5440, Math 4610.

5650 Vibrations of Continuous Media (3) Equations of motion for continua; waves, beams, membranes, plates, and shells; natural modes and frequencies; response of damped and un-
damped systems to applied dynamic loads; approximate methods of solution. PreReq: 5410 and Math 4550.

5710 Advanced Dynamics (3, 3) Physical laws relative to translating and rotating refer-
ence frames; rigid body, non-rigid body, variational methods; Lagrange's equations; Hamilton's principle. PreReq: 3710 or 4710, Math 4610.

5730 Advanced Vibrations (3) Vibrations of continuous systems (e.g., beam, electric circuits, 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 un-
damped systems to applied dynamic loads; approximate methods of solution. PreReq: 5410 and Math 4550.

5750 Orbital Mechanics (3) Planetary, satellite, and astronomical orbits and trajectories; orbital perturbations; classical principles of minimization. PreReq: 3710 and 4710.

5800 Introduction to Continuum Mechanics (3) An integrated approach to the fundamentals of mechanics of solids and fluids; introduction to Cartesian tensors; stress, deformation, and strain models. Kinematics and equilibrium equa-
tions, applications to solids and fluids. PreReq: Fluid Mechanics and Mechanics of Materials or equivalents.

5840 Perturbation Methods in Mechanics (3) A study of regular and singular perturbation methods for the solution of linear and non-


5860 Introductory Finite Element Methods (3) Introduction to the general finite element procedure; convergence requirements; programming applications to stress analysis, heat transfer, fluid flow, and solution of differential equations. Prereq: 5800 or 5310, or Mech. Engr. 5450, or consent of instructor.

5910 Special Topics in Engineering Mechanics (3) Students interested in recent developments should contact the instructor to arrange for special topics. Prereq: Consent of instructor. May be repeated with consent of department.

6000 Doctoral Research and Dissertation

6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) Critical survey of literature on advanced convective momentum, heat, and mass transfer; boundary layer theory based on the Navier-Stokes equations; boundary layer stability analysis; phenomenological theories of turbulence; turbulent boundary layer flow; high speed flow of phenomena in nonisothermal and reacting systems. Prereq: 5110-20 (or equivalent); Math 4610, 4540-50, 4710. (Same as Environmental Engr. and Mech. Engr. 5110-20.)

6230-40-59 Theory of Turbulence (3, 3, 3) Mathematical description of turbulence; isotropic turbulence, energy spectra, Kolmogorov's hypothesis; large and small eddy structures by turbulent flows; turbulent diffusion by continuous movement; applications to turbulent jets, wakes, on natural and boundary layers. Prereq: 5110-20. Coreq: Math 5610-20.

6310 Theory of Plates (3) The classical theory of bending of plates of various shapes; thick plates; plates of variable thickness; buckling and deflection problems. Prereq: 5310-20.

6320 Theory of Shells (3) The classical membrane and bending theories for shells of various shapes; buckling; inextensional deformation. Prereq: 5310-20-30.


6340 Theory of Plasticity (3) YIELD CONDITIONS; STRAIN HARDENING; GENERAL CONSTITUTIVE EQUATIONS; PLASTIC POTENTIAL; UNIQUENESS THEOREMS; EXTREMUM AND VARIATIONAL PRINCIPLES; PROBLEMS IN PLASTICITY OF SOLIDS; PLASTIC DEFORMATIONS; PIECEWISE LINEAR PLASTICITY. Prereq: 5410 and Math 4550.

6510 Photelasticity (3) The stress-optic law in three dimensions and index ellipsoid, rotation of principal axes; general constitutive equations; plastic potential; uniqueness theorems; extremum and variational principles; problems in plasticity of solids; plastic deformation; piecewise linear plasticity. Prereq: 5410 and Math 4550.

6710 Impact and Stress Waves in Solids (3) Mechanical impact; wave propagation in elastic solids; impact and stress waves in elastic rods, beams, and plates; contact problems in impact of elastic bodies; dynamic loading in viscoelastic and plastic materials; dynamic properties and nonlinearity. Prereq: 5410, Coreq: Math 5630.

6800 Advanced Continuum Mechanics (3) Prereq: Chem. Engr. 5520 or M.E. 5410, or Mech. Engr. 5460 or equivalent. (Same as Poly. Engr. 6210.)


6910 Special Topics in Engineering Mechanics (3) Selected advanced problems of current interest in mechanics, worked either as a group or individual project. May be repeated with consent of department.

Note: Not all of the above graduate courses will be offered in any one year.

**Industrial Engineering**

**MAJOR**

**DEGREE**

**Industrial Engineering**

**M.E., M.S.**

**Professors**

J. R. Bruch, M.S. Georgia Institute of Technology; W. W. Clamoy, Ph.D. Virginia Polytechnic Institute, Ph.D. University of Virginia; R. H. LeFarge, M.S. Georgia Institute of Technology, P.E.; N. L. Loveless, M.S. Northern Carolina State, P.E.

**Associate Professors**


**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, human factors, decision making, facilities planning and engineering economy. Either one or two minors can be elected in engineering, mathematics, psychology, business, computer science, statistics or economics.

**MASTER OF ENGINEERING PROGRAM**

This professional degree program is intended as a culmination year in a five year baccalaureate-master program which emphasizes engineering design and professional practice. Admission requirements include those presented above plus the requirement that the student's degree from an E.C.P.D. accredited engineering program. This 45-quarter hour program requires 18 hours of course work in an industrial engineering core, 8 hours of technical methods electives, 5 of industrial engineering electives and 9 hours of thesis or design project. 

**4060 Production and Inventory Systems (3)**

**Fundamentals and applications of statistical forecasting for production planning, inventory analysis and control, time-cost trade-off algorithms, multi-project control, and computer programs. Prereq: Statistics 3450.**

**4080 Forecasting Methods in Industrial Engineering (3)**

**Application of technological forecasting techniques to industrial engineering problems. Includes regression, time-oriented smoothing, linear and polynomial regression models, autocorrelated time-series analysis, and probability methods for select industrial forecasting methods. 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 algorithms, multi-project control, and computer programs. Prereq: Statistics 3450.**

**4160 Materials Handling (3)**

**Analysis and planning for the overall problem of moving, packaging, storing and handling of materials; equipment comparison and selection, cost analysis, and estimating. Prereq: Work Measurement, 4550, and Mechanics of Materials. Not available for graduate credit for industrial engineering students.**

**4170 Automatic Process Control (3)**

**Characteristics of automatic processes and control systems; open-loop control systems; feedback control systems. 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 Predetermined Time Systems (3)**

**Work design and measuring using a predetermined time system such as methods time measurement, basic motion time-study, or work factor. Theory and application. Prereq: Work Measurement.**

**4250 Work Measurement Applications (3)**

**Application of learning curves, queuing theory, standard data methods and incentive systems to the design of industrial work situations. Prereq: Work Measurement.**

**4520 Engineering Economy (3)**

**Methods and problems in the selection or replacement of equipment. Decisions among engineering alternatives, involving capital recovery, economic life, equipment, and scrap values. Credit for industrial engineering students. Not available for graduate credit for industrial engineering students.**

**4530 Case Studies in Engineering Economy (3)**

**Application of engineering economy principles to actual problems faced by competitive firms and regulated industries. Case studies taken from literature form basis of classroom discussion. Out-of-class assignment is made which involves working with local companies to evaluate, make or buy options, leasing versus cash purchases, equipment replacement studies, energy source economics, etc. Prereq: 4550.**

**4540 Industrial Development (3)**

**Factors other than mechanical or chemical which enter into the successful establishment of manufacturing enterprises. Costing and market analysis to determine the commercial feasibility of new plants or projects.**

**4580 Simulation (3)**

**Generation of outcome of a complex random process by computer. Models of complex systems using available simulation languages. Simulation as a design tool in industrial systems. Prereq: Computer Science 3150.**

**4810 Human Factors in Work Design II (3)**

**Human capabilities and limitations affecting work place layout, working environment, design of tools and equipment, and communication and response in man-machine systems.**
5430 Health Systems Engineering (3) A study of health systems and the models by which they may be improved through the application of modern industrial engineering principles and techniques. Prereq: Work Methods and Design.


4910-20-30 Special Topics in Industrial Engineering Topics (3, 3, 3) Open with consent of instructor. May be repeated.

4950 Industrial Safety (3) Development of organization and programs for prevention and control of accidents with emphasis on OSHA Rules and Regulations.

5000 Thesis

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

5110 Work Design (3) Advanced methods and principles for the design and improvement of work systems, human factors, workers' response and management participation. Prereq: Motion and Time Study or Work Methods and Design.

5210 Advanced Work Measurement (3) Characteristics of some of the better known 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 techniques in manufacturing facility. Prereq: Production Facilities Planning or consent of instructor.

5250 Advanced Scheduling (3) Review of scheduling problems and methods, mathematical formulation. Solutions, analysis and development of heuristic procedures for scheduling. Topics include evaluation and costs of scheduling. Prereq: 4230.

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.


5600 Human Factors Engineering (3) Study of the characteristics of man which influence the design, equipment, environment and products. Particular attention given to the modeling of man as a process or system controller. Prereq: Consent of instructor.

5610 Human Factors Engineering (3) The human operator's transfer characteristics are described through both quasi-linear models and models describing the operator as an information processor. Prereq: 4610 or 5600.

5700 Optimization Methods in Industrial Engineering (3) Review of classical optimization theory, N-dimensional geometry and the calculus of variations, to selected areas of operations research. Prereq: Computer Science 3150 and Matrix Algebra.

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: Computer Science 3150 and Matrix Algebra.

5720 Queuing Models, Inventory, and Simulation (3) Waiting line models and the analysis of inventory systems. Development of simulation methods and computer simulations applied to inventory and waiting line problems. Emphasis will be given to the computational aspects as well as the theoretical aspects of dynamic programming. Decision making under certainty and under risk will be considered. Prereq: 5710.

5740 Advanced Topics in Optimization of Dynamic Systems (3) Advanced topics in multi-stage optimization techniques. Topics may include incremental dynamic programming, adaptive optimization theory, and other selected topics. Prereq: 5720.


5900 Design Project (1-4) Study of an industrial engineering project to fulfill the design project requirement in the non-thesis program. Enrollment limited to industrial engineering students. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5910-30 Special Topics in Industrial Engineering (3, 3, 3) Special problems for students who are qualified to do individual or group research projects. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6520 Operations Research Models in Engineering Economy (3) Review of traditional capital planning and budgeting techniques. Analysis and application of operations research approaches to capital budgeting problems with emphasis on mathematical programming and computer simulation. Interrelated topics. Prereq: consent of instructor or permission of instructor. Choice of appropriate evaluation criteria are considered. Prereq: 5520, 5710.

6700 Nonlinear Programming (3) Development of optimization techniques for static and dynamic nonlinear problems. Emphasis is placed on the computational aspects as well as the theoretical aspects of dynamic programming. Decision making under certainty and under risk will be considered. Prereq: 5710.

6740 Dynamic Programming (3) Techniques for solving multistage optimization problems as a sequence of single-stage optimization problems. Emphasis will be given to the computational aspects as well as the theoretical aspects of dynamic programming. Decision making under certainty and under risk will be considered. Prereq: 5710.

6920 Advanced Topics in Industrial Engineering (3) Selected topics of current interest. Topics will cover those not covered in other graduate courses. The course will provide a forum for advanced graduate students to study individually or in a group as appropriate. Prereq: Graduate standing and consent of instructor. May be repeated with consent of department.

Mechanical and Aerospace Engineering

MAJORS DEGREES

Aerospace Engineering A.E., M.S., Ph.D. Mechanical Engineering A.E., M.S., Ph.D.

Professors: M. W. Milligan (Head), Ph.D., Tennessee, P.E.; J. F. Bailey, Ph.D., Lehigh, P.E.; G. W. Braun, Ph.D., Georgia Institute of Technology; R. W. Holland, M.S., Texas A. & M., P.E.; B. H. Goheer, Ph.D., California Institute of Technology, P.E.; J. W. Hodgson, P.E., Georgia Institute of Technology, P.E.; J. Wu*, Ph.D., California Institute of Technology, Y. L. Wu*, Ph.D.
G R A D U A T E  S T U D Y  P R O G R A M S

Graduate programs with specializations in mechanical engineering or aerospace engineering are available which lead to the degrees of Master of Engineering, Master of Science, and Doctor of Philosophy. In addition to the general policies and requirements of the Graduate School each student must satisfactorily complete a program of study which has been approved by the student's committee. Specific program requirements are given below.


Entrance into the Master of Engineering program is restricted to qualified graduates of ECPD-accredited undergraduate curricula in mechanical or aerospace engineering. At least one-third of the program of study must be classified as engineering design. The student's advisor will assist in planning the program of study to ensure that it includes the necessary design content.

Three program options (thesis, course, and problems) are described below. Note that some students may not be eligible for the course option.

M A S T E R  O F  S C I E N C E  P R O G R A M S

Entrance into the Master of Science programs is available to qualified graduates of recognized undergraduate curricula in mechanical or aerospace engineering and to qualified graduates of other curricula who satisfy the necessary prerequisites. Three program options (thesis, course, and problems) are described below. Note that some students may not be eligible for the course option.

M A S T E R ' S  P R O G R A M  O P T I O N S

Three program options are available:

1. The Thesis Option The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 36 quarter hours of course work (4000-level or above) in mathematics.
   2. A minimum of nine quarter hours of credit in the thesis.

2. The Course Option 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 committee. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   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. No more than three quarter hours of engineering course work may be below the 5000 level.

3. The Problems Option The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   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.

4. A minimum of 36 quarter hours in mechanical and/or aerospace engineering courses numbered 5000 and above, with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis, problems or dissertation credit.

5. Participation in the departmental seminar program.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

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 normally use more than one 4000-level engineering course to meet their advanced degree requirements. Non-mechanical or non-aerospace engineering graduate students should consult with instructors regarding prerequisites for undergraduate courses.

M e c h a n i c a l  E n g i n e e r i n g

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 Applied Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties; applications to engineering problems. Prereq: College physics and calculus.

3311 Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties.

3330 Engineering Thermodynamics (3) Properties of gases and mixtures; chemical reactions; equilibrium; applications to mechanical engineering problems.

3410 Fluid Flow (3) Development of continuity, momentum and energy principles for fluid systems; applications to mechanical and aerospace engineering problems.

3440 Heat Transfer (3) Heat transfer processes, heat conduction, thermal radiation.

3520-30-40 Thermal Sciences (3, 3, 3) Fundamental principles of thermodynamics and transport phenomena as applied to engineering design. To be taken in sequence.

3610 Mechanics of Machinery—Kinematics (3) Machine motions, graphical and analytical methods, instantaneous centers; velocities, accelerations.

3620 Mechanics of Machinery—Dynamics (3) Newton's laws; work, energy, impact; single degree vibrating systems. Balancing of machinery.


3650 Introduction to Machine Design (3) Ductile-brittle behavior of materials under static and cyclic loading. Stress concentration, design factors and theories of failure. Changes

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1 Alumni Distinguished Service Professor.
2 Space Institute, Tullahoma.
in material behavior in processing and fabrication; 2 hrs and 1 2-hr lab.

3660 Manufacturing Processes (3) Selection of manufacturing processes. Prerequisites: knowledge of machine parts. Casting, hot and cold forming, metal removal and weldments. Manufacturing tolerances and surface finishes. 2 hrs and 1 2-hr lab.

3910 Engineering Analysis (3) Advanced analysis techniques for problems of aerospace and mechanical engineering. Emphasis on approximate methods.

4140 Energy Conversion Systems (3) Laws governing energy transformations and their application to power plants.

4150 Energy Conversion Systems (3) Operating and design characteristics of new technology energy conversion systems, selected direct conversion techniques.

4160 Energy Conversion Systems (3) Economic and technical design parameters as applied to power plants for public utilities or industrial applications. Selected design and layout problems.

4170 Turbo-Machinery (3) Basic principles of turbo-machinery; systematic methods of analysis, design performance evaluation.

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.

4220 Environmental Noise (3) Basic principles of noise—measurement and control of noise in industrial and community environments.

4420 Heat Transfer (3) Heat transfer by free and forced convection, heat transfer in phase change, heat transfer in high speed flow, heat exchanger applications.

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.

4471-91 Experimental Mechanical Engineering (3, 3) Experimental methods and measurement of force, length, time, temperature, pressure, transport rates, and physical properties. Planning, conducting, analyzing, and reporting experiments run according to test standards and other specifications.

4510 System Dynamics (4) Analytical models of physical systems, linearization, Laplace transforms, dynamic characteristics and stability of systems, numerical simulators, and analog computer solutions. Not for department graduate credit.

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.

4622 Tool Design (3) Principles underlying tool and fixture design of high-volume production tools and molds, work holding fixtures.


4624 Manufacturing Engineering Systems Design (3) Design of complete 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) Principles of operating dimensional analysis of size and form; true position tolerance theory; tolerance analysis; and workplace control for production to tolerance.

4631 Energy Methods in Mechanical Design (3) Application of strain energy principles in complex beams and structures.

4632 Application of Lagrangian Mechanics in Vibration Problems (3) Generalized coordinates and multiple degree of freedom vibrating systems.

4633 Matrix Analysis (3) Application of matrices to solution of complex structures and lumped parameter vibrating systems.

4660 Materials and Manufacturing Process (3) Selection of materials in design process, emphasizing relationships between stress and strain analysis, material properties, environment, temperature, manufacturing technology and cost.

4700 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design of machine elements, precision and shafting; design of sleeve and rolling element bearings.

4720 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design of cam, gearings, brakes and clutches; selection of chains and belting.

4860 Machine Design (3) Innovative design of complete machine; documentation including specifications, design calculations, working drawings and cost analysis. Written and oral report.

4710 Thermal Environmental Systems (3) Vapor compression and absorption cycles; heat pump systems; moist air properties; psychrometric processes.

4770 Thermal Environmental Systems (3) Design and analysis of air washers, cooling towers and extended surface coils; solar radiation; building heat transmission; physiological effects.

4770 Thermal Environmental Systems (3) Design of heating ventilation and air conditioning systems.

4810 Internal Combustion Engines (3) Thermo-chemical phenomena in internal combustion and propulsion engines. Combustion, detonation; equilibrium; dissociation. Analysis of internal combustion engines using ideal and real fluids.

4830 Propulsion Systems (3) Design of propulsion engine and supporting systems.

4910-20-30 Selected Topics in Mechanical Engineering (3, 3, 3) Problems related to developments and practice in mechanical engineering.

5000 Thesis

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

5110 Conduction Heat Transfer (3) Analysis of steady state and transient heat conduction by analytical and numerical techniques. Prerequisite: Undergraduate heat transfer, Engr. Analysis, and Math 3150.

5120 Convection Heat Transfer (3) Equations of viscous fluid flow, energy equation, convection analysis of internal and external flows including the effects of variable heat flux, surface temperature, and fluid properties. Prerequisite: 5310 or equivalent.

5310 Radiation Heat Transfer (3) Properties of radiating media, diffuse and specular surfaces and extended surfaces. Gas radiation. Prerequisite: Undergraduate heat transfer.

5410 Phase Change Heat Transfer (3) Prerequisites: Consent of instructor.

5420 Environmental Noise (3) Basic principles of noise—measurement and control of noise in industrial and community environments.

5450 Lubrication (3) Hydrodynamic theory of lubrication of sliding bearings; application of Navier-Stokes equations to infinite and finite bearings; solar radiation; building heat transmission; physiological effects.

5471-91 Experimental Mechanical Engineering (3, 3) Experimental methods and measurement of force, length, time, temperature, pressure, transport rates, and physical properties. Planning, conducting, analyzing, and reporting experiments run according to test standards and other specifications.

5510-20-30 Rocket Propulsion Systems (3, 3, 3) Rocket propulsion fundamentals. Topics in chemical, electrical and nuclear propulsion systems.
current research at The University of Tennes-
see, Knoxville. May be repeated. S/N only.

5990 Special Topics in Aerospace Engineering
Credit to be arranged, 3 hrs maximum each quar-
ter.

6000 Doctoral Research and Dissertation


6320 Magneto-hydrodynamics II (3) Continuum magneto-hydrodynamic equations: Alfvén and shock waves, exact solutions for magneto-hydrodynamic channel flows, one-dimensional model of channel flow, theoretical magneto-hydrodynamic boundary layer. Prereq: 6310, Math 5620.

6330 Magneto-hydrodynamics III (3) Engineering applications of magneto-hydrodynamics with particular emphasis on propulsion and power generation. Prereq: 6320, Math 5630.

6410 Physical Gasdynamics (3) The fundamentals of high-speed, high-temperature flow of a gas from the molecular point of view; molecular concepts of simple kinetic theory, equilibrium properties of gases and gas mixtures as obtained from steady-state kinetic theory, chemical thermodynamics, and statistical mechanics. Prereq: 5220 and ME 5220.

6420 Physical Gasdynamics (3) Continuation of 6410; flows of gas mixtures in local thermodynamic and chemical equilibrium; physical and chemical basis of rate equations; flow with vibrational and chemical nonequilibrium. Prereq: 6410.

6610 Advanced Boundary Layer Theory (3) Derivation and critical review of the governing equations. Asymptotic solutions; similarity and methods; boundary layer transformations. Approximation integral methods to include compressibility and heat transfer. Application of attached and separated flows; shock-wave-boundary layer interaction. Prereq: 5220, ME 5120, and Physics 5620.

6910 Advanced Topics in Gasdynamics (3) Selected advanced topics in gas dynamics. The selection of topics will be based on the particular interests of the students registering for the course. Representative topics may include non-equilibrium transport phenomena, radiation gas dynamics, non-equilibrium gasdynamic flows, advanced kinetic theory, perturbation techniques. Prereq: Consent of instructor.

Nuclear Engineering

MAJOR DEGREES

Nuclear Engineering

M.E., M.S., Ph.D.


Associate Professors: H. L. Dodds, Ph.D. Tennessee; J. B. Pussey, Ph.D. Georgia Institute of Technology; H. G. Roland, Ph.D. Tennessee; O. L. Smith, Ph.D. Missouri.

Assistant Professor: L. Miller, Ph.D. Texas A & M, P.E.

MASTER OF SCIENCE PROGRAM

A graduate program leading to a degree of Master of Science is available to graduates of recognized undergraduate cur-
icula in engineering and physics. Each applicant will be advised as to the neces-
sary prerequisite courses before he/she enters the program.

The student must complete a program of study of 45 quarter hours which has been approved by the student's advisory committee and which includes the following:

1. A major consisting of a minimum of 18 quarter hours of graduate courses in nuclear engineering.
2. A minor of 9 quarter hours in mathematics.
4. Final examination covering the thesis and graduate course work.

An alternate program is available for the Master of Science degree which involves engineering practice rather than a thesis. The student must complete a program of study which includes the following:

1. Thirty-six quarter hours of course work similar to the requirements for the regular Master of Science program (see above).
2. Twenty-four quarter hours of Nuclear Engineering 5960, Nuclear Engineering Practice. A student usually registers for 6 hours of Nuclear Engineering 5980 each quarter and investigates problems assigned by a member of the faculty. At the end of each quarter the student submits a written report and makes an oral presentation of the work.
3. Final examination covering graduate course work and practice school problems.

MASTER OF ENGINEERING PROGRAM

A graduate program in nuclear engineering leading to the degree of Master of Engineering is available to those graduates with an accredited engineering degree or one which satisfies ECPD basic level criteria.

In addition to Graduate School requirements the following degree requirements must be met:

1. 36 quarter hours of course work, 18 of which must be in nuclear engineering.
2. A minimum of 9 hours of design project, thesis, or Nuclear Engineering Practice (5960). Documentary proof of significant engineering experience may be submitted in lieu of the design project, thesis or Nuclear Engineering Practice, but in this case 45 hours of course work are required.
3. Nine hours of course work submitted must be from out of department.
4. A minimum of one-third of the program must be in engineering design, and one-third in one of, or a combination of, advanced math, computer sciences, basic sciences, or engineering sciences.
5. A candidate must pass a final oral examination on all work presented for the degree.

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. In addition, the candidate 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 design.

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

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.
2. A minimum of 36 quarter hours of credit in doctoral engineering.
3. A minimum of 45 quarter hours in nuclear engineering courses numbered 5000 and above (or the equivalent), with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.
4. A minimum of 18 quarter hours in mathematics or computer science in courses beyond nuclear engineering undergraduate requirements. Must be numbered 4000 or above.
5. A minimum of 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/her knowledge in a given field.
6. A reading knowledge of one foreign language will be determined by the student's doctoral committee.

4110-20-30 Introduction to Nuclear Reactor Theory (3, 3, 3) Nuclear structure; radioactive decay laws; neutron interaction; fission processes, chain-reaction systems; diffusion equations including multigroup diffusion theory, neutron moderation; reactivity coefficients; perturbation theory. Prereq: Physics 3730 or consent of instructor.


4210-20-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation, counting theory, half-life 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 neutrons and adjoint flux. Prereq or Coreq: 4110 or equivalent.

4550 Reactor Simulation Laboratory (3) Simulation of reactor design and operation with analog computer; reactor kinetics; single and multigroup theory, reactivity coefficients, poisoning, control rod calibration; power reactor; subcritical assembly. Prereq: 4110 or equivalent.

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.

48 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; fuel element thermal design, steam generator design. Prereq: 4710.

4730 Nuclear Reactor Design (3) First order reactor design, integration with non-nuclear heat transfer and power conversion system, economic evaluation; optimization procedures, description of typical systems. Coreq: 4130.

4810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation, shield design. Prereq: Physics 3720, Math 4710.

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 accidents; fission product release and transport; containment systems; accident analysis; engineering safeguards. Prereq: 4150. 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: 4123.

5000 Thesis

5092 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110-20-30 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) 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 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.

5310-20-30 Nuclear Systems Reliability (3, 3) Principles of system reliability analysis as applied to nuclear systems. Both qualitative and quantitative methods are included. Coreq: Stat 3450.

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. Prereq: 4130 or equivalent.

5740 Reactor Shielding (3) Application of analytic solutions of Boltzman transport equation to shield design problems. Spherical harmonics; moments methods, numerical solutions, adjoint calculations, and invariant 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 breeders; 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. Integration of neutronic, mechanical and thermal flow systems. Cycle, reactor plant cost estimating.

5960 Nuclear Energy 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.

5980 Nuclear Engineering Practice (3-12) Experiences in solving and reporting on engineering problems. Prereq: Consent of instructor. May be repeated with consent of department.

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 crises, two-phase instabilities. Prereq: 5130 or equivalent.
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 head in the area of the student's major interest or from the Associate Dean of the College of Home Economics for the interdisciplinary doctoral program.

PROGRAMS LEADING TO THE DEGREE OF MASTER OF SCIENCE

Thesis Option:

Majors and minors are offered in the following areas:
- Child and Family Studies
- Consumer Studies and Housing
- Public Policy
- 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

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.

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 seminar work in any one area of home economics.

Non-Thesis Option:

The non-thesis option is available for all majors listed under the thesis option and is the only option available for public health nutrition.

In addition to the regulations of the Graduate School, the non-thesis program of study for all majors except consumer studies and housing; public policy** shall consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000 level. A minimum of 27 hours of 5000- and 6000-level courses is required in the pro-

* Requirements include Crafts, Interior Design, and Housing 5615 or Child and Family Studies 5170, Child and Family Studies 5720 or Planning 5100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5600. Three-hour course in research methods or statistics.

Twenty-four hours in consumer studies or housing to include nine hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5200.

In addition to the regulations of the Graduate School, the non-thesis program of study for all majors except consumer studies and housing; public policy** shall consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000 level. A minimum of 27 hours of 5000- and 6000-level courses is required in the pro-

** Requirements include Crafts, Interior Design, and Housing 5615 or Child and Family Studies 5170, Child and Family Studies 5720 or Planning 5100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5600. Three-hour course in research methods or statistics.

Twenty-four hours in consumer studies or housing to include nine hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5200.

In addition to the regulations of the Graduate School, the non-thesis program of study for all majors except consumer studies and housing; public policy** shall consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000 level. A minimum of 27 hours of 5000- and 6000-level courses is required in the pro-
gram. Some majors may require nine hours in one collateral area.

Request for the non-thesis option must be made in writing by the student to the department head not later than the end of the first term in residence.

DOCTORAL PROGRAMS

The doctoral program in home economics provides three options for study: interdisciplinary, food science, and nutrition. The interdisciplinary option involves all departments in the College.

The doctoral program with a major in home economics requires:

1. A minimum of 96 quarter hours in courses beyond the Bachelor's degree exclusive of credit hours for the dissertation.
2. Selection of an option and fulfillment of the requirements as supervised by the faculty committee.
3. The faculty committee for each doctoral student shall determine whether a reading knowledge of a foreign language is required.
4. Written preliminary examinations.
5. Doctoral research and dissertation (minimum 36 hours; maximum, 48 hours) may be included in the 96 hours presented for the degree.
6. A final examination.

Option Requirements:

Interdisciplinary option:

1. Home Economics 6110-20, 6210.
2. Twenty-four to 36 hours from at least two different departments in the College of Home Economics representing one of the following concentrations: Individual and Family Behavior as related to development and change throughout the human life cycle. Emphasis may be on normal developmental processes, in individuals and families; socialization through child-rearing, adolescent, and adulthood; behavior in diverse environmental and cultural settings; interaction processes within families; community services and planning to meet development needs of individuals and families.

Phylogeological 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.

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; aesthetics in improving the quality of the environment.

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 areas.

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, 5700-40, 6110, Food Systems Administration 6110; and Zoology 5350 (Biometry) or equivalent.

2. Twenty-four hours in 5000 and 6000 level courses in food science or in food systems administration.

3. Nine hours in a collateral area (upon approval of student's faculty committee) 4000, 5000, and 6000 courses in collateral area may be substituted for 5000 and 6000 courses in food science or in food systems administration.

4. Minimum of four hours of credit in doctoral seminar.

Nutrition option:

1. Thirty hours of 5000 or 6000 courses in nutrition exclusive of research and Zoology 5350 (Biometry) or equivalent.

2. Nine hours in a collateral area (upon approval of student's faculty committee) 4000, 5000, and 6000 courses in collateral area beyond the 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 Arrowmont 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 92.

GRADUATE PROGRAMS FOR HOME ECONOMICS EXTENSION

Graduate programs at both the doctoral and Master's levels are available for students interested in home economics extension. At the doctoral degree level, programs of study may be planned in the interdisciplinary or in the food science or the nutrition options. A Master's degree may be completed in Consumer Studies and Housing, Public Policy being 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

Child and Family Studies

Consumer Studies and Housing: Public Policy

Home Economics

DEGREES

M.S.

Ph.D.

Associate Professors:

J. L. Cunningham, Ph.D. Michigan State;

D. B. Eastwood, Ph.D. Tufts;

V. M. Nordquist, Ph.D. Tennessee;

R. M. Swagler, Ph.D. Ohio State.

Assistant Professors:

M. F. Kaloine, Ph.D. Massachusetts;

B. C. Miller, Ph.D. Minnesota;

M. L. Rawlings, Ph.D. Pennsylvania State;

H. M. Reed, M.S. Tennessee; P. Scott, Ph.D. Tennessee;

L. Southworth, Ed.S. Tennessee;


Professors:

R. L. Highberger, Ph.D. Iowa; J. L. Kulpers
(Head), Ph.D. Michigan State.

Associate Professors:

J. L. Cunningham, Ph.D. Michigan State;

D. B. Eastwood, Ph.D. Tufts;

V. M. Nordquist, Ph.D. Tennessee;

R. M. Swagler, Ph.D. Ohio State.

Assistant Professors:

M. F. Kaloine, Ph.D. Massachusetts;

B. C. Miller, Ph.D. Minnesota;

M. L. Rawlings, Ph.D. Pennsylvania State;

H. M. Reed, M.S. Tennessee; P. Scott, Ph.D. Tennessee;

L. Southworth, Ed.S. Tennessee;

4110 Student Teaching in Preschool Settings (3) Increasing responsibility for planning and guiding groups of young children under supervision of head teacher includes 2 hr weekly seminars in Early Childhood Education, Program Planning for Preschool Children, Creative Experiences for Preschool Children, Child Development, and Core: Student Teaching of Preschool Children.

4210 Family Finance (3) Analysis of alternate ways of meeting financial problems encountered during life cycle of family. Prereq: Human Socialization or Family Nutrition.

4230 Conserving Time and Energy in the Home (3) Application of management principles to homemaking activities; evaluation of equipment, work centers and work procedures in terms of time and energy demands. Adaptations for the handicapped.

4230 Infant Development (3) Development during prenatal period and during first 2 years of life. Prereq: Human Socialization or Human Development, physiology or equivalent.

4260 Adult Development and Aging (3) Adult life in our society. Adjustment to internal and environmental changes through middle and aged years. Prereq: Human Socialization or Family Nutrition. Human Development or equivalent or consent of instructor.

4350 Advanced Child Development (3) Survey of selected theories relevant to child development. Emphasis on emphasis on role of literature and research methodology. Prereq: 6 hrs psychology and 6 hrs child development or equivalents.

4400 Learning Experiences with Parents (3) Dynamics of parent-teacher interaction. Emphasis on a variety of techniques for developing positive interaction 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. Prereq: Intimate Relationships or Family Development.

4610 Child in the Community (3) Needs of children; community agencies meeting these needs; visits to agencies contributing to the welfare of children. Prereq: Human Socialization, Human Development or equivalent.

4620 Administration of Programs for Young Children (3) Planning for the staff, housing, feeding, scheduling, and financing for day care of infants and young children, nursery school programs, and specialized programs for young children. Prereq: Program Planning for Preschool Children, Music and Literature for Preschool Children, or 4110.

4630 Field Work in Child, Family and Consumer Studies (3) Opportunity for student to work in nursery schools or community 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 selected topics pertinent to the field; topics selected for study to be determined by students and instructor with departmental approval. Prereq: Consent of instructor. May be repeated with consent of department head. Maximum 9 hrs.

4810 Afro-American Families (3) Historical background, family structure and relationships; emerging needs and programs. Prereq: 4 hrs in social sciences.

4830 Consumers and the Market (3) Factors important to homemakers as family purchasing agents; standardization of goods; grading, branding, labeling; advertising; consumer practices; reflecting costs; specific household commodity information. Prereq: Principles of Economics.

5000 Thesis

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

5050 Practicum (1-12) Field experience in selected agencies and organizations that focus on solutions to particular problems. 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. Prereq: Consent of instructor or CQID 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.

5160 Management of Time and Energy in the Home (3) Developing and selecting labor-saving methods and devices for the able-bodied and the handicapped. Analysis of literature, relevant trends and methods of research. Prereq: 4220 or consent of Instructor.

5170 Consumer Economics (3) Consumer functions in the economy; structure of consumer markets; government action relating to consumers; factors affecting prices of consumer goods.

5180 Family Financial Consultation (3) Analysis of family expenditure patterns, consideration of common financial difficulties, and avenues by which families are assisted. Field experience with consumer consulting services. Prereq: 4530 or 4530 or 5170.

5190 Standards in Consumer Protection (3) Product and performance standards in consumer protection. Theoretical and operational questions relating to standards, including analysis of costs and benefits to consumers. Prereq: 4830, 5170 or consent of instructor.

5210 Theories of Child Development (3) Major theories of child development. Prereq: 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 Sexuality (3) Cultural, social, and psychological dimensions of human sexuality. Review of major contributions from anthropological, sociological, and personality theory and research.

5410 Advanced Family Relationships (3) Problems in modern family life; individual adjustments and family relationships. Prereq: Family Development, 4430, or consent of instructor.

5420 Parents and Children (3) Discussion of common problems of young children faced by parents and teachers with particular emphasis on methods available to modify problem behavior.

5430 Families in Crisis (3) Interpersonal transactions in disordered family behavior. Prereq: 5410 or equivalent.

5510 Survey of Research in Child and Family Studies (3) Review, evaluation, discussion of research literature; locating, abstracting, reporting research studies. Prereq: 5530 or equivalent.

5530 Research Methods in Child and Family Studies (3) Basic and advanced research procedures used in study of child and family behavior; basic methodology of the behavioral sciences. Prereq: Research Methods as prerequisite to beginning thesis work in this area. Prereq: 9 hrs child and family studies.

5540 Supervision in Preschool Programs (3) Emphasis on guidance of students working in nursery school and child care. Prereq: Supervising 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 in attempting to develop 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 clinic. May be repeated. Maximum 9 hrs.

5840 Family Planning Programs (3) Community and family planning programs. Internship in planned parenthood programs and clinic. May be repeated. Maximum 9 hrs.

5900 Seminar in Child and Family Studies (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6250 Advanced Topics (3) Comprehensive individual study and group discussion of topics related to current problems in the areas. Prereq: Consent of the instructor. May be repeated. Maximum 9 hrs.

6310 Individual and Family Development, Physiological Development (1-3) Advanced study selected from the field of family members' physiological potential, development, and status. The family's contributions to members' developmental potential for growth and development and to the realization of human potential. Prereq: 6 hrs in advanced child studies and 3 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, 6530, 6535, 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 and concepts of family 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 perspectives for understanding families. Exploration and applications of frameworks on both theoretical and research levels. Historical to contemporary development of family theories. 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.

6510-20 Applied Behavior Analysis in Natural Settings (6, 6) Individual supervision in the application of behavior analysis in natural settings. Prereq: 5420 or consent of instructor.

6710 Elements of Consumer Choice (3) Analysis of consumer decision making, beginning with the theory of consumer choice. Impact of influence on consumers and consideration of dynamic aspects of consumer behavior. Involving all the roles of aspirations, expectations, uncertainty and information. Prereq: 5170 or consent of instructor.

6720 Consumer Protection (3) Consumer protection issues including: regulation, standards, information disclosure and other consumer protection legislation. Assumptions involved in these efforts and relative success of the consumer protection legislation. Assumptions about standards, information disclosure and other regulatory agencies, including selected agencies and organizations that focus on these issues. Prereq: 5410 or equivalent.

To be admitted to the Graduate School in the craft program a student must have a professional knowledge of media and technique. Work with creative design concepts is emphasized at the graduate level; media and technique are important only in so far as the experimentation with these contributes to the 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 as a personal and group expression of 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 comprehension 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). An interdisciplinary program in consumer studies and housing: public policy is available to students with interest in the social science approach to housing. Courses dealing with the design aspects of housing may be selected.

PI BETA PHI ARROWMONT SCHOOL OF CRAFTS Graduate students in the area of crafts have a unique opportunity to participate in the summer program at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Instructors at the school are nationally and internationally recognized designers-craftsmen who offer additional areas of expertise. Therefore, graduate students attend the Arrowmont School of Crafts during the summer term(s) and pay the additional fee for housing. Prereq: 5170, 5190 or consent of instructor.

Crafts, Interior Design, and Housing

MAJORS

DEGREES

Crafts, Interior Design, and Housing

Consumer Studies and Housing:

Public Policy

M.S.

Ph.D.

Professors:

R. G. Blackmore (Head), Ph.D. Florida State; J. A. Corbin, M.A. Ohio State; M. G. Heard (Director, Arrowmont School of Crafts), A.M. Columbia.

Associate Professors:

L. M. Mamer, M.S. Iowa State; W. Moran, M.S. Wisconsin.

Assistant Professors:


Lecturers:


4110 Home Wiring and Lighting Requirements (3) Service of electricity in modern homes; evaluation of lighting and wiring plans in terms of family desires and need for equipment. 1 hr and 2 labs.

4130 Contemporary Design (3) Furnishings and interior designs in relation to materials, props and special exhibition areas. Emphasis on knowledge and understanding of the design principles as they relate to promotion, design construction, display and evaluation for two and three dimensional work. Annual student Craft and Interior Design exhibit culminates 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 or consent of instructor.

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 and designer for industry.

4320 Family Housing Problems (3) Housing problems for 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 projects 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

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter whom a student uses university facilities and/or faculty time before degree is completed. May not be used toward major requirements. Prereq: 5210 or equivalents. S/NC only.

5040 Seminar in Design (3) Intensive reading, discussion and critical evaluation of twentieth century design concepts, terms, and movements and the creative components leading to visual innovation.

5050 Advanced Design Studio (4) 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.
5345-57-67 Ceramics I, II, III (4, 4, 4) 5347—
Initial development of theory of investigation of the development of 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.


5367-Experimentation in the graduate exhibition. PreReq: Consent of instructor.

5330 Craft Design (3) Fine design in international crafts; designing in basic craft media. 1 hr and 2 labs.

5341-51-51 Metal Design I, II, III (4, 4, 4) 5341—Initial development of theory of investigation of aesthetic concepts in the development of two and three dimensional forms in metal design. 5351—Advanced experimentation using aesthetic concepts in the development of two and three dimensional forms in metal design. 5361—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. PreReq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5342-52-62 Weaving I, II, III (4, 4, 4) 5342—
Initial development of theory of investigation of aesthetic concepts in the development of two and three dimensional forms in weaving. 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 weaving 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 of investigation of aesthetic concepts for the surface decoration of textiles. 5353—Advanced experimentation in unifying 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 of investigation of aesthetic concepts in two and three dimensional forms in wood design. 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 of investigation of aesthetic concepts 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 of investigation of aesthetic concepts in plastics and consent of department head. Each course may be repeated one time.

5347-57-67 Ceramic Science and Consent of Instructor.

5350-60-70 Fabric Structures I, II, III (4, 4, 4) 5350—
Initial development of theory of investigation of aesthetic concepts in the development of fabric structures. 5370—Experimentation in unifying concepts in preparation for the graduate exhibition. PreReq: Previous work in fabric structures and consent of department head. Each course may be repeated one time.

5368 Ceramics—Glaze Calculation (4) Experimentation using various types of clay bodies and glazes for reduction and oxidation firing atmospheres. PreReq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5369 Ceramics—Kiln Construction (4) Investigation of kilns and kiln construction in 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 environments—aphasis on the derivation of design implications from anatomy, physiology, anthropometry, and the behavioral sciences. PreReq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5520 Environmental Factors in Interior Design (3) Study of systematic design methodology as applied to the design of 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 systematic 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 members. PreReq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5610 Furniture Design (3) Analysis of human factors data in the design of body support, task support, and storage furniture pieces and systems; emphasis on the production of construction drawings and scale models. PreReq: Consent of instructor. PreReq: Previous work in wood design and consent of department head. Each course may be repeated one time.

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 Welfare Workers (3) Research methods and techniques used in planning work centers such as for kitchens and laundries; evaluation in terms of adequacy, convenience, and social factors; facilities, fuels, costs, problems of installation and remodeling.

5810 Crafts (1-4) Advanced study in crafts. Hours and credit arranged. PreReq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5820 Interior Design (1-3) Advanced study in interior design. Hours and credit arranged. PreReq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5830 Problems in Housing (1-3) Advanced study in housing. Hours and credit arranged. PreReq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5910-30-30 Seminar (1-4, 1-4, 1-4) Hours and credit arranged. PreReq: Consent of instructor.

6110 Contemporary Housing Issues and Problems (3) Individual study and group discussion of various issues and problems related to housing. PreReq: Consent of instructor.

6120 Advanced Topics in Housing Research (3) Examination of special problems related to contemporary concepts in crafts and interior design. PreReq: 4310, 5040, 6 hrs of graduate level psychology, or consent of instructor.

6210 Environmental Design Analysis (3) Advanced methodology in the psycho-biology of environmental design with particular attention to multidisciplinary research data and methods. PreReq.: 5510-30-30.

6320 Role of Crafts in Society (3) Comprehensive individual study and group discussion of advanced concepts and current problems in crafts PreReq: 4310, 5040, 6 hrs of graduate level psychology, or consent of instructor.

6410 Conceptual Development in Craft Design (3) Advanced concepts in the use of visually perceived design elements as demonstrated in hand crafted objects and environments. PreReq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

6420 Perspectives in Crafts and Interior Design (3) Historical influences as related to contemporary concepts in crafts and interior design. PreReq: 5640, 6 hrs of graduate level art history, or consent of instructor.

Courses offered periodically only at the Pi Beta Phi Arrowmont 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)
Food Science, Nutrition, and Food Systems Administration

MAJORS

Food Science
Nutrition
Food Systems Administration
Home Economics

DEGREES

M.S.
M.S.
M.S.
Ph.D.

Professors:


Associate Professors:

F. E. Andrews, Ph.D. Ohio State; M. A. Bass, Ph.D. Wisconsin; G. W. Hubbard, Ph.D. Indiana; R. H. Holman, Ph.D. Wisconsin; J. R. Smith, Ph.D. Missouri.

Assistant Professors:


Food Science

4000 Origin of Food and Foodways (3) Tracing of food and the development of individual and groups. 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 batters and dough systems. Prereq: Nature of Foods II.


4040 Food in Contemporary Society (3) Consumer's options, responsibilities and potential influences with respect to food supply.

5000 Thesis

5902 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5140 Foods and Nutrition: Physicochemical Principles (3) Introduction to thermodynamics; physical properties of proteins, carbohydrates, and lipids; chemistry of the solute; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: Nutrition 3320 and College Algebra or equivalent.

5510 Food Texture (3) Classification of foods according to textural parameters; use of instrumentation in the evaluation of textures. Prereq: 4101 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: 4101; 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 and changes in the choices of food and eating habits of the individual. Prereq: 4000, 3 hrs of nutrition, or consent of instructor.

5560 Foodways in the United States (3) Current foodways and food culture in the United States and the historical basis for their development. Prereq: 4000, 3 hrs of nutrition, or consent of instructor.

5610-20 Advanced Food Science (3, 3) Biochemical and biophysical interactions in food. Must be taken in sequence. Prereq: 4010; Nutrition 3320 or equivalent, or consent of instructor.

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: 4101; 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.

7000 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. Prereq: 4011 or 5530.

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 processing industry for agency. Under the supervision of a faculty member. Prereq: Consent of instructor.

6000 Seminar in Food Science (1-3) Prereq: Consent of instructor. May be repeated.

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.

6210 Food Dispersions (3) Physical characteristics of solutions, colloidial dispersions, and suspensions in relation to treatments applied. Prereq: 5530.

5310-20 Structure of Food Plants and Animal Tissues (3) Histological structure of food plants and animal tissues as related to physical characteristics and chemical properties of their components. Prereq: 5530-40.

5540-20 Food and Socio-Cultural Change (3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. May be repeated. Prereq: 5550 or 5560; or consent of instructor.

6090 Seminar (1-3) May be repeated. S/NC only.

Nourishment

3310 Organic Chemistry (4) Emphasis on subjects leading to 3320-30 and Text, and Ciba. Prereq: 3320. 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 (3) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Prereq: 3320 or equivalent. Not for graduate credit for food science, nutrition and food systems administration majors.

3333 Physiological Chemistry Laboratory (1) Emphasis on 3330 laboratory work. Prereq: 3320 or 3330. Graduate credit for food science, nutrition, and food systems administration majors.

4010 Reproductive and Developmental Nutrition (3) Nutritive requirements for expectant mothers, infants, and preschool children. Prereq: 8 hrs of nutrition, 2 hrs and 1 lab.

4020 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.

4030 Community Nutrition (3) Introduction to nutrition problems and services in the community. Supervised field experiences are an integral part of the course. Prereq: 8 hrs of nutrition. 2 hrs and 1 lab.

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: 8 hrs of nutrition. 2 hrs and 1 lab.

4331 Clinical Experience in Dietetics (1) Planned clinical experiences applying principles of nutrition in disease. Coreq: 4230.
4240 Nutrition in Disease II (3) Interdisciplinary lectures and discussions on the metabolic processes of normal and diseased organs and/or tissues and the dietary or behavior modifications required. Prereq: 4230. Designed for senior students in the coordinated undergraduate program in dietetics.

4430 Diet and Drug Therapy (3) Effect of drug therapy on absorption and utilization of nutrients, and effect of diet on absorption, utilization and toxicity of drugs. Prereq: Science of Nutrition or consent of instructor.

5000 Thesis

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

5110 Advanced Physiological Chemistry (4) Bioenergetics and related metabolism of nutrients. Prereq: 3330 or equivalent. 3 hrs and 1 lab.

5120 Advanced Physiological Chemistry (3) Nutritional factors in relation to body fluids, gas transport and endocrine function. Prereq: 3330.

5140 Foods and Nutrition: Physicochemical Principles (3) Introduction to thermodynamics; physicochemical properties of proteins, carbohydrates and lipids; chemistry of the colloid state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: Nutrition 3330 and College Algebra or equivalent.


5230 Experimental Methods in Nutrition (3) Use of small animals in experimental nutrition. Prereq: 5 hrs Science of Nutrition. 2 hrs and 1 lab.


5310 Community Nutrition I (Nutrition 5310) (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. Location of the in-depth study to be selected in consultation with the instructor. Prereq: 5320 and consent of instructor. S/NC only.

5350 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students 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 World Food Supply and Human Nutrition (3) Food supplies and food practices as related to human nutrition throughout the world. Regional, national and international agencies concerned with food and nutrition problems. Prereq: 5210 or 5410-20.

5470 Nutrition and Aging (3) Nutritional problems of the aging individual. Emphasis on nutritional requirements, dietary intakes and the effect of nutrition on the rate of biological aging. Prereq: 5210 or consent of instructor.

5510 Nutrition in Mental Retardation and Developmental Disorders (1-12) Orientation to, observation of and participation in the interdisciplinary diagnosis and treatment of the developmentally delayed child. Emphasis is given to the role of the nutritionist; includes clinical experience and lectures at the Child Development Center, Center for the Health Sciences, Memphis. Prereq: Consent of department head.

5700 Current Programs and Trends in Nutrition I (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 I (1-3) Advanced study selected from the field of nutrition. Prereq: Consent of department head and professor in charge of 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 I (3) Discussion of recent advances, concepts, research techniques and current problems. Prereq: 5410-20 or consent of instructor.

6900 Seminar (1-3) May be repeated. Maximum 9 hrs. S/NC only.

Food Systems Administration

4130 Food Systems Administration (3) Functions of management applied to food service systems. Prereq: Quantity Food Procurement, Production and Service.

4140 Food Systems Personnel Development (3) Development of training programs for food systems personnel. Prereq: 4130 or consent of instructor.

4150 Design and Layout of Food Service Systems (3) Physical facilities equipment for food service systems based on needs of the system. Procedures for purchasing equipment. Prereq: Quantity Food Procurement, Production and Service, or consent of instructor.

4250 Food and Lodging Managerial Cost Control (3) Cost analysis for control. Use of financial statements for decision making for food and lodging systems. Prereq: 4130; Fundamentals of Accounting.

4260 Food and Lodging Physical Plant, Planning and Maintenance (3) Planning, development and construction of food and lodging physical plant and maintenance. Electrical, heating, plumbing, air conditioning and ventilation and illumination systems. Systems of building materials and construction. Interdisciplinary with Home Economics, City and Regional Planning, and College of Business Administration.

4270 Food and Lodging Information Systems (3) Qualitative and quantitative analysis of information systems for decision making in food and lodging operations. Prereq: 4130, 4560, and Electronic Data Processing.

5000 Thesis

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

5110-20 Experimental Quantity Food Study (3, 3) Analysis of food production, holding environment, and service problems related to quality of food prepared in volume. Use of management resources. Prereq: 4130, Quantity Food Procurement, Production and Service, or consent of instructor.

5210 Methods of Food Systems Research (3) Research methods applicable to food systems administration. Prereq: 4130, Statistics 5211 or equivalent.

5220 Experimental Design of Food System Facilities (3) Experimental approach to environment in which food is prepared, held, and served in volume. Prereq: 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 (3) The role and responsibilities of the administrator in maintaining desired quality and quantity standards in food service delivery system. Prereq: Quantity Food Procurement, Production and Service or consent of instructor.

5350 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 food service system. Prereq: Consent of instructor.

5900 Seminar in Food Systems Administration (1-3) May be repeated.

College of Home Economics
Home Economics

MAJOR DEGREE
Textiles and Clothing Ph.D.

Professor: A. J. Treece (Head), Ph.D. Ohio State.
Assistant Professor: R. P. Dowlen, M.S. Tennessee; M. F. Miller, Ph.D. Pennsylvania State.

Lecturer: A. L. Bullock, B.S. Mississippi College.

5210 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.

5240 Design Analysis II (3) Creative interpretation of dress design terminating in finished garments developed through the media of draping, 1 hr and 2 labs.

5900 Seminar in Human Resource Development (1-3) May be repeated. S/NC only.

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6000 Doctoral Research and Dissertation

6110-20 Theoretical Issues in Human Resource Development (3, 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 administration 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 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 approaches and methodologies. Prereq: 1 graduate-level course in research methodology or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

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6000 Doctoral Research and Dissertation

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5900 Seminar in Human Resource Development (1-3) May be repeated. S/NC only.

5900 Seminar in Human Resource Development (1-3) May be repeated. S/NC only.
9800 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.

6140 Selected Behavioral Theories in Clothing (3) Role of clothing in the functioning of people, utilizing behavioral theories. Prereq: 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6150 Social-Psychological Theories of Clothing Consumption (3) Analysis and evaluation of social science theories of consumer behavior in relation to the areas of textiles and apparel. Prereq: CFS 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6160 Textile Flammability (3) Factors affecting textile flammability as a consumer issue. Standards, regulations, test methods, economic impact. Prereq: 5120, 5160, 5250, or consent of instructor.

6170 Physical Performance Behavior of Textile Structures I (3) Fundamentals of yarns and fabric structures; relationship of structure to physical characteristics of textile materials. Prereq: 5120, or consent of instructor.

6910 Seminar in Textiles and Clothing (1-3) May be repeated. Maximum 6 hrs.
Intercollegiate Programs

Aviation Systems

MAJOR
Aviation Systems

DEGREE
M.S.

Professors:
B. H. Goethert, Ph.D. Berlin; E. C. Huebschmann, Ph.D. Texas; R. L. Young, Ph.D. Northwestern.

Associate Professor:
J. M. Wu, Ph.D. California Institute of Technology; R. L. Young, Ph.D. Northwestern.

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 statistics as represented by Statistics 3450 or equivalent, a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance as represented by A.E. 4110 and A.E. 4120 or equivalent, a background in accounting as represented by Accounting 5710 or equivalent basic accounting courses, a basic knowledge of economics as represented by introductory economics or equivalent.

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 required for the degree and defense of the project course paper.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.


Electives typical of those suitable for credit in the area of Aviation Systems, Research and Development include: A.E. 5150-60-70; Computer Science 4410-20-30 and 5110-20-30; Industrial Engineering 4060, 4150, 4230, 5720, 5730, 6700, 6730; Mathematics 4220-30, 4510-20-30; Metallurgical Engineering 5510-20-30; 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.
Ecology

MAJOR

DEGREES

Ecology  M.S., Ph.D.

J. Frank McCormick, Director, Ph.D. Emory

The Graduate Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary ecology for students from undergraduate programs in basic and applied biology, social sciences, mathematics and engineering. Research opportunities in both fundamental and applied ecology are intended to prepare students for academic careers as well as professional positions in industry or government. The Environmental Sciences Division of the Oak Ridge National Laboratory and the Tennessee Valley Authority provide advisors and research facilities. The Great Smoky Mountains, Cumberland Plateau, valley and ridge topography, TVA lakes and wild rivers provide locally a spectrum of natural habitats and consequent biological diversity which is truly unique. In addition, facilities of the developed management program provide open and closed feedback loop interactions. Consideration of flight mechanics with emphasis on experimental techniques. Specially equipped airborne laboratory allows active student participation in a series of experiments demonstrating the acquisition of flight test data. Tests will be conducted covering a broad range of flight parameters and control characteristics. In addition to the development of the theory necessary to support the directed experiments, test techniques, instrumentation and data reduction methods will also be the subject of the series of lectures included in the course. 5210 encourages performance and 5220 emphasizes stability and control. Prereq: A.E. 4120.

5970 Special Topics in Aviation Systems (3) Consent of instructor. May be repeated with consent. See also course descriptions for AE 5810, AE 5920, and IE 5840.

Cybernetics and Bionics

Professors:

T. C. Helvely (Emeritus), D.Sc. H.C., University of the Atlantic*; R. S. Sleeper, M.A. Harvard*.

5110 General Systems and Cybernetics Fundamentals (3) Fundamentals of the theories of cybernetics, bionics, interelectronics, and general cybernetics. Designed with a review of the theories of information, automatic and manual controls, and computers, which are necessary for the understanding of the main topics.

5120 Cybernetic Biophysics (3) Interdisciplinary and systems aspects of the mechanism of the human body are presented which include the topology, chemistry, physics, and mental functions. Course presents primarily the engineering aspects of man; useful elective of all engineering programs.

5130 Applied Cybernetics and Bionics (3) Utilization of cybernetics and bionics for communication and control in large human systems and in the approach to man-machine systems. Eligible for those having participated in 5110 and 5120; persons primarily interested in an overview of systems dynamics may take with the instructor's consent.

5140 Cybernetics of Human Behavior (3) Aspects of human behavior with emphasis upon open and closed feedback loop interactions with the environment. Systems aspect of cognition and mental functions, second order interaction in interpersonal communication. Recommended for engineers and persons interested in man-machine interactions.

5990 Cybernetics Seminar (3)

Space Institute, Tullahoma.

* Space Institute, Tullahoma.

5080 Collection and Distribution (3) Capabilities, technology, plans, programs and developments for collecting and distributing passengers and freight to and from various types of airports. Ground, water, air and mixed transportation. Present and future requirements analysis, and model analysis of the system. Prereq: A.E. 5810.

5090 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure and administrative and enforcement procedures. Prereq: A.E. 5810.

5100 Project in Aviation Systems (3) In-depth study and formal report on an aviation systems topic, normally performed during the last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.

5210-20 Experimental Flight Mechanics (3, 3) Consideration of flight mechanics with emphasis on experimental techniques. Specially equipped airborne laboratory allows active student participation in a series of experiments demonstrating the acquisition of flight test data. Tests will be conducted covering a broad range of flight parameters and control characteristics. In addition to the development of the theory necessary to support the directed experiments, test techniques, instrumentation and data reduction methods will also be the subject of the series of lectures included in the course. 5210 encourages performance and 5220 emphasizes stability and control. Prereq: A.E. 4120.

5970 Special Topics in Aviation Systems (3) Consent of instructor. May be repeated with consent. See also course descriptions for AE 5810, AE 5920, and IE 5840.

COURSES

The following courses are those offered directly by the Ecology Program and those which, although listed in other departments, have been approved to satisfy Master's degree requirements. Additional ecology courses are described elsewhere in the catalog under the departments identified in the following list.

Agricultural Biology

4010 Biology of Soil Microorganisms (4)
4510 Freshwater Fishery Biology (4)
4520 Management of Lakes and Ponds (4)

Botany

4310 Plant Ecology (4)
5340 Plant Geography (4)
5350 Analysis of Plant Communities (4)
5510-20-30 Systems Ecology (3, 3, 3)
5830 Field Methods in Plant Ecology (4)

Master's degree are listed on page 17. A minor in ecology shall include Ecology 5210-20-30 (six hours) and at least three additional hours in approved ecology courses.

DOCTOR OF PHILOSOPHY

The requirements for this degree are in general the same as those of the Graduate School with the following two exceptions: (1) each student's faculty committee shall consist of at least two members from the department in which the dissertation is being supervised and, at least two from outside this department; (2) this doctoral program must include Ecology 5210-20-30 and a minimum of nine quarter hours of courses numbered above 6000. A student cannot enroll for dissertation until the research proposal has been discussed and approved by the doctoral committee.

Shared Faculty

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 (3)

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)

5290 Quaternary Problems (4)

Plant and Soil Science
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)

4600-70 Limnology (4, 4)

5570 Animal Populations (3)

5850 Insect Auteology (4)

5860 Geographic Distribution of Animals (4)

5870 Insect Synecology (4)

Industrial and Organizational Psychology

MAJOR
Organizational Psychology
M.S., Ph.D.

Committee:
J. M. Larsen, Jr. (Chairman); R. D. Arvey; R. L. Dipboye; M. E. Gordon; J. M. Louisburg; E. D. Sundstrom; G. H. Whitlock.

(For complete Faculty Listing, see Department 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 assistantship 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 (Prerequisite in Industrial and Organizational Psychology)

2. Statistics 5050-60-70 (Behavioral Statistics). Exemption by petition

3. Psych. 5070 (Academic Practicum)

4. Minimum of three 6000-level seminars to be selected from Psych. or I.M. 6250, 6260, 6270, and I.M. or Psych. 6300*

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 (I.M. 5220)
      Seminar in Personnel Research (I.M. 5240)
      Labor Economics
   b. Through College of Liberal Arts: Psych. 6450, 6460, 6470 (Industrial Sociology)

II. Program Requirements

A. Attainment of a B average in the Proseminar in Industrial and Organizational Psychology. (I.M. or Psych. 5170, 5180, 5190)

B. Completion of a comprehensive examination 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 the qualifications for pursuing a Ph.D. are required.
within no more than two years of entry by attaining a score of 650 on the GRE Advanced Test in Psychology.

C. Completion of a general preliminary examination in scientific methodology 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 a faculty committee, depending on the background and field of interest. If during the undergraduate work the student has, in the opinion of the faculty committee, sufficient training and education in one or more of the required courses, the student may substitute other elective courses. Electives will consist of advanced work in the student's specialty or in a related field.

3410 Principles of Ground Water Geology (3)
   (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, tomorrow in today's planning, project formulation and justification, direct and indirect economic consequences, state and local participation, and municipal and industrial uses of water developments.
The College of Liberal Arts offers programs leading to eight advanced degrees*. See page 9 for degrees and majors.

Departments of Instruction

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

Anthropology

MAJOR

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. Jaetz, Ph.D. Kansas;

M. C. R. McCullough, Ph.D. Pennsylvania.

Assistant Professors:

J. M. Bishop, Ph.D. California (Berkeley); A. M. Henderson, Ph.D. Colorado;

M. H. Logan, Ph.D. Pennsylvania State;

F. H. Smith, Ph.D. Michigan.

MASTER'S PROGRAM

The formal requirements for the Master's degree include:


1. A minimum of three quarters of residence at the University of Tennessee.
2. A minimum of 45 quarter hours for graduate credit, including preparation of thesis. Thirty-six of these 45 hours must be in anthropology, nine hours may be taken in closely related disciplines (at least one-half of the courses must be at the 5000 level).
4. A thesis. In addition to the two (2) copies required by the Graduate School, one bound copy of the thesis is to be presented to the department and one bound copy to the student's thesis advisor.

PH.D. PROGRAM

Although there is no minimum credit hour requirement for the Ph.D. degree, students in this program should plan to devote to its attainment no less than 3 years beyond the B.A. level, and to complete the following requirements:

1. Admission to Ph.D. program through passing the Graduate Evaluation Examination at completion of first year of study, or through departmental acceptance of a previously earned M.A. degree in Anthropology.
2. Formation of an Advisory Committee and establishment in consultation with that Committee of a program of study. Delineation of field(s) of competence by the student and Committee and subsequent presentation to Graduate Advisor.
3. Demonstration of competence in a foreign language as determined by the student's Committee.
4. Successful completion of oral and written comprehensive examinations and admission to candidacy.
5. Successful completion of the dissertation and final oral examination.

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.
3460 Field Work in Cultural Anthropology (3-9) A practicum devoted to fieldwork methods, ethnographic fieldwork reporting, survey and interview techniques, and the devising and carrying out of fieldwork projects. Prereq: 3 quarters of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

3560 Prehistoric of Tennessee (3) History of anthropological research in Tennessee, survey of prehistoric American Indian cultures identified through this research.

3710 European Folk Cultures (3) Traditional aspects of European life, as seen from folklorology, beliefs 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).

3900 Human Osteology (4) Intensive examination of the human skeleton. Prereq: Human Origins and consent of instructor, 3 hrs and 1 lab.


3930 The Biology of Races of Man (3) 1st quarter: Historical development; 2nd quarter: Historical development and the classification of the human species. Prereq: Human Culture recommended.

3950 Human Identification (3) Introduction to techniques used in identification of human skeletal material in forensic medicine.

4200 Contemporary North American Indian (3) Survey of Indian cultures from initial Euro-American contact 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, ordering and utilizing data. Prereq: Consent of instructor.

4240 Applied Cultural Anthropology (3) Applied cultural anthropology: theory, methodology and findings in programs of community and national development, public health, international agencies, etc. Examination of the roles of anthropologists, questions of values and ethics in intervention schemes, and steps in 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. Focus is on analyses and descriptions 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 and the folk medicine systems which co-exist with Western medical systems. Prereq or coreq: 4250.

4300 Readings in Anthropology (1-9) Intensive reading, problem oriented. Prereq: Consent of instructor.

4340 Field Work in Archaeology (3-9) Practical 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 interview techniques, and the devising and carrying out of fieldwork projects. Prereq: 3 quarters of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

4360 Field Work in Physical Anthropology (3-9) Practicum in the collection and analysis of human biological data. May include osteological, dental, and physical anthropology. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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 integrative review in symposium of the current trends, 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 sex behavior from cross-cultural and diachronic viewpoints. Draws disparate and scattered studies together and attempts to arrive at conclusions on questions as how sex roles are learned, the parameters of acceptable sexual behavior and degrees of tolerance for sexual deviation in various cultures.

4500 Peoples of China I: Chinese Society Before 1800 (3) Historical survey of Chinese society and culture during the pre-Shang, dynastic and early Western contact periods. Prereq: Human Culture or consent of instructor. Recommended: 3510 or an East Asian course.

4510 Peoples of China II: Chinese Society After 1839 (3) An anthropological survey of Chinese society and culture in the period of intense Western contact, rejection of the West, and development of modern, communist Chinese society and culture. Prereq: Human Culture, or consent of instructor. Recommended: 4500, or an East Asian course.

4550 Indians of the Southeastern United States (3) Survey of southeastern Indian cultures; emphasis on aboriginal adjustment to environment; lifeways of southeastern American groups prior to Euro-American contact. Prereq: Human Culture or consent of instructor.

4560 Cherokee Ethnology (3) Intensive survey of ideology and material aspects of Cherokee culture existing at time of first European contact.

4570 Peoples of Southeast Asia (3) Survey of representative ethnic groups and indigenous cultures of mainland and island Southeast Asia. Problems of contemporary culture changes.

4580 Asians in the Americas Since 1800: Anthropological Perspectives (3) Character, factors, and motivations in Asian immigration to North, Central and South America. Assimilation patterns and enclave communities are major focus. Prereq: Human Culture or consent of instructor.

4590 Peoples of Japan (3) An analysis of the cultural diversity and unity of the people of Japan. Prereq: Human Culture or consent of instructor. Recommended 3510 or an East Asian course.

4600 Method and Theory in American Archaeology (3) The historical development of New World archaeology with emphasis on theory and field techniques. Prereq: Prehistoric Archaeology or consent of instructor.

4610 African Prehistory (3) Survey of cultural history in Africa, 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 vertebrate classes; emphasis on aboriginal man's utilization of native animals in his subsistence and culture. Identification, analysis and interpretation of archaeologically derived molluscan and vertebrate remains.

4650 Archaeology of Southeastern United States (3) Survey of prehistory of Southeastern United States, special focus on the prehistoric and early historic periods of the American Indian. Special emphasis on Tennessean prehistory. Prereq: 3510 or consent of instructor.

4740 Southern Appalachian Folk Culture (4) Research-oriented course dealing with wide range of traditional culture in Southern Appalachian cultures; emphasis on relationship of economy, clothing, belief, speech, art, song, dance, and oral traditions and customs. Prereq: Consent of Instructor. May be repeated.

4780 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 matura1ion, 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.

4960 Primate Paleontology (3) Survey of fossil primate forms; the origin and evolution of primates, the paleoanthropology of the earliest Hominid and related forms. Prereq: Human Origins, Recommended: Zool 4380.

4970 Human Paleontology (3) Survey of the major human fossil forms and interpretation of human phylogeny. Emphasis on Pleistocene and more recent Hominid forms and the factors which shaped them into 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 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

5140 Seminar in Zooarchaeology (3) Approaches to the analysis and interpretation of archaeological faunas. Intensive reading; evaluation and discussion of major faunal studies,
guides to identification, methods of presenting faunal data. May be repeated. Maximum 6 hrs.

5149 Laboratory Studies of the Vertebrate Skeleton (4) Examination and comparison of skeletal morphology of fish, amphibians, reptiles, birds, mammals. Oriented toward the identification of archaeologically derived faunas. May be repeated. Maximum 6 hrs.

5159 Laboratory Study of the Molusca (4) Examination and identification of terrestrial and freshwater mollusks of eastern U.S. Emphasis on living and archaeologically derived pelecypods. Prereq: 4640. 1 hr and 3 labs.

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: 4440 or consent of instructor.

5340 Fieldwork in Archaeology (2-9) Practicum work surveying, excavating, processing, and analyzing of data; intensive reading. Prereq: 4440 or 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-urban polarities, interactions, and different cultural manifestations of agricultural populations. Prereq: Consent of instructor.

5450 Comparative Social Organization (3) Social structure in non-literate societies. Kinship, 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 probibility or equivalent.

5470 The Healer in Cross-Cultural Perspective (3) A graduate seminar dealing with the socialization, methods of diagnosis, and therapeutic models of the healer. Particularly non-Euro-American milieus. Prereq: 4250.

5510 Seminar in Ethnology of Western North America (3) Native North American culture types west of the Rockies; selected social systems, economies, 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) A detailed study of the ancestry and evolution of various cultural elements and social systems west of the Rockies; selected social systems and their interrelationships in terms of language, religion, and social organization. Prereq: 4970. 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 prehistory 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.)

5630 The Maya (3) Intensive survey of Maya cultural traditions, from its earliest manifestations in pre-Columbian times to the present. Prereq: 3580.

5640 Archaeological Resource Management (3) Theory and practice—public, conservation, contractual, and legal aspects of the profession. Special emphasis on: legislation, contracts, responsibilities, and certification; agencies and project design, administration, and logistics; standards of field work, analysis, and publication; archaeology and the public; conservation, and archaeology as a career. May be repeated. Maximum 6 hrs.

5660 Seminar in Prehistoric Lithic Technology (3) Analysis of techniques employed in products of domestication; raw materials employed; resultant implements; their morphology and function; 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 prehistoric 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 cultural homogeneity, particularly East and Middle Tennessee. Course work includes input from professional geologists, and field research. Prereq: 5600 recommended.

5700 Theory in Folk Culture Studies (3) Graduate seminar analyzing major theoretical viewpoints of European and American folklore and field study trends from inception to the present.

5710 Problems in Folk Culture Studies (3) Topical seminar dealing with selected problems and approaches to traditional behavior in Euro-American culture. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.


5910 Measurement of Man (3) A survey of the theories of measuring and describing skeletal material and the human subject with emphasis upon the practical 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 the field of physical anthropology. Prereq: 3900.

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 medicine. Prereq: 3900.

5940 Skeletal Biology of Early Human Population (3) An intensive treatment of practical and theoretical approaches to analysis of prehistoric human skeletal populations. Demography, vital statistics, pathology, nutrition, and culture and 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 description 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 Emergence 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 Neanderthal 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 variation to population structure. Prereq: 3930 or consent of instructor.

6000 Doctoral Research and Dissertation

6410-20-30 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.

6510 Selected Topics in Archaeology (3) May be repeated. Maximum 9 hrs.

6910 Selected Topics in Physical Anthropology (3) May be repeated. Maximum 9 hrs.

6970 Seminar in Human Paleontology (3) Prereq: 4970 and consent of instructor.

Archaeology—Greek and Roman

See Classics

Art

MAJOR

DEGREES

Art

M.A., M.F.A.

Professors:


Associate Professors:

W. C. Kennedy, M.F.A. Wisconsin; P. R. Livingston, M.F.A. Wisconsin; D. Peacock, M.F.A. Iowa; F. G. Stewart, M.F.A. Claremont; R. P. Young, M.A. Columbia.

Assistant Professors:


Instructors:

E. Evans; T. J. Riesing, M.F.A. Nebraska.

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.
French, German, or Italian, unless waived by the art history faculty.

**Classification of Art Courses**

A. Studio Art: 3516, 3517, 4015, 4115, 4215, 4315, 4415, 4515, 4525, 4534, 4545, 4615, 4616, 4617.

B. Art History: 3705, 3715, 3716, 3725, 3726, 3735, 3736, 3737, 3745, 3746, 3756-57, 3785, 3775-76-77, 3811, 4655-56-57, 4876-77-77.

3516 Typography (4) Theories and techniques of typography and printing as a fine art medium. May be repeated. Maximum 12 hrs.

3517 Airbrush (4) Techniques and creative applications. May be repeated. Maximum 8 hrs.


3705 Northern European Painting: 1350-1600 (4) Painting and printmaking of the low countries, France, Germany, and England. Includes International Style, Netherlandish, Eyck, Bosch, Dürer, Holbein, and Bruegel.

3715 Early Italian Renaissance Art: 1300-1500 (4) Painting, sculpture, and architecture. Includes Giotto, Masaccio, Donatello, Brunelleschi, Alberti, Botticelli, and Leonardo.


3725 Art of Southern Europe and New World in Seventeenth and Eighteenth Centuries (4) Emphasis on El Greco, Caravaggio, Zurbaran, Velazquez, Bernini, Tiepolo, Goya, artistic relations between Iberia and Latin America, and the urban development of Rome.

3726 Art of Northern Europe in Seventeenth and Eighteenth Centuries (4) Emphasis on Rembrandt, Vermeer, Hals, Rubens, Poussin, Callot, Georges de la Tour, Watteau, David, urban development of Paris and London, and pilgrimage churches of Southern Germany.

3735 History of Nineteenth-Century Painting in Europe and America (4) Emphasis on France: Neo-Classicism, Romanticism, Friedrich, Constable, Turner, Corot and Barbizon landscapists, Hudson River Group, Pre-Raphaelite Brotherhood, Manet, Courbet, Impressionism, Eskins, Homer, Seurat through Cézanne.

3736 History of Twentieth-Century Painting in Europe and America (4) Fauvism, Die Brücke, Cubism, Der Blaue Reiter, Futurism, Dada and Surrealism, geometric abstraction, social commentary painting. Abstract Expressionism in the U.S.A. and parallels in Europe, Pop, Op, Minimal, and Concept Art.


3746 History of Modern Sculpture in Europe and America (4) From 1880 to 1900: Neo-Classicism to Rodin. From 1900 to present: emphasis on Cubism, Constructivism, Expressionism, Assemblage, Pop, Primary Forms, Environment, and Earthworks.

3755-56-57 Studies in Art History (4, 4, 4) Concentration in selected areas. Prereq: 9 hours of art history or consent of instructor.

3765 History of North American Art (4) Survey of landmarks in painting, architecture, sculpture, and design from prehistory to 1900.

3766 History of Twentieth-Century American Art (4) Analysis of developments in American painting, sculpture, and design from 1900.

3775 Art of Indian Asia (4) History of Indian art with consideration of art of Central Asia and Southeast Asia.

3776 Chinese Art (4)

3777 Japanese Art (4)

3811 Introduction to Museology (3) Concepts, practices and historical development of museums of art, archaeology, anthropology and science. (Same as Anthropology 3811.)

4015 Individual Problems (4) May be repeated. Maximum 12 hrs. Prereq: Consent of instructor.


4215 Painting IV (4) May be repeated. Maximum 12 hrs. Prereq: Consent of instructor.

4315 Watercolor IV (4) Advanced composition in transparent and opaque watercolor. May be repeated. Maximum 12 hrs. Prereq: Consent of instructor.

4415 Sculpture IV (4) May be repeated. Maximum 12 hrs.

4515 Visual Communication IV (4) Corporate design introduction.


4545 Visual Communications Seminar (2) Political, social, economic and moral problems of contemporary designer. Prereq: 4515.

4615 Intaglio IV (4) Color problems with intaglio lithography. May be repeated. Maximum 12 hrs.

4616 Lithography IV (4) Color problems in lithography. May be repeated. Maximum 12 hrs.

4617 Advanced Screen Printing (4) May be repeated. Maximum 12 hrs.

4855-56-57 Reading and Research in Art History (2, 2, 2) Prereq: 16 hrs of art history and consent of instructor.

4875-76-77 Studies in Oriental Art History (4, 4, 4) Concentration in selected areas.

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

5011-21-31 Exhibition I In Lieu of Thesis (3, 3, 3)

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

5109-20-30-40-50-60 Drawing and Composition (3, 3, 3, 3, 3)

5110-20-30-40-50-60 Oil Painting (3, 3, 3, 3, 3, 3)

5210-20-30-40-60 Sculpture (3, 3, 3, 3, 3, 3)

5310-20-30-40-60 Watercolor Painting (3, 3, 3, 3, 3, 3)

5410-20-30-40-50-60 Typography (3, 3, 3, 3, 3, 3)

5416 Intaglio IV (4) Color problems with intaglio lithography. May be repeated. Maximum 12 hrs.

5416 Lithography IV (4) Color problems in lithography. May be repeated. Maximum 12 hrs.

5455-56-57 Reading and Research in Art History (2, 2, 2) Prereq: 16 hrs of art history and consent of instructor.

4875-76-77 Studies in Oriental Art History (4, 4, 4) Concentration in selected areas.

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

5011-21-31 Exhibition I In Lieu of Thesis (3, 3, 3)
THE DOCTORAL PROGRAM

The Ph.D. program in speech and hearing sciences seeks to develop individuals for research or college teaching careers in the field of speech pathology, audiology, or speech and hearing science. This degree program is research oriented, with primary emphasis upon developing the scientific and cognitive skills which allow individuals to identify and independently study important questions concerning the human act of oral and aural communication. Students will be expected to master the accumulated knowledge in the area of:

1. basic speech, hearing and language processes,
2. speech, hearing and language disorders,
3. related disciplines providing insight into human communication processes,
4. technical skills in instrumentation and experimental design which enable the student to investigate problems pertaining to speech and hearing processes.

The program will normally consist of two or more calendar years of graduate study beyond the Master's degree with the first year being devoted primarily to formal course work and the last year to full-time research culminating in the doctoral dissertation.

Specific programs of study will be determined by the student in consultation with his faculty committee. In addition to the general Graduate School requirements, specific requirements for the degree of Doctor of Philosophy in speech and hearing sciences will include:

1. Successful completion of course work in the study of one or more research tools, or other specific scientific methodological vehicles pertinent to the research interests of the student and advisor. The choice of research tool(s) is subject to departmental approval.
2. A minimum of nine quarter hours of graduate credit obtained in course work in a cognate field outside the Department of Audiology and Speech Pathology. These hours are in addition to those required in item 1 above.
3. Sufficient course work within the department but outside the area of specialization to give a broad foundation and understanding.
4. A comprehensive examination to demonstrate a general knowledge of the bases of audiology, speech and language pathology, and speech and hearing science; advanced knowledge of the specifics of the area of specialization.
5. Research and dissertation to give at least 36 hours of graduate credit (6000 level).
6. A final oral examination.

4040 Appraisal of Speech and Language Disorders (4) Diagnostic procedures for children and adults with speech and language problems including observation and practice with diagnostic tools. Prerequisite: Phonetics. (Same as Special Education 4040.)
4060 Speech Science II (3) Speech production; clinical applications of speech science research. 2 lectures and 1 2-hour lab per week. Prerequisite: 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 Shattering (4) Nature and treatment: Review and integration of various theories. (Same as Special Education 4310.)
4320-30-40 Clinical Practice in Speech Pathology (1-6, 1-6, 1-6) Prerequisite: 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 (4) Etiology, diagnosis and treatment of organic and functional voice disorders. Prerequisite: Speech Science II. (Same as Special Education 4400.)
4450-50-70 Clinical Practice in Audiology (1-6, 1-6, 1-6) Prerequisite: 4720, 4930, or 4940. S/NC only. (Same as Special Education 4450-50-70.)
4520 Speech Pathology (3) Independent study of special problems in speech pathology. Prerequisite: Consent of instructor.
4550 Problems in Speech Pathology (1-6) Prerequisite: Consent of instructor.
4590 Problems in Audiology (1-6) Prerequisite: Consent of instructor. May be repeated. Maximum 6 hrs.
4610 Introduction to Language Pathology in Children (4) Nature, etiology and treatment of language retardation. Observation in the language clinic is available. Prerequisite: Speech and Language Development.
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
memorization and from different geographic regions: their causes, and their effects upon educational programs.

4700 Audiology for Educators of the Deaf (4) Fundamental aspects of hearing, including physiology of sound and physiology of the ear, etiology and rehabilitation of hearing loss and basic audiometric techniques. May not be used as requirements of major in Audiology and Speech Pathology.

4720 Audiology II (4) Etiology and rehabilitation of hearing loss including pediatric and pediatric hearing loss and audiologic treatment and diagnostic audiometry. Prereq: Audiology I. (Same as Special Education 4720.)

4750 Noise in the Environment (3) Discussion of the extent to which the noise problem exists, introduction to methods of noise measurement, basic techniques in sound and vibration abatement, acoustical factors, and physiological concomitants of noise stimulation. A knowledge of acoustics is advisable.

4930 Aural Rehabilitation: Speechreading and Auditory Training (4) Speechreading as a receptive language process and development of manual signs on neurologically handicapped. (Same as Special Education 4930.)

4939 Laboratory in Aural Rehabilitation (1) (Same as Special Education 4939.)

4940 Advanced Aural Rehabilitation: Acoustic Training (4) Development of maximum use of residual hearing in the acoustically handicapped. (Same as Special Education 4940.)

5000 Thesis

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

5040 Advanced Clinical Practice in Audiology Study and Practice (1-6) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. (Same as Special Education 5040.)

5050 Practicum in Aural Habilitation (1-6) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

5051 Practicum in Aural Rehabilitation (1-6) Enrollment by consent of instructor may be repeated. Maximum 9 hrs. S/NC only.

5060 Anatomy and Physiology of Speech (3) Structure and function of the neuro-muscular system involved in breathing, phonation, respiration, and articulation. Prereq: Speech Science II.

5070 Anatomy and Physiology of Hearing (3) Structure and function 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 statistics, 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 science. Upon completion, the student should be able to select proper instrumentation for measuring the parameters of speech and hearing.

5200 Seminar on Slurring (3) Current significant research in the area of stuttering. Prereq: 4310 or consent of instructor.

5201 Aphasia (3) A historical review of aphasia literature including theories of brain functioning, classification and terminology, tests and rationale for testing, etiology, therapy considerations and prognosis for recovery. Prereq: 4380 or equivalent or consent of instructor.

5230-54-50 Advanced Clinical Practice in Speech Disorders (1-6) Prereq: Consent of instructor. S/NC only. 5340 may be repeated. Maximum 9 hrs. S/NC only.

5380 Cerebral Palsy (3) Study of cerebral palsy with emphasis on pathological foundations and speech and language training. Prereq: Articulation Disorders. (Same as Special Education 5380.)

5390 Cleft Palate (3) Etiology, diagnosis and clinical management of cleft palate speakers with emphasis on speech. Prereq: Articulation Disorders. (Same as Special Education 5390.)

5440 Hearing Aid Evaluation (3) Study of the procedures involved in assessing the benefits of amplification of sound for the acoustically handicapped. The pertinent research in the areas of evaluation methods, binaural vs. monaural, prescription fitting, etc., will be reviewed. Prereq: 4720.

5450 Sound Measurement and Analysis in Hearing Conservation (3) Study of noise measuring systems and techniques; a survey of factors in military and industrial audiology, and study of the role of the audiologist in industry. Prereq: 4710 or consent of instructor.

5460 Differential Diagnosis of Auditory Disorders (3) Theory and practice of advanced pure tone and speech audiometry; instrument and interpretation of audiometric findings with special reference to differential diagnosis. Prereq: 4720.

5470 Impedance Measurement in Audiology (3) Theoretical considerations behind the emergence of impedance measurement in audiology. Prereq: 4710, 4720, 3800 or consent of instructor.

5500 Seminar in Audiology (3) Study of significant research in various areas of audiology. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

5503 Seminar in Advanced Audiological Procedures (3) Theoretical and practical considerations of auditory procedures used for differentiating between cochlear versus retrocochlear auditory lesions, identifying central auditory lesions, and for identifying nonorganic hearing loss.

5520 Seminar in Speech Pathology (3) Special study of current significant research in speech pathology. Topics vary from quarter to quarter. Prereq: 4710 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.


5550 Special Problems in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5560 Independent Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5560 Independent Study in Audiology (1-6) Special study in an area of specialization and/or practice involving the discussion and utilization of testing tools and analyses of rehabilitative philosophies and techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5561 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, procedures and instrumentation of Verbo-tonal System in areas of habilitation, rehabilitation, diagnosis, speech therapy, and foreign languages. Prereq: 4710. Recommended: 4920 and Phonetics.

6000 Doctoral Research and Dissertation

6010 Experimental Phonetics (3) Principles involved in acoustical and physiological analyses of speech production and perception. Prereq: 5119 or consent of instructor.


6050 Applied Anatomy and Physiology of Speech Mechanism (3) Dissection and related readings. Prereq: 5060 or equivalent.

6070 Experimental Techniques in Cochlear Physiology and Neurophysiology (3) Prereq: 5570 or equivalent.

6080 Seminar in Speech Science (3) Advanced study of experimental designs and related methodology of speech physiology, acoustic analysis, recognition, perception and intelligibility of speech, communication theory, and psycholinguistic measurement of speech and language. Topics vary from quarter to quarter. Prereq: 6010 or consent of instructor. May be repeated. Maximum 9 hrs.

6090 Seminar in Hearing Science (3) Advanced study of various topics of the perception of the non-speech acoustic signal: detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 6020 or consent of instructor. May be repeated. Maximum 9 hrs.

6110 Experimental Design in Speech and Hearing (3) Analysis of experimental design in theses and related journals. Psychophysical methods for data acquisition. Generation of experimental designs based on parametric and non-parametric statistics. Prereq: 5110 or equivalent and consent of instructor.

6117 Theories of Hearing (3) The physiological processes basic to the classical theories of hearing as related to sensitivity; loudness; pitch; and discrimination of acoustic stimuli. Prereq: 5070 or consent of instructor.

6120 Neurophysiology of Speech Pathology (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
6520 Directed Research (1-6) Participation in on-going or non-dissertational research. Pre-req: Consent of instructor. May be repeated. Maximum 9 hrs.

6570 Directed Study in Speech Pathology (1-3) May be repeated. Maximum 9 hrs.

6580 Directed Study in Audiology (1-3) May be repeated. Maximum 9 hrs.

6590 Directed Study in Speech Science (1-3) May be repeated. Maximum 9 hrs.

6600 Directed Study in Hearing Science (1-3) May be repeated. Maximum 9 hrs.

Biochemistry

MAJOR

Biochemistry

DEGREES

M.S., Ph.D.

Professors:
J. W. Greenawalt (Head), Ph.D. Purdue;
J. E. Churchich, Ph.D. Sheffield (England);
K. R. Monty, Ph.D. Rochester;
T. P. Stolo, Ph.D. Michigan; J. R. Toter,
Ph.D. Iowa State.

Associate Professor:
J. G. Joshi, Ph.D. Poona (India).

Assistant Professors:
R. Bryant, Ph.D. Illinois;
R. H. Feinberg, Ph.D. California (Berkeley);
S. W. Hinsonson, Ph.D. Chicago; L. Huang,
Ph.D. Michigan State.

THE MASTER'S PROGRAM

Candidates usually should offer an undergraduate major in either biology or chemistry. Departmental requirements consist of the satisfactory completion of 45 credit hours of graduate work and the mastery of the subject matter of the following courses:

1. Introductory Organic Chemistry with laboratory (at least 1 year)*, Inorganic Quantitative Analysis* (e.g., at least 1 quarter of analytical chemistry), Organic Qualitative Analysis* (e.g., Chemistry 4510), Introductory Physics*, Differential and Integral Calculus*; at least 3 quarters of approved graduate courses in chemistry or physics, for example: Organic Reaction Mechanisms (e.g., Chemistry 5110-20-30-35), Quantum Chemistry (e.g., Chemistry 5340), Advanced Physics (Physics 6210-20-30), Infrared and Raman Spectroscopy (Physics 5440), Radiation Chemistry (Physics/Chemistry 5460). Advanced Thermodynamics and Statistical Mechanics (Physics 5110-20-30); plus minimum of 3 quarters of approved physical chemistry (e.g., Biochemistry 4210-20-30, Chemistry 3410-20-30) and at least 18 hours of biology beyond the introductory level.


3. Participation in Biochemistry 6410-20-30 and in the advanced biochemistry seminars during the entire period of residence.

4. Preliminary examinations are administered by the department at the beginning of the fall quarter of the student's third year and are designed to test in comprehensive fashion the mastery of the required formal course work listed in 1 and 2.

5. A dissertation reporting the results of original and significant research carried out during the term of candidacy.

6. A final examination which will be concerned primarily with the student's dissertation.

Petitioning for Master's Degree: Students who have passed the preliminary examination in the Ph.D. program may petition the department for award of a Master's degree. The additional requirements for such a degree shall be:

(a) the completion of at least 45 hours of approved course work for graduate credit, at least half of which must be at or above the 5000 level;

(b) the preparation of a research manuscript suitable for submission for publication in a major scientific journal;

(c) the oral defense of that manuscript before an examining committee of three faculty members appointed by the head of the department, at least two of whom shall be members of the department.

4110-20 Cellular and Comparative Biochemistry (4, 4) Electrolyte behavior; the chemistry and structure of proteins; enzyme behavior and biological function; catalysis and energy capture; synthetic metabolism; nucleic acid functions and genetics; the regulation of biological processes. Must be taken in sequence. Pre-req: Organic Chemistry; 1 quarter of analytical chemistry. Pre-req or coreq: 4110.

4210-20 Introduction to Physical Biochemistry (3, 3) 4210—Introduction to thermodynamics; phase stability and phase change; charge potential; osmotic pressure; activity and the Debye-Hückel model; electrochemistry; membrane permeability; 4220—Elements of statistical mechanics, diffusion, collision theory; chemical kinetics and transition state theory; higher order kinetics; the specialized kinetics of enzymatic processes; some bio-polymer considerations. Pre-req: Single Variable Calculus, Organic Chemistry, and an introductory course in biology.

4230 Introduction to Physical Biochemistry (3) Physical characterization of macromolecules, polarized light, absorption and fluorescence, sedimentation and transport hydrodynamics, electrochemical mobility, light scattering, and structural x-ray crystallography of proteins and nucleic acids. Pre-req: Biochemistry 4220 or Chemistry 3430, or equivalent.

5000 Thesis

5101 Biochemical Techniques (2) Theory and laboratory practice in sedimentation, chromatographic and electrophoretic techniques in the isolation and characterization of macromolecules of importance in biology and molecular biology. Pre-req: 4119 or equivalent. Open to undergraduates with consent of the department.


5120 Membranes, Compartments, and the Regulation of Energy Metabolism (3) Examination of the metabolic pathways for electron transport, oxidative phosphorylation, and lipid synthesis, storage and degradation, and of the intracellular and inter-organ compartmentalization and the consequences of these processes which make possible the biological control of these pathways. Pre-req: 4110-20.

5130 Protein Structure and Enzyme Function (3) Physical-chemical properties of proteins, primary, secondary, tertiary and quaternary structure; denaturation, renaturation and other conformational changes, conformational transitions, and structure-function considerations. Coenzyme-specific models of catalysis; steady-state, transient, relaxation, and allosteric kinetics of catalysis. Pre-req: 4110 and either 4220 or Chemistry 3430.


5290 Protein Synthesis and Its Role in Metabolic Regulation (3) Mechanism of assembly of polypeptide chains; ribosome structure and function; decoding and genetic code; regulation of transcription and translation (e.g., induction, repression, etc.) Pre-req: 4110-20.

5300 Graduate Research Participation (3-9) May be repeated. Maximum 12 hrs.

5310-20 Experimental Techniques (2, 2, 2) A tutorial laboratory course in modern experi-
ments and instrumentation. Intended primarily for departmental majors.

5450 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated.

6000 Doctoral Research and Dissertation

ADVANCED BIOCHEMISTRY SEMINARS

Special subjects not covered in detail in the formal lecture courses of the department will be presented by students and staff. These will be supplemented with lectures by invited guest speakers who are recognized as leading authorities in the particular topic being discussed. One series (e.g., 6110-20-30) will generally be presented each year in a three-year repeating cycle. May be repeated for credit with the permission of the department. Satisfactory/No Credit.

6110 Enzyme Kinetics and Mechanisms of Enzyme Action (1) S/NC only.

6120 Functions of the Vitamins (1) S/NC only.

6130 Functions of the Trace Elements (1) S/NC only.

6210 Structure and Function of Macromolecules (1) S/NC only.

6220 Biochemical Genetics (1) S/NC only.

6230 Metabolic Regulation (1) S/NC only.

6310 Biological Energy Transformations (1) S/NC only.

6320 Antigen-Antibody Interactions (1) S/NC only.

6330 Biochemistry of Specialized Physiological Processes (1) S/NC only.

6410-20-30 Current Topics in Biochemistry (2, 2, 2) Seminars and lectures dealing with current advances in the field of chemical biology. May be repeated with the consent of the department. S/NC only.

Biology

MAJOR

DEGREE

Biology

M.A.C.T.

The Master of Arts in College Teaching program is administered by an interdepartmental committee composed of one representative from each of the following departments: biochemistry, botany, microbiology, 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 Cytogenetics.

B. Eighteen quarter hours of graduate credit in each of the following four fields: biochemistry, botany, microbiology, or zoology. The minimum requirement is 36 quarter hours of graduate credit in one or more of these fields as specified by the interdepartmental committee administering the M.A.C.T. program in Biology.

C. At least 21 quarter hours of course work in requirement B (not including special 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 at least 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 techniques of college teaching.

G. Six quarters of part-time, supervised college teacher-internship training.

H. A final comprehensive examination, oral, covering the thesis endeavor and the subject matter of the course requirements.

Botany

MAJOR

Botany

DEGREES

M.S., Ph.D.

Professors:

R. W. Holton (Head), Ph.D. Michigan;
E. E. C. Clebsch, Ph.D. Duke; R. H. DeSeim, Ph.D. Ohio State; W. R. Herndon, Ph.D. Vanderbilt; L. R. Hepler (Emeritus), Ph.D. Cornell;
E. G. Hunt, Ph.D. Cornell; L. W. Jones, Ph.D. Texas;
F. H. Norris, Ph.D. Ohio State;
J. S. Olson, Ph.D. Chicago; R. H. Petersen, Ph.D. Columbia; A. J. Sharp (Emeritus), Ph.D. Ohio State;
P. L. Waine, Ph.D. Texas.

Assistant Professors:

C. C. Amundsen, Ph.D. Colorado; S. L. Bell, Ph.D. Chicago; M. W. Bierner, Ph.D. Texas;
J. D. Caponetti, Ph.D. Harvard;
A. M. Evans, Ph.D. Michigan; A. S. Helman, Ph.D. Ohio State; H. H. Shugart, Ph.D. Georgia.

Associate Professors:

K. W. Hughes, Ph.D. Utah; D. J. Schwartz, Ph.D. North Carolina State; D. K. Smith, Ph.D. Tennessee.

Requirements for admission: In addition to the general Graduate School requirements (see page 11) the botany department also strongly recommends submitting aptitude and advanced scores from the Graduate Record Examinations, at least three letters of recommendation from academic or professional persons, a short statement describing probable areas of interest in botany, and the following specific courses: (1) general botany or biology, 12 quarter hours; (2) advanced botany or closely allied biological sciences, 18 quarter hours; (3) physical sciences; general inorganic chemistry, 12 quarter hours, organic chemistry and physics highly recommended; (4) college mathematics, nine quarter hours.

General degree requirements are given on page 17, and special departmental requirements include successful completion of:

MASTER OF SCIENCE DEGREE

1. Satisfactory preparation of a written formulation and an oral defense to the student's committee of a research proposal suitable for a thesis problem. Must be completed before enrollment in Botany 5000.

2. Satisfactory performance on an examination in one modern foreign language or an A or B in French 3030 or German 3030 (can also be applied to the doctoral program).

3. Satisfactory completion of two credit hours at the 6000 level.


5. Presentation of a 30-minute departmental seminar.

6. Educational service is required of each graduate degree candidate and such service will include teaching and/or ancillary services performed in the department related to the instruction of courses.

DOCTOR OF PHILOSOPHY DEGREE

1. Satisfactory presentation of a written formulation and oral defense to the student's committee of a dissertation problem. Must be completed before enrollment in Botany 6000.

2. Satisfactory performance on a written and 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.

**3010-20 Plants in Evolution (4, 4) Monera to angiospermae; emphasis on evolutionary relationships, morphology, and development. Prereq: 6 hrs in biological sciences.

**3030 Field Botany (4) Study of plants in natural environments including plant identification, collection, preservation and basic ecological concepts. Prereq: 5 hrs in biological sciences.

203-32 Field Botany (4, 4) Emphasis on fall and winter flora, respectively. Prereq: 3030. Need not be taken in sequence.

**3050 Socio-Economic Impact of Plants (3) Significance of plants in the origin and development of human cultures, evolution of cultivated plants, and the role of plants in present civilizations. Occasional field trips.

**3070 Genetics and Society (3) An introduction to genetics, anthropology, and evolution with emphasis on their implications in human society. (Same as Anthropology 3070.)

**3090 Biology and Human Affairs (3) Basic biological principles involved in deterioration and preservation of an environment in which man and his cultures may survive.

3130 Introductory Plant Pathology (4) (Same as Agric. Biology 3130.)

**3210 Introductory Plant Physiology (4) Mineral nutrition, water relations, translocation, respiration, photosynthesis, growth phenomena. Prereq: General Chemistry, 3 hrs and 1 lab.

4030 Mechanisms of Plant Speciation (4) Processes of plant speciation emphasizing population genetics, isolation, drift, hybridization, variation in populations, establishment of population barriers and other aspects of plant speciation. Prereq: 3010-20 and General Genetics.

4120 Plant Anatomy (4) Comparative structure of vascular plants. 1 hr and 3 labs. Prereq: Fundamentals of Botany.

4240 Paleobotany (4) (Same as Geology 4240.)

4310 Plant Ecology (4) Interactions between individuals, species, communities and their environments. Circulation of energy and matter in terrestrial and aquatic systems. Field trips or laboratory periods, and at least two weekend field trips. Prereq: 3030 or equivalent.

5000 Thesis

5011 Mycology (4) An intensive survey of the fungi, including all major classes, utilizing lecture, laboratory and field information. Occasional field trips. Prereq: 3010. 3 hrs and 1 lab.

5012 Morphology and Evolution of the Phycocyanates (4) Similar to 5090, but dealing with the Phycocyanaceous fungi. Prereq: 5011 or consent of instructor.

5017 Field Mycology (4) An intensive summer course on the field characteristics and morphology of higher fungi. Frequent field trips. Prereq: Consent of instructor. May be repeated.

5021 Bryology (4) Taxonomy, phycology, ecology, physiology, and developmental morphology. Prereq: 5012 with emphasis on field studies and current research. Prereq: 3020. 1 hr and 3 labs.

5022 Lichenology (4) Taxonomy, phyllogeny, ecology, economy, and symbiosis of lichens with an emphasis on field studies and current research. Prereq: 3020, 5018 or 5017, and 5081 recommended. 1 hr and 3 labs.

5031 Vascular Plant Taxonomy (4) Family characteristics of vascular plants, including principles of phyllogeny and classification, based primarily on plants of the local flora. Prereq: 3030 or equivalent. 2 hrs and 2 labs.

5061 Phyology (4) An intensive, comparative study of the major divisions of algae, both freshwater and marine, including morphological, ecological and developmental and phylogenetic aspects. Field and laboratory studies emphasizing identification and classification. Introduction to experimental phyology. Prereq: 3010 or consent of instructor. 2 hrs and 2 labs.

5070 Principles of Biological Illustration (3) Principles and application of photography, including photomicrography and photomacrography, drawing graphics, and other methods to the recording and presentation for research and publication of data in pictorial or graphic form. 1 hr and 2 labs.


5090 Morphology and Evolution of Basidiozymes (4) Discussion of structure and function of somatic and sexual life cycles as they apply to evolution in the group. Examination of cultures and specimens in laboratory complements discussion material. Prereq: Botany 3010 or equivalent.

5120 Agrostology (4) Collection, identification, classification, and phylology of the tribes of grasses. Prereq: 3030 or consent of Instructor. 2 hrs and 2 labs.

5150 Advanced Morphology of Flowering Plants (4) A consideration of vegetative and reproductive organography including regulatory physiology, floral development, pollination mechanisms, embryology and its deviations, seed and fruit development. Prereq: 3020-30 or 4120; 3210 or consent of instructor.

5160 Biosystematics (4) A study of the major experimental methods being used today in systematic botany. Emphasis will be placed on specific types of systematic problems. Cytotaxonomy, numerical taxonomy and chemotaxonomy will be emphasized if the consent of instructor. 2 hrs and 2 labs.

5210 Advanced Plant Physiology I (3) Plant cell components and their metabolism including photosynthesis, respiration, and biosynthesis, control mechanisms, Water and solute movement into the cells and within the plant. Mineral nutrition. Prereq or Coreq: Chemistry 3231.

5220 Advanced Plant Physiology II (3) Growth and differentiation of plants at the molecular, cellular, and organismic levels. Chemical regulation of development; macro-molecular interpretation of differentiation; photosynthesis, and endogenous rhythms; dormancy; germination; flowering and senescence, Prereq: 5210 or equivalent. 4120 and a plant cell physiology course.

5250 Quaternary Problems (4) (Same as Geology 5290.)

5310-20-30 Special Problems in Botany (1-6, 1-6, 1-6)

5340 Plant Geography (4) Distribution of ecosytem types, general, climatic and historical aspects are emphasized. Prereq: 4310. 2 hrs and 2 labs.

5350 Analysis of Plant Communities (4) Plants as species and ecosystems components considered from the standpoint of genealogy, ordination, and ecosystem function. Prereq: 4310. 2 hrs and 2 periods (field trips).

5410-20 Seminar in the Teaching of College Botany (1, 1) Objectives in the teaching of general botany, success and failure in general course; seminars in techniques, testing, concepts, and materials. Required of teaching assistants. Prereq: Consent of Instructor. S/NC only.


5780 Plant Cytology (4) An intensive consideration of cell, structure, function, development, and reproduction, with emphasis on the correlation where possible, of ultrastructure, biochemistry and function of subcellular organelles. Prereq: 4100, 4220; 3210 or consent of instructor. 2 hrs and 2 labs.

5810 Cytogenetics (4) Changes in chromosomes and genes with relation to mutation, hybridization, speciation, and phylogeny. Prereq: General Genetics; 5780, or Zoology 4310. 2 hrs and 2 labs.

5822-21-22-23-24 Methods and Instrumentation in Laboratory Investigations (1-6, 1-6, 1-6) A laboratory course providing project experience and theoretical background in various currently used research methods. May include ion-exchange resins, adsorption spectrometry, disc electrophoresis, polarography, zonal and ultra-centrifugation, gas chromatography, automatic analyzers, microscopy, culture methods, use and detection of radioisotopes, and others. Prereq: 4310. May be repeated with consent of instructor. S/NC only.

5830 Field Methods in Plant Ecology (4) Analysis of plant communities and ecosystems. Prereq: 4310, 5340, 5350. 2 hrs and 2 periods (field trips).

5840 Microbes in Ecosystems (3) Microbial communities, their metabolic activity, mineral relationships, and interactions with the physical and biotic factors in natural environments and microcosm systems. Prereq: 4310 and Microbiology 3000 or consent of instructor.

5850-51-52-53-54 Methods and Instrumentation in Field Investigations (1, 1, 1, 1, 1) Frequent field work using appropriate methods and instrumentation. Topics will vary according to the needs of the students. May be repeated with consent of instructor. S/NC only.

5870 Advanced Plant Genetics (4) Genetics of plants stressing molecular aspects and including mechanisms of gene action, controlling elements, translocations, recombinations, and their organization, and adaptation. 3 hrs and 1 lab. Prereq: General Genetics and Chemistry 3231.

5910-20 Developmental Plant Morphology (3, 1) Developmental morphology of plants from the aspect of the morphogenetic, differentiations-correlations, polarity, symmetry, differentiation, regeneration, tissue mixtures, abnormal
growth, environmental and genetics factors. Prereq: 3010-20 or 4120, and 3210 or 5210 for 5910, 5910 for 5920. 2 hrs and 1 lab for 5910; 1 lab for 5920.

6009 Doctoral Research and Dissertation

6019 Advanced Topics in Morphology of Vascular Plants (2-4) Needs of the student determine the content. Topics will be selected from the broad categories of experimental anatomy, morphology and morphogenesis. Prereq: 3025-30, 4120, 5910-20 or consent of instructor. May be repeated with consent.

6069 Advanced Topics in Cryptogamic Botany (2-4) Advanced studies and current research in (a) experimental physiology, (b) mycology, (c) botany, (d) palaeobotany, or (e) developmental morphology of cryptogams. May be repeated with consent of the department.

6210 Photobiology (3) The interaction of non-ionizing radiation with living systems. Prereq: Elements of Physics or equivalent; Biochemistry 4110.

6310 Advanced Topics in Cytology and Cell Biology (2-4) Requirements and interests of the students would determine topics, such as (1) actions of chemicals on actively dividing cells, (2) current ultrastructural research in selected cytoplasmic organelles and cellular systems, (3) experimental cytology, (4) cellular responses to radiation and other stresses, (5) molecular biology. Prereq: 5780 or Zoology 4310; General Genetics; Biochemistry 4110-20. May be repeated with consent.

6320 Ecosystems of the World (3) Classification and characterization of the world's regional ecosystems, interrelations of climate, topography, soils, vegetation, and fauna. Prereq: 5040.

6420 Advanced Topics in Genetics (2-4) Literature survey of selected topics from all areas of genetics. Prereq: General Genetics; Biochemistry 4110-20. May be repeated with consent.

6620 Seminar in the History of Botany (2)

6530-40 Radiation Ecology (2, 2) Use of radioisotopes for delineation of food chains, and estimation of energy flow and other ecological processes. Relations of ionizing radiation and other stresses on populations and communities of plants, animals, and microorganisms. Field study of biogeochemical cycles and dosimetry of isotopes released to air, land, water. 6 hrs of ecology or Chemistry 3810 or Physics 4710.

6820 Advanced Topics in Plant Physiology (2-4) Requirements of the student determine the content, including such topics as (1) growth and growth hormones; (2) minor element nutrition; (3) photoperiodism; (4) radiation effects. Prereq: 5210; one year of college physics. May be repeated with consent of the department.

6830 Advanced Topics in Ecology (2-4) Needs of the student determine the content, including such topics as: (1) community analysis; (2) biogeochemistry; (3) bioclimatology; (4) geneo- and paleoecology; (5) radiation ecology; and (6) system ecology. Prereq: 4310, 5340, 5550. May be repeated with consent of the department.

6930 Advanced Topics in Systematic Botany (2-4) Needs of the student determine the content, with such possible subjects as: (1) morphological and biochemical systems of vascular plants; (2) developmental genetics; (3) experimental taxonomy; (4) current research in systematics; (5) systems of classification. Seminars or lectures and labs depending on subject. Prereq: 3020-30, 5031. May be repeated with consent of department.

Chemistry

MAJOR

DEGREES

Chemistry

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

Professors:

D. A. Shirley (Head), Ph.D. Iowa State; N. S. Bowman, Ph.D. Princeton; C. A. Buehler (Emeritus), Ph.D. Ohio State; W. E. Bull, Ph.D. Illinois; C. J. Collins, Ph.D. Northwestern; J. A. Dean, Ph.D. Michigan; F. E. Eastham, Ph.D. California (Berkeley); W. H. Fletcher, Ph.D. Minnesota; C. W. Keenan, Ph.D. Texas; D. C. Kleinfeilder, Ph.D. Princeton; M. H. Lietzke, Ph.D. Wisconsin; G. Mamantov, Ph.D. Louisiana State; A. D. Melvian (Emeritus), Ph.D. Pennsylvania State; G. D. Olney, Ph.D. California (Berkeley); G. K. Schweitzer, Ph.D. Illinois; G. P. Smith, Ph.D. Virginia; H. A. Smith (Emeritus), Ph.D. Harvard; W. T. Smith (Emeritus), Ph.D. Ohio State; W. A. Van Hook, Ph.D. Johns Hopkins; T. F. Williams, Ph.D. London; J. H. Wood (Emeritus), Ph.D. North Carolina State.

Associate Professors:

J. E. Bloor, Ph.D. Manchester; J. O. Chambers, Ph.D. Kansas; G. W. Kabafla, Ph.D. Purdue; C. A. Lane, Ph.D. California.

Assistant Professors:

D. C. Ficker, Ph.D. Purdue; R. M. Magid, Ph.D. Yale; R. M. Pagli, Ph.D. Wisconsin; J. R. Peterson, Ph.D. California (Berkeley); E. L. Wehrly, Ph.D. Purdue.

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. Students enrolling in the faculty 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:
   - 5910-21-31 during the entire period of graduate study. (No more than three credit hours of seminar may be applied to the above requirements.)

3. A final oral examination.

M. S. degree in chemistry consist of the satisfactory completion of:

1. Research and thesis to give nine to 18 hours of graduate credit (5000).

2. Chemistry 4160-70 and two of the following:
   - 5910-21-31 during the entire period of graduate study. (No more than three credit hours of seminar may be applied to the above requirements.)

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.

DOCTOR OF PHILOSOPHY PROGRAM

The department offers specialization in nine areas for the Ph.D. degree: analytical chemistry, chemical physics, environmental chemistry, energy, inorganic chemistry, organic chemistry, physical chemistry, polymer science and analytical chemistry. For the Ph.D. degree in chemistry with specialization in analytical, inorganic,
organic, physical, or theoretical chemistry, the satisfactory completion of the following is required:

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).
2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.
3. Participation in seminar (5911-21-31) 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 groups: (a) for analytical, 5250-59-69-70-79; (b) for inorganic, 5420-5710-20-30; (c) for organic, 5110-20-29-30-35 and at least nine hours from the following courses: 5260-60-70, 5340-50-50-60, 5410-20-30-50, 5710-20-30; (d) for physical, 5340-50, 5410-20-30-50, 5710-20-30; (e) for theoretical, 5340-50-60, 5410-20-30-50, Physics 5210.
5. Graduate course work in related fields may be used for undesignated course work in this requirement upon approval of the student's faculty committee.
6. A comprehensive advanced examination in the field of specialization.
7. Demonstration of a reading knowledge of one of the following languages: French, German, Russian, or an approved alternate.
8. A final oral examination.

The requirements for the Ph.D. degree in chemistry with specialization in environment or energy consist of the satisfactory completion of:

1. Research and a dissertation on an environment- or energy-related problem to give at least 36 hours of graduate credit.
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 and a six-month internship in a governmental or industrial laboratory.
4. Thirty-nine hours of additional graduate course work including six hours at the 6000 level. For emphasis in environment, these additional courses must include Chemistry 5250-59-69-69-70-79, Ecology 5310, Environmental Engineering 3000, plus selected courses from other areas of chemistry, environmental engineering, meteorology, microbiology, health physics, ecology, computer science, statistics, and industrial health. For emphasis in energy, these additional courses must include Chemistry 5410, a chemistry sequence (Chemistry 5110-20-30-35 or 5250-60-70 or 5420-30 or 5710-20-30, 5810), Geology 5810, Mechanical Engineering 4140, plus other course selections from areas such as catalysis, heterogeneous equilibria, kinetics, and multidisciplinary research and propulsion engines, resource economics, nuclear engineering, and electrical engineering. All course selections must be approved by the appropriate departmental committees.
5. A comprehensive advanced examination.
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 on the basic principles of mechanics, electricity, and magnetism. Chemistry 5410-20-30-50, 5110-20 or 5710-20, 5840-50, 6730 or 6810; Mathematics 4540, 4610, 4710; Physics 4610-20-30, 5110-20-30, 5210, 5610-20-30.
4. 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 Nuclear 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, 5531, 5140-50, 5160 or 5170, Chemical Engineering 4910.
3. Participation in Chemistry 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 at the 6000 level and at least 12 hours 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 course 3211-21-31 is a corequisite.

*3219-29-39 Organic Chemistry Laboratory (1, 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 laboratory.


*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 interest and of spectroscopic and physical techniques to elucidate reaction mechanisms. Recommended for chemistry majors and students planning careers in biological sciences. Must be taken in sequence. Prereq: General Chemistry. Corresponding laboratory: 3511-21-31 or 3519, with 3529-39 as a corequisite. The latter is recommended.

*3529-39 Organic Chemistry Laboratory (1, 1) Experiments on topics discussed in 3521-31. Similar to 3529-39 except designed for students who have need for operating knowledge of various spectroscopic and chromatographic techniques. Corresponding lecture (3521-31) 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 a corequisite.

4160-70 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 solutions, and chemical equilibria. 4170—Gases and kinetic theory, chemical kinetics, molecular spectroscopy, and introduction to chemical kinetics.

4210 Advanced Analytical Chemistry (3) Chemical separations including chromatography, ion exchange and solvent extraction; spectrophotometric techniques. Prereq: Analytical chemistry.

4219 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4210. Coreq: 4210.

4220 Advanced Analytical Chemistry (3) Electroanalytical methods of analyses (including potentiometry, coulometric, electroanalysis, voltammetry); magnetic resonance methods; mass spectrometry; x-ray absorption and fluorescence techniques. Prereq: Advanced 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 quantum nuclear chemistry. Prereq: 4310-20-39, 4110.

4430 Intermediate Inorganic Chemistry (3) Detailed application of theoretical concepts of the inorganic elements, their chemical states, and the reactivity of their compounds.

4510 Organic Qualitative Analysis (3) Identification of pure organic compounds and mixtures. Prereq: 3211-21-31, 3219-29-39 or 3219, 3529-39 3 labs. Not open to students who have completed 4610.

4550 Organic Reaction Mechanisms (3) Theory

* Not for graduate credit for chemistry majors.
of bonding and reaction mechanisms. Prereq: 1 year of organic chemistry.

4610-20 Advanced Chemical Experimentation (2) Chemical analysis and instrument methods. Prereq: Chemical analysis and instrumental methods. Must be taken in sequence. Not open to students who have completed 4510.

4640 Electronics for Chemists (4) Electronics in design and construction of chemical instrumentation. Prereq: 1 year of physics.

*4910-20-30 Biophysical Chemistry (3, 3, 3) Physicochemical principles with application to biological systems. Must be taken in sequence. Not open to students having 3410-20-30. 4910—Gas laws; first, second and third laws of thermodynamics; equilibrium. 4920—Solution chemistry; electrochemistry; kinetics; nuclear chemistry; 4930—Elementary quantum chemistry; optical and magnetic spectroscopy; light scattering; macromolecular properties. Prereq: General chemistry, or equivalent; 1 year of mathematics.

5000 Thesis


5129 Advanced Organic Chemistry Laboratory (3) Organic synthesis of aliphatic, alicyclic, aromatic, and alicyclic compounds illustrating 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 step growth and chain growth polymerizations. Prereq: 5140 and 4160-70 or equivalent.

5160 Organic Chemistry of Polymers (3) Synthesis of monomers; mechanism, stereosechemistry, and sequence distribution of polymerization of monomers; formation of block, graft, and network polymers. Reactions in synthetic methods including degradation. Prereq: 5140 and 5531.

5170 Physical Chemistry of Polymers (3) Rubber elasticity; solution properties of macromolecules; preparation and instrumental and computational statistics of polymers. Prereq: 5150.

5240 Electronics for Chemists (4) Includes the material of Chemistry 4640 plus a special project. Prereq: Consent of instructor.

5250-60-70 Advanced Analytical Chemistry (3, 3, 3) 5250—Absorption and emission spectroscopy. Prereq: 2, 2. 5260, 5270, 5280. NMR, UV, and mass spectra; 5260—Chemical separation methods: solvent extraction, chromatography, electrophoresis; radiocchemical methods; fluorescence; x-ray methods; 5270—Elementary quantum mechanics and thermal analytical methods; on-stream and automatic analysis. Prereq: 1 year of physical chemistry.

5250-69-79 Advanced Analytical Chemistry Laboratory (1, 1, 1) Experiments in the use of chemical separation methods and instrumental methods covered in the concurrent lecture course. Prereq: 1 year of physical chemistry, or equivalent; 5250 for 5259; 5260 for 5269; 5270 for 5279.

5280-90 Clinical Chemistry (3, 2) Introduction to clinical chemistry, significance of physiologic parameters, electrolytic balance, metabolic dysfunctions, 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.

5299 Clinical Chemistry Laboratory (1) Techniques of handling physiologic samples, analytical methods and special problem areas. Prereq or coreq of instructor. May be repeated. Maximum 9 hrs.

5310-20-30 Research in Chemistry (3, 3, 3) Special reading, consultation and laboratory (not applicable to formal course requirements.)

5340 Quantum Chemistry (3) Postulate approach to the fundamental principles of quantum mechanics and applications to the electronic structure of the Schrödinger equation; approximate (ab initio and semi-empirical) molecular orbital methods; calculation of molecular properties.

5350 Quantum Chemistry (3) Electronic excited states; introduction to group theory; perturbation theory; reactivity of organic molecules. Prereq: 5340.

5410-20-30 Advanced Physical Chemistry (3, 3, 3) 5410—Classical thermodynamics. 5420—Molecular 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 with emphasis on the medium. Basic principles: ionization; radiation chemical yields; stopping phenomena; loss spectra; secondary processes and transient intermediates; diffusion models in the theory of 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.)

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. Prerequisites: Any two of 5210-30-40-50, 5310-30-50. May be repeated.

5521 Survey of Analytical Chemistry (3) Volume and gravimetric analysis; acid-base, oxidation-reduction, complexation and precipitation equilibria; spectrophotometric, electroanalytical, and separation methods.

5531 Survey of Organic Chemistry (3) Bonding in organic molecules, chemistry of hydrocarbons, alicyclic compounds and conformational analysis, monofunctional oxygenated derivatives, carbonyl 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 chemistry. 5730—Investigational methods of structural inorganic chemistry. Prereq: 1 year of physical chemistry.

5810 Nuclear Chemistry (3) Nuclear properties, radioactivity, radioactive decay processes, nuclear structure and models, nuclear reactions, radiation and Mendeleev's period table. Prereq: 1 year of physical chemistry.

5911-21-31 Chemistry Seminar (1, 1, 1) Discussion of current and recent research literature and general topics. May be repeated. Prereq: Graduation. Additional charge of $450 per quarter. S/NC only.

6000 Doctoral Research and Dissertation

6111 Selected Topics in Organic Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: environmental chemistry, spectroelectrochemistry, modern liquid chromatography, new electroanalytic methods, bioanalytic methods, and minicomputer and microprocessor applications in chemical instrumentation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6210 Advanced Analytical Spectroscopy (3) Newer methods of spectroscopic analysis, including: transform methods, lasers in spectroscopy, fiber optics, introductory non-linear optics, and spectroscopic techniques for remote sensing. Prereq: 5250.

6211 Selected Topics in Analytical Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: environmental chemistry, spectroelectrochemistry, modern liquid chromatography, new electroanalytic methods, bioanalytic methods, and minicomputer and microprocessor applications in chemical instrumentation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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.

6320 Natural Polymers (3) Structure, modification, and non-biochemical utilization of natural polymers and polymers derived from naturally-occurring monomers. Prereq: 5140 and two of 5110-20-30-35.

6411 Selected Topics in Physical and Theoretical Chemistry (3) Subject matter varies among important topics of current significance. Prereq: Any two of 4510-20-30-50, 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 bonding. Prereq: Any two of 5110-20-30-35.

6430 Photochemistry and Radiation Chemistry (3) Fundamental physical and chemical processes involved in the excitation of molecules by photons and electrons; multiphoton processes and uses of laser sources; fluorescence and phosphorescence; radiationless transitions.
as studied by opto-acoustic spectroscopy; chemical reactivity of excited states; ion-molecular and free radical reactions; electronic capture and electron-transfer processes. Pre-req: 5430.

6450 Electrochemistry (3) Electrical double-layer; electrode kinetics; transport properties of electrolytes; electroanalytical methods. Pre-req: 5430 or 5270.

6475 Electronic Structure of Radicals (3) Applications of electron spin resonance to the study of molecular conformation, structure, and bonding in organic and inorganic radicals; comparison of experimental results with theoretical predictions based on the Walsh rules and on INDO molecular orbital calculations. Pre-req: 5340-50 and 6520.

6480 Statistical Thermodynamics (3) Application of statistical mechanical methods to systems whose effects on equilibrium and rate processes, phase equilibria, condensation phenomena, etc. Pre-req: 5410, 5450.

6495 Advanced Chemical Kinetics (3) Mathematical study of elementary chemical reactions at the molecular level including topics such as dynamics of molecular collisions, potential-energy surfaces, reactions, cross-sections, “direct” vs. “complex” modes of reaction, photofragmentation, energy partitioning and transport in chemistry resonance, and chemical lasers. Pre-req: 5430.

6510 Thermodynamics of Solutions (3) The theory of regular solutions and of electrolyte solutions; measurement of activity coefficients and other thermodynamic properties; selected topics from the literature. Pre-req: 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. Pre-req: 5430.

6711 Selected Topics in Inorganic Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: photoelectron spectroscopy, transuranium chemistry, organometallic compounds, inorganic solution kinetics and mechanisms, crystal chemistry, non-aqueous chemistry, chemistry of halogens and compounds. Pre-req: Consent of instructor. May be repeated. Maximum 9 hrs.

6730 Topics in Quantum Chemistry (3) Application of newer methods to complex systems including metal complexes, polymers and molecular significance. Time-dependent phenomena. (The effect of external fields and collision processes). Recent theories of chemical reactivity, etc. Pre-req: 5340-50.

6750 Molten Salt Chemistry (3) Structure, spectroscopic properties, solution thermodynamics, electrochemistry and phase equilibria of solutions of metals in molten salts. Pre-req: 4110 and 5410 or equivalent.

6810 Vibrational Problems in Molecular Spectra (3) (Same as Physics 6810.)

6811 Selected Topics in Nuclear Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: nuclear decay schemes, nuclear models, nuclear reaction theory, nuclear detection techniques, nuclear activation analyses. Pre-req: Consent of instructor. May be repeated. Maximum 9 hrs.

6820 Molecular Vibration-Rotation Theory (3) (Same as Physics 6820.)

Classics

Professors: H. C. Rutledge (Head), Ph.D. Ohio State; A. Rapp (Emeritus), Ph.D. Illinois.

Associate Professors: M. L. Henbest, M.A. Arkansas; J. E. Shelton, Ph.D. Vanderbilt.


The graduate courses in the Classics include the wider reading of Greek or Latin authors in a selected field, 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

3010 Plato (3)
3020 Herodotus (3)
3030 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)
4120 Horace, Satires and Epistles (3)
4310 Readings from Medieval Latin (3)
4320-30 Selected Readings from Latin Literature (3, 3) Latin 4110-20-30-50 will alternate with Latin 4110-20-30-50. May be repeated.
4340 Horace, Odes (3)
4350 Tacitus (3)
4360 Lucretius (3)
4370 Readings in Medieval Latin (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

3210 Early Greek Mythology (3) Comprehensive study of Greek myths through readings, lectures, and discussion with emphasis on significance for Greek thought and religion. Slides and tapes illustrate influence of Greek myths on art, music, and literature of ancient Greek and later cultures. (Same as Religious Studies 5210.)

3220 Greek Mythology in the Classical Period (3) A study of myth in literature, history, religion, philosophy, and art of Classical Age of Greece, and change of attitude toward myth from earlier periods. Familiarity with basic Greek myths is assumed. Readings, lectures, slides, and discussion. (Same as Religious Studies 5320.)

3230 Roman Mythology (3) Study of myths created by Romans, as well as those the Romans borrowed from Greeks, with reference to Roman attitude toward history, religion, and society. Readings, lectures, slides, and discussion. (Same as Religious Studies 5320.)

3310 Art and Archaeology of the Aegean Bronze Age and 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 Mycenae, Athens, Piersia, 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, Praene, and Basiliek.

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 literature 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 (3) Content varies; may be repeated with consent of department.

5520 Problems in Old World Archaeology (3) (Same as Anthropology 5520.)

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, Welles, and others. Pre-req: 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 Thingham, Croce, and Baldanza. Pre-req: 5012; completion of three literature courses in a foreign language above 3000, or the equivalent.

5032 Studies in Comparative Literature (3) Independent research problems. Pre-req: 5012 and 5022.
Computer Science

MAJOR

Degree: M.S.

Computer Science

Professors:
R. T. Gregory (Head), Ph.D. Illinois;
R. E. Clines, Ph.D. Purdue (Mathematics);
F. Donaldson, Ph.D. Texas; R. J. Plenmanns,
Ph.D. Purdue (Mathematics); G. R. Sherman,
Ph.D. Purdue (Director of Computing Center).

Associate Professors:
R. M. Aiken, Ph.D. Northwestern;
R. C. Gonzalez, Ph.D. Florida (Electrical
Engineering); C. E. Hughes, Ph.D. Pennsylvania
State; S. M. Selkow, Ph.D. Pennsylvania.

Assistant Professors:
A. M. Davie, Ph.D. Illinois; T. Fettig, Ph.D.
Texas; C. P. Huang, Ph.D. SUNY (Buffalo);
S. R. Jordan, Ph.D. Wisconsin; J. M. Mosheil,
Ph.D. Illinois; J. P. Pileoeger, Ph.D.,
Pennsylvania State; J. R. Pinkert, Ph.D.
Wisconsin; D. W. Straight, Ph.D. Texas; M. G.
Thronson, Ph.D. Duke.

ENTRANCE REQUIREMENTS

TO M.S. PROGRAM

Upon admission to the Graduate School, students
who wish to enter the Master’s degree program in Computer Science
should have the following background:

1. Mathematical maturity at least
   equivalent to that of a student who has
   completed the calculus sequence through
   one year of Multivariable Calculus and
   Matrix Algebra.

2. Computer Science 3155 or an
   equivalent introductory numerical
   algorithms course.

3. A basic statistics and probability
   course such as Statistics 3450 (statistics
   for engineering) or Math 3050 or 4650.

4. Computer Science 3715 or an
   equivalent introductory course in discrete
   structures and logical foundations of
   computer science.

5. Computer Science 3510 and 3520 or
   equivalent courses in advanced FORTRAN
   programming, machine organization and
   assembler language programming.

REQUIREMENTS FOR

THE M.S. DEGREE

All students must receive departmental
credit for or exhibit proficiency in the following
courses:

1. CS 4550 and 4510
2. EE 5615-25-35
3. One of the three courses CS 4710,
   CS 4835, or CS 4925

The student may then select either Plan
A or Plan B.

Plan A: Thesis Option

1. Complete 36 hours of courses at the
   4000 level or above, including at least 18
   hours at the 5000 level, exclusive of
   EE 5615-25-35.

2. Complete at least 9 additional hours
   of thesis credit, CS 5000.

3. Pass an oral examination by a
   committee of at least three faculty
   members.

Plan B: Non-Thesis Option

1. Complete 45 hours of courses at the
   4000 level or above, including at least 27
   hours at the 5000 level, exclusive of
   EE 5615-25-35.

2. Pass written and oral comprehensive
   examinations.

Under either plan, courses which are
taken from a department other than
computer science must have the approval
of the Computer Science department.

3030 Introduction to Structured Programming
(4) Intermediate computer programming. Use
of general purpose languages as CLIP, PL/I.
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.
Introduction to programming in FORTRAN.
Prereq: Coreq: Multivariable Calculus and
Matrix Algebra. (Same as Mathematics 3150.)

3155 Introduction to Numerical Algorithms (3)
Roots of equations, systems of linear equa-
tions, least-squares data fitting, numerical in-
tegration, numerical methods for ordinary dif-
ferential equations. 3150 and 3155 may not
both be taken for credit. Prereq: Introduction
to Computer Science or consent of instruc-
tor. Prereq or coreq: Multivariable Calculus
and Matrix Algebra.

4010 Discrete Structures and Logical Foun-
dations of Computing (3) Sets, relations, ord-
nerings, Boolean algebra, propositional logic,
functions and computable functions; graph
theory and its applications to computer sys-
tems; set theoretical characterizations of
computing machines and computer languages.
Prereq: 3150 or consent of instructor.

4020 Introduction to Algorithms, Languages,
and Automation (3) Introduction to finite
automata; "effective procedures" and algorithms;
Turing machines; formal languages and gram-
mars. Prereq: 3415-45.

4035-45 Introduction to Numerical Linear
Algebra (3, 3) Floating-point numbers and
arithmetic on modern digital computers;
numerical algorithms for solving systems of
linear equations; linear least-squares methods
and eigenvalue computations. Prereq: 3150 or
3155. (Same as Math 4035-45.)

4225-35 Introduction to Numerical Analysis
(3, 3) (Same as Mathematics 4225-35.)

4310 Computation in Statistical Analysis (3)
Use of digital computer in standard statistical
analysis, such as frequency tabulations,
percentiles and data reduction, correlation and
regression. Prereq: 3150 or consent of
instructor. Elementary programming in a
problem-oriented scientific language, e.g.,
FORTRAN. Use of statistics in package
programs. Not intended for persons who
have credit for a computer science course.
For credit for computer science majors.
Prereq: Probability and statistics or equivalent.

4320 File Maintenance and Data Processing
(3) (Not for credit for computer science ma-
jors.) Applied computer programming. Error
analysis of FORTRAN programs, overlay struc-
tures, maintenance of tape and direct access
information storage files, use of utility pro-
grams, and applications to computer sys-
tems. Prereq: 1 course in FORTRAN program-
m ing.

4330 Special Projects in Applied Programming
(3) Applied programming in area of student’s
primary interest, using the digital computer.
To be directed by computer science faculty,
perhaps jointly with student’s faculty adviser.
Oral and written reports required; programming
experience 1-3 hours. May be repeated. Maxi-
mum 9 hrs.

4510 Data Structures and Nonnumeric Pro-
gramming (3) A study of data structures and
algorithms for their manipulation. Arrays and
orthogonal lists; stacks, queues, rings, doubly-
linked lists, trees, dynamic storage allocation;
organization of files; programming languages
for information structures. Prereq: Computer
Organization and Programming II or consent of
instructor.

4510 Operating Systems—Concepts and
Facilities (3) Detailed examination of major
operating system. Memory, processor, device,
and data management. Interrupts, machine-
level I/O, loaders and relocation, device char-
eristics, data sets, organizations, SPOOLing.
Prereq: 4510 and Computer Organization and
Programming III.

4690 Project—Operating Systems—Case Studies (3)
Alternatives in operating system design, dy-
namic relocation, paging, segmentation, time
sharing, time slicing, protection, concurrency,
real time systems. Examples from different
operating systems analyzed as appropriate.
Prereq: 4610 or equivalent or consent of
instructor.

4820 Introduction to Pattern Recognition (3)
(Same as Electrical Engineering 4820.)

4830 Digital Image Processing (3) (Same as
Electrical Engineering 4830.)

4850 Small Computer Systems (3) (Same as
Electrical Engineering 4850.)

4910 Analysis and Management of Computer
Installations (3) Analysis and design of com-
puter systems; implementation; justification,
personnel in systems; perspective on systems.
Prereq: Computer Organization and Program-
m ing II or equivalent.

4990-90 Special Studies in Computer Science
(1-4, 1-4) Credit determined at registration.
Prereq: Recommendation of computer science
staff. May be repeated with consent of depart-
ment. Maximum 9 hrs.

5000 Thesis

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

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 they will play in future education. Research
projects involve use of a CAI programming
language to implement a CAI course. Prereq:
Computer Organization and Programming I
or consent of instructor.

5050 Computer Modeling and Simulation of
Physical Systems (3) Techniques for computer
modelling and simulation of physical sys-
tems, errors, outputs, interactive simulations
as applied to various physical systems. Models
to represent spatial relationships. Prereq: 3150
or 3155, and Computer Organization and
Programming II and Statistics 3450.

5210 Artificial Intelligence (3) Study of the
simulation of intelligent processes by com-
puter. Techniques of representation, search,
and manipulation for various areas: problem
solving, game playing, pattern perception, the-
orem proving, expert system simulation.
Computer simulation of AI problems. Prereq:
4510 or consent of instructor. (Same as Elec-
trical Engineering 5210.)

5250 Medical Computing (3) A study of the
achievements and problems associated with the
application of computer technology to the field
of health care. Various areas of medical com-
puting will be covered, including laboratory
data systems, patient monitoring systems, diag-
nostic assistance, patient records, automatic
history taking, and hospital administration sys-
tems. Prereq: 4510.

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: 4510, Computer Organization and Programming III, and 5750.

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 5655-65-75.)

5870-60 Advanced Operating Systems (3, 3) Theory and analysis of operating systems. Synchronization and deadlock analysis. Analysis of operating systems using mathematical models, simulation, and hardware and software monitors. Comparison of good heuristic scheduling algorithms with best possible schedules; scheduling anomalies. Case studies of virtual memory systems. Analysis of page swapping and placement strategies. Prereq: 4910 or equivalent or consent of instructor.


5750 Theory of Formal Languages (3) Phrase-structure languages, their generators and processors. Type 0, 1, 2, and 3 languages: operations on languages and grammars; deterministic context-free languages. Theory of translation. Prereq: Formal Languages and Automata.


5910-20-30 Spacial Topics in Computer Science (1-3, 1-3, 1-3) May be repeated. Maximum 9 hrs.

5940-50 Advanced Small Computer Systems (3, 3) (Same as Elec. Engr. 5940-50.)


Cultural Studies

Asian Studies

4010-20-30 Readings in Asian Literature (4, 4, 4) Prereq: Mastery of intermediate level of Japanese, Chinese, or Sanskrit and consent of instructor.

4012 Selected Topics in Asian Studies (4) Content varies. May be repeated. Maximum 12 hrs.

Black Studies

3140-50-60 Directed Readings in Black Studies (1, 1, 1) Designed for students who are interested in doing intensive reading in some area of Black Studies which is defined by the student and the instructor. Prereq: Introduction to Black Studies.

3500 Resource Materials in Black Studies (4) Introduction to basic references such as bibliographies, indices, and listings of audiovisuals in Afro-American history, African history, and children's literature. Prereq: Introduction to Black Studies or consent of instructor.

4200 Senior Seminar on Pan-Africanism (4) Explores concepts and philosophers of Pan-Africanism and implication of this ideology for various societal institutions.

4310 Research in Black Studies (4) Deals with Black experience and research process.

4650 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 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

Linguistics

4020 Historical Linguistics, Neogrammaring School, and Growth of Structuralism (3) Traces development of scientific approach to linguistics from Jacob Grimm and Franz Bopp through nineteenth century and change in linguistic interest under influence of Ferdinand de Saussure, Leonard Bloomfield and others.

4471-81 English as a Second or Foreign Language (3, 3) (Same as English 4471-81.)

Economics

See College of Business Administration.

English

MAJOR DEGREES

English

M.A., M.A.C.T., Ph.D.

Professors:

H. B. Fisher (Head), Ph.D. Pennsylvania; E. W. Bratton (Associate Head), Ph.D. Illinois; R. G. Adams (Director of Graduate Studies) Ph.D. Texas; N. Wright (Acting Director of Graduate Studies), Ph.D. Yale; L. L. Allen, Ph.D. Florida; K. Curry, Ph.D. Yale; R. B. Davis, Ph.D. Virginia; R. V. Drake, Jr., Ph.D. Yale; J. A. Hansen, Ph.D. Yale; R. M. Kelly, Ph.D. Duke; D. S. Miller, Ph.D. Virginia; J. E. Reese (Chancellor), Ph.D. Kentucky; N. J. Sanders, Ph.D. Shakespeare Institute, Stratford-upon-Avon; H. E. Spivey, Ph.D. North Carolina; B. T. Stewart, Ph.D. Pennsylvania; T. V. Wheeler, Ph.D. North Carolina.

Associate Professors:

L. S. Burghardt, Ph.D. Chicago; D. A. Carroll, Ph.D. North Carolina; B. K. Dumas, Ph.D. Arkansas; A. R. Ennor, Ph.D. Indiana; B. J. Gaines, Ph.D. Wisconsin; J. E. Gill, Ph.D. North Carolina; B. J. Good, Ph.D. Florida; R. B. Miller, Ph.D. Brown; D. M. Myers, Ph.D. Florida; A. R. Fenner, Ph.D. Colorado; F. K. Robinson, Ph.D. Texas; R. H. Walker, M.A. Texas.

Assistant Professors:

J. A. Armstead, Ph.D. Duke; D. R. Cox, Ph.D. Missouri; R. T. Goode, Ph.D. Texas; D. F. Goosen, Ph.D. Yale; N. M. Goosey, Ph.D. Yale; T. A. J. Heffernan, D.Phil. Cambridge; M. A. Loftano, Ph.D. Maryland; M. P. Richards, Ph.D. Wisconsin.

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 requirements for the M.A. degree in English include (1) a thesis and 36 quarter hours of courses in English or 45 quarter hours without a thesis, (2) evidence of proficiency in one foreign language, and (3) a final examination. The courses should include 12 hours at the 6000 level, 12 hours of additional courses at the 5000-6000 level, and 12 hours at any level for graduate credit, including the 3000-4000 level.

Students seeking the Master of Arts without a thesis may substitute 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 (M.A.C.T.) the requirements include (1) 45 quarter hours of courses designed for M.A.C.T. students, (2) a thesis or 9 additional quarter hours of 5000- or 6000-level courses in English, (4) evidence of proficiency in one foreign language, (5) a final examination, and (6) a program of supervised teaching approved by the department.

The language requirement may be fulfilled in one of the following ways:

a. The completion, before beginning graduate study, of a second year of a foreign language in college with a grade of C or better.

b. The completion of French 3020 or German 3020, at The University of Tennessee, with a grade of B or better.

c. The passing of the 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 prerequisite courses (or their equivalent) in English: 12 courses at the 6000 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 divided as the department directs. Successful completion of these examinations will be followed by the writing of the dissertation and an oral examination.

*1211 Written and Oral English for Foreign Students (6) Rapid review of English grammar structures and areas with intensive oral, aural, and written drill. Required during the first quarter of residence of all foreign students (graduates and undergraduates and transfer students) who are not excused from it on the basis of the English Proficiency Examination required of every new foreign student.

*1221 Written and Oral English for Foreign Students (6) Emphasis on the more advanced structures of English grammar and on paragraph writing. Required during the first quarter of residence of foreign students who on the English Proficiency Examination demonstrate need for work in English structure, but not at the intensive level of English 1211. Required also of foreign students who complete 1211.

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) 3210-20 Victorian Prose (3, 3) 3210—Carlyle, Macaulay, Froude, Newman, Mill, Thackeray. 3220—Ruskin, Arnold, Huxley, Morris, Pater, Stevenson, 3230-3240-3250 Modern Drama (3, 3, 3, 3) 3411—Continental to 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 Prose (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 Literature of the English Bible (3) Types of Old Testament literature, excluding wisdom literature.

3910-20-30 Comparative Literature (3, 3, 3) 3910—Ancient and Medieval literature. 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, c. 1590-1601, including 1) Henry IV, 2) Twelfth Night, 3) Measure for Measure, 4) Later plays, 1601-1613, with emphasis upon tragedies and dramatic romances.

4050-50-70 American Novel (3, 3, 3) 4050—From earliest novelistic ventures through Brown, Cooper, and Kennedy, and major figures to 1875. 4060—Henry James and Mark Twain through early works of Faulkner and Hemingway. 4070—Early thirties to present.

4110-50 Technological Writing (3, 3) 4140—For students planning careers in the physical, life and health sciences, engineering, agriculture, and forestry. The writing of proposals, laboratory and progress reports, abstracts and journal articles. 4150—The writing of scientific feature articles in which data are marshalled and analyzed for their human interest.

4210-20-30 Victorian Poetry (3, 3, 3) 4210—Tennyson and the Pre-Raphaelites. 4220—Browning. 4230—Arnold, Clough, Fitzgerald, and others.

4320-30-40 The British Novel (3, 3, 3) 4310—Defoe to Jane Austen. 4320—Scott to Thackeray. 4330—George Eliot to Galsworthy. 4340—James Joyce to the present.

4430 Modern English Grammar (5) 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 methodology of diachronic and synchronic fieldwork and analysis. Prereq. Varieties of English or consent of instructor.

4460 Special Topics in English Linguistics (3) May be repeated with consent of department.

4471-81 English as a Second or Foreign Language (3, 3, 3) 4471—Applied linguistics in teaching and learning of English as a second or foreign language. Phonological and grammatical structures of non-English speaking world and of present-day English. Analysis of differences (phonological, grammatical, and lexical) between English and another language. 4481—Approaches to language teaching, with emphasis on preparation of materials and structured teaching situations. Theory of learning, analysis of research, and methods of language teaching, with an experienced member of the staff. Prereq: 4471. (Same as Linguistics 4471-81.)

4510 Introduction to Literary Criticism (3)

4610-20-30 Black Literature (3, 3, 3) Trends and developments.

4651 Southern Literature from 1858 to 1890 (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) Hurston, local colorists, and results of the later nineteenth century and of the New South; emphasis upon the southern flowering of 1920-1950; recent trends.

4680 Emerson and Thoreau (3) Selected writings of American Transcendentalism.

4680 American Humor through Mark Twain (3)

4720 Introduction to Folklore (3)

4730 The Popular Ballad (3)

4850 Milton (3) Emphasis on major poems.

4880 Seventeenth-Century Prose and Poetry: Bacon and Donne to Marvell (3)

4910 Chaucer—Early Poems and Troilus and Cressida (3)

4920 Chaucer—The Canterbury Tales (3)

4950 Approaches to Literature (3) Basic knowledge and techniques necessary to understand and evaluate various kinds of imaginative literature.

5000 Thesis

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

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

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)

5170-80 History of the English Language (3, 3) 5170—Phonetic transcription, Old English, development of inflection and syntax. 5180—Middle and Early Modern English, developments in pronunciation and vocabulary.

5210-20-30 Readings in American Literature from the Colonial Period to the Present (3, 3, 3)

5310 Rhetoric and Composition: Theory and Practice (3) Concentration on stylistics and types of expository writing.

5410-20-30 Readings in Middle English Literature (3, 3, 3)

5510-20 Readings in Literary Criticism from Plato and Aristotle to the Present Day (3, 3, 3)

5510-20-30 Readings in English Literature of the Nineteenth Century (3, 3, 3)

5710-20-30 Readings in English Literature of the Eighteenth Century (3, 3, 3)

5810-20-30 Readings in English Literature of the Renaissance (3, 3, 3)

5860 Introduction to Literary Research (3) Critical examination of the aims of English studies, the profession of the English teacher, theory of literature, and methods of research, including collecting of information, evaluation of material, and transmitting of the results of scholarship.

5910-20-30 Readings in English and American Literature of the Twentieth Century (3, 3, 3)

6000 Doctoral Research and Dissertation

6110-20-30 Studies in Elizabethan Literature (3, 3, 3)

6150 Old English Poetry (3) Prereq: 5150.

6160 Beowulf (3) Prereq: 5150, 6150.

6170 Studies in Middle English (3)

6181-82-83 Studies in the English Language (3, 3, 3)

6210-20-30 Studies in American Literature (3, 3, 3)

6241-42 Studies in Colonial American Literature (3, 3) 6241—From Thomas Haviot through Increase and Cotton Mather. 6242—From Jona-
than Edwards to the adoption of the Constitution.

6270-80 Studies in American Fiction (3, 3, 3)
6310-20-30 Studies in Victorian Literature (3, 3, 3)
6410-20-30 Studies in Chaucer (3, 3, 3)
6510-20-30 Studies in Spenser and Milton (3, 3, 3)
6610-20-30 Studies in English Romanticism (3, 3, 3)
6710-20-30 Studies in Eighteenth-Century Literature (3, 3, 3)
6810-20-30 Studies in Drama and Theatre (3, 3, 3)
6910-20-30 Studies in Twentieth-Century Literature (3, 3, 3)

French
See Romance Languages

Geography

MAJOR
Geography

DEGREES
M.S., Ph.D.

Professors:
E. H. Hammond (Head), Ph.D., California (Berkeley);
R. G. Long, Ph.D., Northwestern;
T. H. Schmudder, Ph.D., Wisconsin.

Associate Professors:
G. S. Allen, Ph.D., Georgia;
L. W. Brinkman, Jr., Ph.D., Wisconsin;
J. B. Rehder, Ph.D., Louisiana State.

Assistant Professors:
J. R. Carter, Ph.D., Georgia; W. N. Cherry, M.S., Tennessee; B. Raídon, Ph.D., Northwestern.

MASTER’S PROGRAM

The department requires a minimum of 45 quarter hours beyond completion of a sound undergraduate major program. Of these, half must be in courses numbered above 5000, in addition to thesis, and must include Geography 5150-60. 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 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.

3410 Intermediate Economic Geography (4)
3430 Urban Geography (4)
3450 Rural Geography (4)
3490 Geography of Resources (4)
3520 The Atmospheric System and Man (4)
3550 Cultural Geography (4)
3590 Geography of Middle America (4)
3600 Cultural Geography (3)
3650 Political Geography (4)
3790 Geography of the American South (4)
3800 Geography of South America (4)
3870 Geography of Asia (4)
3910 Regional Geography of United States and Canada (4)
3920 Geography of the American South (4)
3940 Geography of Appalachia (4)
4100 Quantitative Methods in Geography (4)
4210 Problems in Geographic Method (4)
4220 Historical Geography of the United States (4)
4230 Principles of Geomorphology (4)
4240 Historical Geography of the United States (3)
4510 Principles of Geomorphology (4)
4550 Geography of Soils (4)

systems and their relationship to environments. Investigation of specific cases of the role of soil in the management of environmental systems.

4510 Industrial Geography (4)
4710 Cartography (4)
4720 Data Mapping (4)
4740 Remote Sensing: Types and Applications (4)

See Romance Languages

French

See Romance Languages

Geography

MAJOR
Geography

DEGREES
M.S., Ph.D.

Professors:
E. H. Hammond (Head), Ph.D., California (Berkeley);
R. G. Long, Ph.D., Northwestern;
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Assistant Professors:
J. R. Carter, Ph.D., Georgia; W. N. Cherry, M.S., Tennessee; B. Raídon, Ph.D., Northwestern.

MASTER’S PROGRAM

The department requires a minimum of 45 quarter hours beyond completion of a sound undergraduate major program. Of these, half must be in courses numbered above 5000, in addition to thesis, and must include Geography 5150-60. 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 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.

3410 Intermediate Economic Geography (4)
3430 Urban Geography (4)
3450 Rural Geography (4)
3490 Geography of Resources (4)
3520 The Atmospheric System and Man (4)
3550 Cultural Geography (4)
3590 Geography of the American South (4)
3600 Cultural Geography (3)
3650 Political Geography (4)
3790 Geography of the American South (4)
3800 Geography of South America (4)
3870 Geography of Asia (4)
3910 Regional Geography of United States and Canada (4)
3920 Geography of the American South (4)
3940 Geography of Appalachia (4)
4100 Quantitative Methods in Geography (4)
4210 Problems in Geographic Method (4)
4220 Historical Geography of the United States (4)
4230 Principles of Geomorphology (4)
4240 Historical Geography of the United States (3)
4250 Advanced Historical Geography (3)
4290 Advanced Topographic and remote sensing techniques. Emphasis upon value of various types of imagery for geographic interpretation and simple mapping. Prereq: Consent of instructor.

4700 Remote Sensing: Types and Applications (4)

5000 Thesis

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5200 Special Problems in Geography (2-4) Reading and research on problems or topics of interest to individual students. Students 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) Application of principles and techniques of research in historical geography. Critical review of work of major historical geographers, with emphasis on current literature and ideas. Prereq: 4241 or permission of instructor. May be repeated with consent of instructor.

5260 Advanced Cultural Geography (3) Geographic analysis of rural settlement 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 United States (3) Intensive work in the delineation and analysis of one or more selected regions of the United States. The regions involved will change from offering to offering. May be repeated with consent of instructor.

5320 Advanced Regional Geography of the South (3)

5410-20 Advanced Economic Geography (3, 3)

5520 Advanced Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 4340 or consent of instructor.

5550 Topics in Geography of Land-Surface System (3) Examination of trends, problems, systems and their relationship to environments. Investigation of specific cases of the role of soil in the management of environmental systems.

4510 Industrial Geography (4) Factors affecting location of manufacturing activities, with emphasis on the United States. Prereq: 3410 or consent of instructor.

4530 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 graphics. Mappable 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 interpretation and simple mapping. Prereq: Consent of instructor.

5000 Thesis

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5150 Introduction to Geographical Research (3) The aims of geographical research; survey of printed source materials; practice in effective presentation of research findings.

5160 Research Design and Field Problems (4-6) Development of research design; preparation of appropriate study designs, and practical field 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 (2-4) Reading and research on problems or topics of interest to individual students. Students 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) Application of principles and techniques of research in historical geography. Critical review of work of major historical geographers, with emphasis on current literature and ideas. Prereq: 4241 or permission of instructor. May be repeated with consent of instructor.

5260 Advanced Cultural Geography (3) Geographic analysis of rural settlement 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 United States (3) Intensive work in the delineation and analysis of one or more selected regions of the United States. The regions involved will change from offering to offering. May be repeated with consent of instructor.

5320 Advanced Regional Geography of the South (3)

5410-20 Advanced Economic Geography (3, 3)

5520 Advanced Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 4340 or consent of instructor.

5550 Topics in Geography of Land-Surface System (3) Examination of trends, problems, systems and their relationship to environments. Investigation of specific cases of the role of soil in the management of environmental systems.
and methods in geography of land-surface system. May be repeated for credit with permission of instructor. Prereq: 3550 or consent of instructor.

5610 Topics in Climatology (3) Examination of trends, problems, and methods in modern climatology. May be repeated for credit with permission of instructor. Prereq: 3520 or consent of instructor.

5710 Seminar in Geography (3)

5720 Topics in Quantitative Geography (3) Multivariate analysis applied to problems in geography; research problems utilizing appropriate packaged computer programs; usefulness to geographic research of techniques developed by other disciplines. Prereq: 4100 or consent of instructor.

5740 Advanced Topics in Remote Sensing (3) Applied research using remote sensing and aerial photographic imagery for the interpretation and mapping of geographic data. Prereq: 4740 or consent of instructor.

5915 Regional Geomorphology (4) (Same as Geology 5915)

6000 Doctoral Research and Dissertation

5110-20 Seminar in Economic Geography (3, 3)

6220-50 Seminar in Urban Geography (3, 3)

6240-50 Seminar in Historical Geography (3, 3)

6260-70 Seminar in Cultural Geography (3, 3)

6310-20 Seminar in Rural Geography (3, 3)

6410-20 Seminar in Regional Geography of the United States (3, 3)

6510-20 Seminar in Regional Geography of Latin America (3, 3)

6710-20 Seminar in Physical Geography (3, 3)

Geological Sciences

MAJOR

DEGREES

Geology

M.S., Ph.D.

Professors:

G. Briggs (Head), Ph.D., Wisconsin; H. J. Kiefer, Ph.D., Ohio State; O. C. Kopp, Ph.D., Columbia; R. E. McLaughlin, Ph.D., Tennessee; D. H. Roeder, Ph.D., Goethe (Germany); K. R. Walker, Ph.D., Yale; J. G. Walls, Ph.D., North Carolina.

Associate Professors:

G. M. Clark, Ph.D., Pennsylvania State; L. A. Taylor, Ph.D., Lehigh.

Assistant Professors:

D. W. Byerly, Ph.D., Tennessee; F. B. Keiler, M.Phil., Yale; K. C. Misra, Ph.D., Western Ontario; W. P. Straub, Ph.D., Iowa State.

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 without having had an acceptable field and laboratory course to take Geology 4440, or an equivalent course elsewhere, as part of the above department requirements. One year of general physics is required, if not taken as an undergraduate. 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 34 quarter hours in courses for graduate credit, in addition to dissertation. These courses must include a minimum of 45 hours in the 5000- or 6000-series, of which at least 15 hours must be in the 6000 series. 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. Preliminary examination will be both written and oral.

3. Each Ph.D. student must satisfy a research tool requirement which will be determined by his/her faculty committee and which will consist of one of the following:

A. Demonstration by examination of a reading knowledge in one modern foreign language in which there is a significant body of geological literature.

B. Completion of course 3030 in an appropriate foreign language with a B or better.

C. Courses (minimum of 6 hours) at 3000 level or higher taken for undergraduate credit and completed with a B average in appropriate mathematics, statistics, or computer science courses. The courses must be taken during a student's graduate program and must be approved by the student's entire committee.

In no case will option C above be available unless the student has had reading training as a college undergraduate in an appropriate foreign language.

3160 Introduction to Earth Materials (4) An introduction to the study of minerals, rocks and soils. Laboratory includes hand specimen and analytical methods of identification of important rock-forming and economic minerals and major rock and soil types. Prereq: Geoscience 1 or Introductory Geology 2 and 2 hrs.

3180 Mineralogy (4) Classification and identification of silicate and non-silicate minerals. Minerals as phases in natural systems. Laboratory includes hand specimen, chemical and x-ray methods of identification. Prereq: 3160: General Chemistry or equivalent. 2 hrs and 2 labs.

3210-20 Invertebrate Paleontology (4, 4) Systematic review of important invertebrate fossil groups. 3210—Protista to Brachiopoda, including sponges, coelenterates and bryozoa. 3220—Phoronida to Hemichordata, including annelids, molluscs, arthropods and echinoderms. May be taken separately or in any order. Prereq: Paleobiology, General Biology, or consent of instructor. 3 hrs and 1 lab or field period.

3250 Micropaleontology (4) Micropaleontology is an introduction to the principles and materials of paleontology as applied to the interpretation of earth history. Prereq: Geoscience II or Introductory Geology. 3 hrs and 1 lab or field period.

3270 Geological History of Land Organisms (4) The geological development of the terrestrial biota and ecosystem with special emphasis on the fossil record of land plants and animals. Prereq: Invertebrate Paleontology or consent of instructor, 3 lectures and 1 lab or field period.

3290 Physical and Biological Quaternary Environment of Humans (4) Interdisciplinary interactions of the physical and biological Quaternary environment with humanity, stressing important aspects 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. Strongly recommended: 3160. 2 lectures and 2 labs.

3330 Geology of East Tennessee (4) Lectures and field excursions. Prereq: 12 hrs of geology and consent of instructor.

3350 Stratigraphy-Sedimentation (4) An introductory study of stratigraphic principles and practices and of sedimentary processes and the interpretation of depositional environments. Prereq: Geoscience II or Introductory Geology 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, structure contour, contour maps, etc. Prereq: Geoscience II or Introductory Geology and Single Variable Calculus or equivalent. 3 hrs and 1 lab.

3410 Principles of Ground Water Geology (3) Geologic 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 II or Introductory Geology or consent of instructor. 2 hrs 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 stream table experiments and field experience. 2 hrs and 2 labs or field periods.

3610 Quaternary Geology for Engineers (3) Erosional and depositional processes, landforms, groundwater. 2 lectures and 1 lab or field period. Prereq: Introductory Geology for Engineers or equivalent.

3710 Origin and Evolution of the Continents and Ocean Basins (4) An introductory study of the 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 or Introductory Geology.

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 surveys. Prereq: Geoscience II and elementary physics. Differential and integral calculus desirable. 3 lectures and 1 lab.

* Not available for graduate credit for geology majors.
4130 Sedimentology (3) Prereq: 3160. 2 hrs and 2 labs.
4210 Biostratigraphy (4) Fossil faunas and florae and their use in geochronology, strati- 
graphic correlation, and paleoecology. Prereq: 3260. 3 hrs and 1 lab.
4230 Paleozoology (4) Principles of environ- 
mental analysis applied to fossil assemblages and fossil records. Prereq: 3260 or 
consent of instructor. 3 hrs and 1 lab.
4240 Paleobotany (4) Survey of fossil record of plants with particular emphasis on compara- 
tive morphology and evolutionary trends in major plant groups and geologic signifi- 
cance and geographic distribution of past floras on earth. Prereq: Geoscience II or Introductory 
Geology or History of Life on Earth; Plants in Evolution or consent of instructor. 3 hrs 
and 1 lab. (Same as Botany 4240.)
4310 Geologic Mapping (4) Interpretation and 
methods. Prereq: 12 hrs of geology. 3 hrs 
and 1 lab or field period.
4370 Tectonic Styles (4) Elements, habitats, 
and geotectonic causes of basic styles of 
tectonic deformation are presented on maps, 
section and geographic distribution of past floras 
and 2 labs.
4410 Field Geology (5) Five weeks' field 
course, first term summer quarter. Employs 
out-of-classroom study of students. A report is 
required, to be submitted no later than end of fall 
quarter. Prereq: 12-quarter-courses in geology 
and consent of Instructor.
4460 Geophysics and Photogram- 
metry (4) An introduction to the principles of 
terrestrial and aerial geologic photography, 
including principles and practice, geometry of terrestrial and aerial photographs, 
and image interpretation. Prereq: 3370 or con- 
sent of instructor. 3 lectures and 1 lab.
4510 Principles of Geomorphology (4) A study of 
the processes of weathering and transport of material from the earth's surface and the 
landforms produced. Prereq: Geoscience I or Introductory Geology or consent of instructor. 3 hrs 
and 1 lab. (Same as Geography 4510.)
4610 Principles of Geochemistry (4) Applica- 
tion of chemical principles to geological prob- 
lems in the earth's crust. Prereq: General Chemistry or 
equivalent required. Prereq: Introduction to 
earth materials.
4850 Mineral Phase Equilibria (3) Principles of 
phase chemistry and application of phase 
equilibria studies in rock-forming mineral 
systems as aid to understanding conditions of 
formation and modification of rocks. Prereq: 
3310 or consent of instructor.
4660 Electron Microprobe Analysis: Theory 
and Application (3) Techniques and appli- 
cability of electron probe in chemical analysis; emphasis on applications in the earth sciences. 
Prereq: 3310 or consent of instructor. 2 lec- 
tures and 1 lab.
4760 Global Tectonics (3) The earth's gravity 
field; internal heat and internal structure of the 
earth; the electromagnetic field, paleomag- 
etism, radioactivity and the age of the earth; 
the earth's internal heat, creep and plasticity 
of the mantle. 3 lectures per week. Prereq: 
4115 or consent of Instructor.
4810 Special Problems in Geology (1-4) May 
be repeated for credit. Prereq: 3000. 
3000 Thesis
5000 Thesis
5050 Geochemistry of Ore Mineral Deposits (3) Study of ore deposits based on experi- 
mental, empirical, and theoretical geochemical concepts. Prereq: 4950 and 4110 or con- 
sent of instructor.
5060 Experimental Geochemistry (3) Study of 
various experimental techniques for investigat- 
ing mineral systems, including generation of 
mineral formation conditions, and evaluation of the 
geochemical applicability of the derived data. 
Prereq: 5050 or consent of instructor.
5069 Experimental Geochemistry Laboratory (1-3) Independent laboratory work. Prereq: 5068 or 
consent of Instructor.
5120 Geophysics—Gravity and Magnetic Meth- 
ods (4) Potential methods discussed in depth, 
including gravity and paleomagnetism. Prereq: 
4115, Differential and Integral Calculus 
or consent of instructor. Advanced engi- 
eering mathematics desirable, 3 lectures and 
1 lab.
5130 Geophysics—Seismic Exploration Meth- 
ods (4) Seismic reflection and refraction meth- 
ods 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 interdisci- 
plinary approach to the interpretation of phys- 
ical 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: 
4130.
5320-30 Advanced Historical Geology (3, 3) 
5330—Geologic history of the Paleozoic. 5330— 
Mesozoic and Cenozoic. Prereq: 5310.
5340 Seminar in Local Stratigraphy (1) Stra- 
tigraphy of the Knoxville area.
5350 Selected Topics in Geology (1) Presenta- 
tion 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/NC only.
5360 Selected Topics in Geology (1) May be 
repeated for credit with consent of depart- 
ment.
5370 Mesosbatic Analysis (4) Introduction 
to techniques of gathering, processing, and 
Interpretation of structural fabric data. 3 
lectures and 1 lab or field meeting. Prereq: 
3370.
5460 Photogeologic Interpretation (4) Ad- 
vanced photogrammetric techniques used to 
interpret geological measurements from aerial 
photographs. Practice in photo interpretation 
of imagery covering selected geological features. Prereq: 5450 or equivalent or consent of 
Instructor.
5470 Plate Tectonics and Orogeny (4) Geo- 
metry 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, 
nonopaque substances by immersion methods, 
and 2 labs.
5540 Non-carbonate Sedimentary Petrology 
and Basin Analysis (4) A study of clastic de-
positions in environments, e.g., deep-water 
trough, abyssal plain, continental shelf, infra-

cratonic basin, and shoreline features. 3 hrs 
and 1 lab. Prereq: 5540. A report will consist of the 
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.
5630 X-Ray Diffraction and Spectroscopy (4) 
Production and use of x-rays in identifying 
crystalline substances; identification of chemi-
cal elements by their x-ray spectra. Prereq: 
3160 or consent of instructor. 2 lectures 
and 2 labs.
5640 Clay Mineralogy (4) Origin of the clay 
minerals; their structures and properties; ap-
lication of mineralogical techniques in clays 
in clay minerals. Prereq: Mineralogy and 5630 or 
equivalent. 2 lectures and 2 labs. To be 
offered on alternate-year basis.
5650 Thermodynamics for Geologists (3) Prin-
ciples of thermodynamics are related to geo-
physical processes. Prereq: General Chem-
istry and Analytic Geometry and Calculus of 
a Single Variable or equivalents.
5660 Chemical Geology (3) Chemical ap-
proach to geochemical problems. Topics 
of study include oxidation-reduction, phase equilibria, chemical mineralogy. Prereq: 
4115.
5670 Geochemical Prospecting (3) Theory and 
practice of geochemical prospecting for 
metallic ore deposits, i.e., the use of chemical 
analyses of rock, soil, plants, water, and 
stream sediment for locating ore. Prereq: 
4110 and General Chemistry or equivalents.
5710 Advanced Paleontology (4) Fossil in-
vertebrates.
5750 Petrophysics (3) Fluid and heat flow 
through rock. Mohr circle theory and stress-
strain behavior of rock. 3 lectures. Prereq: 
Analytic Geometry and Calculus of a Single 
Variable. Elements in Physics.
5810 Geology of Fuels (4) Origin, occur-
cences, and uses of natural fuels.
5820 Metallic Mineral Deposits (4) Origin, 
ocurrence, and uses of metallic minerals.
5830 Nonmetallic Mineral Deposits (4) Origin, 
ocurrence, and uses of nonmetallic minerals. 3 hrs 
and 1 lab or field period.
5840 Ore Microscopy (4) The study of ores and 
mineral deposits 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) 
Lithology laboratory studies 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 
geomorphologically-related areas, such as 
which have common elements such as history 
or development, related processes which have 
resulted in geometrically similar assemblages of 
landforms. May be repeated with consent 
of department. (Same as Geography 5915.)
6000 Doctoral Research and Dissertation 
*6110 Seminar in Stratigraphic Geology (3)
Germanic and Slavic Languages

MAJORS DEGREES
German M.A., M.A.C.T.
German Language and Literature Ph.D.
Emeritus Professor:
E. T. Hanksmer, Ph.D. Bonn (Germany).

Professors:
H. K. Kratz (Head), Ph.D. Ohio State;
H. W. Fuller, Ph.D. Wisconsin; R. Hiller,
Ph.D. Cornell; R. L. W. Nordström,
Ph.D. Ohio State; J. C. Osborne, Ph.D. Northwestern.

Associate Professors:
J. E. Falcone, Ph.D. Pennsylvania; D. E. Lee,
Ph.D. Stanford; M. P. Rice,* Ph.D. Vanderbilt.

Assistant Professors:
J. L. Elliott, Ph.D. Michigan; D. M. Fiehe,
Ph.D. Indiana; G. Gutenke, Ph.D. Wisconsin;
N. A. Leenks, Ph.D. Wisconsin; C. J. Mellor,
Ph.D. Chicago.

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.

MASTER 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 numbered above 5000. In addition to course work, the student is required to write a thesis, for which he/she may get a maximum of 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 (6200) and the literary or philosophical 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 the dissertation in an oral examination, which will cover also the general area of the dissertation. Central emphasis is put on the doctoral dissertation as a final test of the candidate's 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) May be repeated. Maximum 9 hrs.

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, Lagerfoh, Husaas, Vesaas, Lagerkvist, Bang, Nexa, 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) Varies. May be repeated for credit. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30) or equivalent.

4140-50 Selected Topics in German Literature from 1760 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: Intermediate German or equivalent or consent of instructor.

4210-20-30 Studies in German Literary Types (3, 3, 3) Prereq: 4200—Drama. 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 hours of upper division English, or 9 hours 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 phonemes and phonemics of German. German grammar and the German vocabulary from a descriptive point of view. The dialects of German. An introduction to the study of the other Germanic languages.

4310-20 History of the German Language (3, 3)

4610-20-30 German Civilization (3, 3, 3) Prereq: Intermediate German or equivalent.

4910-30 Advanced Conversation and Composition (3, 3, 3) Prereq: 3810-20-30 or equivalent or consent of department.

5000 Thesis

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

6140 Old Saxon (3) The phonology, morphology, and morphology of Saxon.

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 excuse from this requirement or who wish to pursue vocations other than teaching.

5410-20-30 Medieval German Language and Literature (3, 3, 3) 5410—Introduction to Middle High German; 5420—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)

5560 Goethe's Faust (3)

5560 German Romanticism (3)

5570 German Realism and Naturalism (3)

5580 Modern German Literature (1889-1945) (3)
MAJOR DEGREES

History

MAJORS

History

M.A., M.A.C.T., Ph.D.

Professors:

L. P. Graf (Head), Ph.D. Harvard; G. Brooker, Ph.D. Minnesota; V. C. Chernyshov, Ph.D. Harvard; H. S. Fink (Emeritus), Ph.D. Princeton; A. G. Hass, Ph.D. Chicago; Y. P. Hao, Ph.D. Beijing; R. W. Maksim, Ph.D. California (Berkeley); J. W. Hoffman (Emeritus), Ph.D. Chicago; C. O. Jackson, Ph.D. Emory; M. M. Klein, Ph.D. Columbia; R. C. Marius, Ph.D. Yale.

Associate Professors:

P. H. Bergeron, Ph.D. Vanderbilt; J. D. Blyng, Ph.D. Indiana; J. C. Daniel, Ph.D. Maryland; J. E. Ducan, Ph.D. California (Berkeley); J. R. Finger, Ph.D. Washington; C. W. Johnson, Ph.D. Michigan; P. A. Marr, Ph.D. Harvard; M. C. McDonald, Ph.D. Pennsylvania; J. McTighe, 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 6 additional hours 5300 or above. Total hours, including thesis—45. Plan II: History 5240, and either 5250 or 5260; two M.A. reading courses; 12 additional hours 5300 or above, at least 2 of which must be 6300 or above. Total hours—45. Plan I and Plan II require 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, and either 5250 or 5260; two M.A. reading courses; and one year as a graduate assistant and 1 year as a teaching assistant. Total hours, including thesis—60. Students seeking the M.A.C.T. degree may substitute 9 quarter hours of courses numbered 6300 or above for the Master's thesis.

DOCTORAL PROGRAM

1. Admission: (a) Acceptable scores on the Graduate Record Examination (General Aptitude and Subject). (b) Students successfully completing the M.A. degree at The University of Tennessee must be recommended by the Department of History.

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 in courses that are numbered over 5000. Not less than 6 quarters of the required 9 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 1 language and such additional languages or languages as may be determined by the student's graduate committee. Under normal circumstances students specializing in European history will need 2 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/she should consult with an advisor. The appropriate forms and the time of the examination may be obtained from the Graduate School. (b) By course work. Upon consultation with the advisor, a student may elect to complete an appropriate 3010-20-30 sequence in a language department (or an intermediate language sequence in which the 3010-20-30 sequence is available). Satisfactory completion requires that a student must have at least a B in the final quarter.

4. Preliminary Examinations and Committee: Incomplete students will be advised by the department head. The preliminary examinations must be taken after all course work is completed, and language requirements fulfilled, and at least 9 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 4 fields, distributed as follows: 1 major field (history); 2 minor fields (history); and 1 minor field which may be either in history or outside the department. In any case, the student is required to have 9 hours of graduate work outside the History department. Three of the 4 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 Reformations
   (2) Europe, 1559-1615
   (3) American History to 1815
   (4) Latin America, 1492-1825

III. Modern
   (1) Europe, 1815-1914
   (2) European World Since 1914
   (3) United States, 1815-Present
   (4) Latin America, 1879-Present
   (5) Asia, 1641-Present
   (6) Middle East, 1798-Present

IV. National, Sectional and Topical
   (1) England, 1485-1763
   (2) Great Britain, 1760-Present
   (3) France, 1559-1815
   (4) France, 1769-Present
   (5) Germany, 1555-1806
   (6) Germany, 1806-Present
   (7) Russia, 1600-1800
   (8) Russia, 1800-Present
   (9) Colonialism and Imperialism
   (10) Diplomatic History of the United States
   (11) Social and Cultural History of the United States
   (12) The South
   (13) Frontier and Westward Movement
   (14) Afro-American

Preliminary examinations will be both written and oral.

5. Dissertation and Final Examination:
   Original research forms the basis for the dissertation. After the dissertation has been completed, a final oral examination will be given on the dissertation in its historical context.

3610-20 The American Colonies and the American Revolution (3, 3) 3610—Settlements to 1754. 3820-1754. 3749-1789.

3920-80 The United States: Formation to Reunion, 1789-1817

3710-20-30 History of Germany (3, 3, 3) 3710—The First Reich to 1713. 3720—Habsburg and Hohenzollern and the Formation of the Second Reich, 1792-1871. From a Unified to a Divided Germany, 1890 to present.

3751 Ancient Near Eastern Civilization (3) Early and Middle Bronze Ages.

3752 Ancient Near Eastern Civilization (3) Late Bronze and Iron Ages.

3760-70 The Ancient World (3, 3) 3760—Greece. 3770—Rome.

3780-90 History of the Middle East (3, 3) 3780—Rise and spread of Islamic Civilization to the 16th Century. 3790—The impact of the West on the Middle East from the 16th Century to World War I.

3795 Contemporary Middle East (4) Background of current problems in the area, from World War I to the present.

3810-20-30 History of East Asia (3, 3, 3) 3810—Traditional China and Japan, ancient to mid-nineteenth century. 3920—Modern China, Japan and Korea, mid-nineteenth century to 1920's. 3930—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, Central America and the Caribbean, 1800 to present.

3911-21-31 United States, 1777 to the Present

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 Imperialism
   (3, 3) 4120—Background: age of discovery and exploration to 19th century. 4130—19th century to present.

4250-60-70 European Intellectual and Cultural 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 Relativism (1870-present).

4280 Women in European History
   (4) Comparative analysis of role and image of women in Medieval, Renaissance, and Victorian periods. Attention given to parallel changes in structure of family as well as relationship between Western Culture and women's protest movements.

4290 Women in American History
   (4) Approaches of 4280 applied to American Society.

4311-21 History of American Foreign Relations
   (4, 4) 4311—Revolutions to 1912. 4321—1912 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 Society and its armed forces.

4380—Civilian-Military Relationships in the Modern Western World
   (3) Civilian-military affairs from about 1800 to 1960 in Western Europe, Russia, and America; emphasis on Western Europe: e.g. the Dreyfus Affair, the Army in Nazi Germany, and the Truman-MacArthur controversy.

4410-20-30 Europe Since 1914
   (3, 3, 3) 4410—Pre-war European society and facilities to the World Depression. 4420—The World Depression to the end of World War II. 4430—Postwar Europe to 1945.

4470 Poland and Its Neighbors
   (3) A survey of Polish history from its beginnings to the present with some emphasis on the Polish question within the context of modern international affairs.

4480 Russian Intellectual History
   (3) A survey of Russian intellectual history from the eighteenth century to the present, emphasizing the problems of Westernization, nationalism, and the revolutionary tradition.

4490 Soviet Foreign Policy

4500 History of Medieval England
   (3, 4, 3) 4510—Tudor-Stuart England (3, 3) 4510—1485-1603. 4520—1603-1714.

4551 Great Britain from Burke to Bright (1780-1848)
   (3)

4571 Twentieth-Century Britain

4580 Revolution & Reform: Ireland in the 19th and 20th Centuries

4590 History of Canada

4610-20-30 The American Frontier and Westward Movement I, II, III (3, 3, 3) The settlement and development of the "West" throughout the period.

4640-50-60 Social and Cultural History of the United States
   (3, 3, 3) 4640—Colonial Society and Early Nation to 1825. 4650-1850-Present.

4670 American Urban History

4710-20 Medieval History, 500-1400
   (3, 3, 3) 4710—Early medieval period to revival of Empire in 962. 4720—62 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 18th 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
   (5, 3) 4770—To 1867. 4780—Since 1867.

4811-21 History of Japan

4840 History of Mexico

4850 History of the Caribbean

4870-30-90 China
   (3, 3, 3) 4870—Cultural history of China. 4890—History of modern China. 4900—History of contemporary China.

4910-20-30 History of the South
   (3, 3, 3) 4910—Settlements to 1867. 4920—1867-1870. 4930—Since 1870.

4950-60 The Negro in American History
   (3, 3) A history of the American Negro since 1619.

5000 Thesis

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

College of Liberal Arts
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Before admission to this program, the applicant must have either (a) certification for teaching secondary mathematics in at least 1 of the states of the United States or (b) 3 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 numbered above 3050, 3060, 3090, 3100, 3110, 3120, 3130, 3150, 3155, 3230, 3240, 3310, 3510, 3520, 3530, 3710, 3720, 3810, 3910, or other mathematics courses numbered above 4000.
3. Passing a comprehensive examination on completion of all course work.
4. A minimum of 9 hours of courses numbered above 5000 subject to the approval of the mathematics department and the department in which the courses are taken.

MATER'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 requirements for either of these degrees is a thesis, for which 9 credit hours must be earned, and an additional 9 hours of acceptable course work numbered above 4000. Of the above 36 hours, 9 hours may be in a minor outside the department and the 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 M.A. degree is required to obtain at least 9 hours of resident graduate credit in courses numbered above 4000 and approved by both the major department and the Department of Mathematics.

DOCTORAL PROGRAM

The preliminary examination for the Ph.D. degree in mathematics will include 4 of the following subjects (including at least 2 from Group A) to the extent indicated by the accompanying course numbers, and such other subjects as the graduate faculty may prescribe.

(A) Algebra 5510-30-30
Functions of a Complex Variable 5110-20-30
Functions of a Real Variable 5210-20-30
Topology 5910-20-30
(B) Linear Algebra 5240-50-60
Mathematical Statistics 5750-60-70

**Numerical Analysis 5650-60**
**Partial Differential Equations 5450-60-70**

Note: A student selecting 2 subjects from Group B above is required to take a 1 year graduate level (numbered 5000 or above) mathematics course, which 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 student and his committee.

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, sets, and events; statistical independence; elementary probability theory; random variables and their distributions; simple random processes. Prereq: Introductory Calculus, General Mathematics or equivalent.

**3060 Elementary Statistical Analysis (3)** Elementary probability distributions used in statistics: binomial, Poisson, and normal and their properties; sampling theory; confidence intervals and statistical tests of hypotheses: least squares and linear regression. Prereq: 3050 or consent of instructor.

**3090 Polynomials and Rings (3)** Elementary introduction to modern abstract algebra. Axiomatic approach is used to study divisibility and factorization in rings of integers and of polynomials with coefficients from various fields. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

**3100 Logic and Sets (3)** Elements of mathematical logic; truth sets and open sentences; elementary theory of groups of rings, polynomials with coefficients from various fields, sets with operations of union and intersection. Prereq: 1 yr of college math. Primarily for students in the College of Education.

**3110 The Real Number System (3)** Laws of arithmetic; rational and irrational numbers; fields. Prereq: 1 yr of college math. Primarily for students in the College of Education.

**3150 Introduction to Numerical Algorithms and Programming (3)** (Same as Computer Science 3150)

**3155 Introduction to Numerical Algorithms (3)** (Same as Computer Science 3155)

**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.

* These courses are sometimes offered in special summer institutes for an 8-week period with 4 hours credit. Such special courses are designated 3091, 3092, etc.

**3320 Non-Euclidean Geometry (3)** Foundations of geometry. Elliptic and hyperbolic plane geometry. Prereq: 1 year of college math.

**3330 Transformational Geometry (3)** Fundamental transformations of the Plane. Isometries and similarities; symmetries of a polygon; invariances. Prereq: 1 year of college math.

**3510 Intermediate Analysis (3)** Primarily for students in secondary mathematics education. Course covers elementary calculus from advanced viewpoint with emphasis on proofs of basic theorems. Topics covered include limits of sequences and functions, continuous functions, derivatives, definite integral, and fundamental theorem of integral calculus. Prereq: Calculus of Algebraic Functions, Linear Algebra and Calculus or Single Variable Calculus.


**3780-90 Introduction to Combinatorial Theory (4, 3)** Introduction to problems of arrangement and selection within discrete systems. Enumeration by recurrence relations and generating functions, graph theory, elementary probability distributions used in statistics: binomial, Poisson, and normal and their properties; sampling theory; confidence intervals and statistical tests of hypotheses: least squares and linear regression. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

**3810 How to Prove It (3)** Course is designed to improve understanding of logic and methods of mathematical proof by means of practice and participation in seminar setting. Variables covered include certain standard topics such as elementary set theory, relations and functions, and mathematical induction. Coreqs: Introduction to Linear Algebra and Matrix Algebra or Calculus.

**3920-30 Topology of Euclidean Spaces (4, 4)** Topics will include topology of line and plane, separation properties, compactness, connectedness, completeness, continuous functions, homeomorphisms, continua, and topological invariants. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra and 3810, or Honors: Multivariable Calculus and Linear Algebra.

**3990 Studies in Mathematics (1-4)** Credit determined at registration. Prereq: Consent of instructor. May be repeated for credit 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, systems of linear equations, 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 similarity transformations, quadratic forms, vector and matrix norms, Jordan canonical 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 4050.

**4150-60 Abstract Algebra (3, 3)** Equivalence relations and partitions, properties of integers, elementary theory of groups of rings, polynomial rings, integral domains, divisibility;
unique factorization domains, fields. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra or 4560.

4225-35 Introduction to Numerical Analysis (3, 3) Interpolation and approximation, numerical differentiation and integration, roots of equations, systems of linear and nonlinear equations. Prereq: 3150 or 3155. (Same as Computer Science 4225-35.)


4250 Elementary Complex Variables (3) Complex numbers, Cauchy's theorem and formula, Taylor and Laurent series, residues and their applications. 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 and uniform continuity, differentiation, integration. Functions of several variables; implicit function theorem. Multiple integrals, line and surface integrals, Green's, Stokes' and divergence theorems. Prereq: Multivariable Calculus and Matrix Algebra.

4540 Infinite Series and Functions of Several Variables (3) General theory, power series and Taylor's formula, uniform convergence. Partial differentiation and maxima and minima for functions of several variables. LaGrange multipliers. Prereq: Multivariable Calculus and Matrix Algebra.

4550 Partial Differential Equations (3) Fourier series; Fourier integrals; orthogonal functions; the vibrating string; solution by series; heat flow, Bessel functions. Prereq: Multivariable Calculus and Matrix Algebra. Recommended: 4610 or 4710.


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 random variables; mathematical expectation; regression; and statistical independence; foundations of sampling theory; significance tests. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra.

4719 Vector Analysis (3) Fundamental operations, basis vectors, dot and cross products, directional derivatives, divergence and curl of vector fields, line integrals, integral theorems, convergence of series, divergence of series, uniform convergence, Taylor series, and the central limit theorem. Prereq: Multivariable Calculus and Matrix Algebra.


4810 Elementary Number Theory (3) Divisibility; congruences; theorems of Fermat and Wilson, primitive roots; indices; quadratic reciprocity; the elementary theory of numbers in the Gaussian and Matrix Algebra or consent of instructor.

4960 Readings in Mathematics (1-3) Open to superior students with permission of department head. Independent study with 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 Mathematics faculty member and consent of department.

5000 Thesis

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. Must be taken in sequence.


5240-50-60 Linear Analysis (3, 3, 3) Metric spaces, finite and infinite dimensional Banach and Hilbert spaces, linear operators, vector and operator norms, spectral theory. Examples to be chosen from relevant applied areas. Prereq: 4510-20-30.


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 projective geometry. Prereq: 4150-60. Must be taken in sequence.

5340-50-60 The Numerical Treatment of Algebraic and Transcendental Equations (3, 3, 3) The mathematical principles underlying such methods as those of Gauss, Newton, Bérloumi, Graefe, and others for obtaining numerical solutions: theorems of Budan and Fourier, Sturm and Hurwitz, and phenomena for localizing roots.


5440 Calculus of Variations (3) Function spaces, the variation of a functional, strong and weak extremals for an extremum—Euler's equation. Variational problems in parametric form, functionals depending on higher derivatives. Broken extremals—the Weierstrass-Erdmann conditions. Quadratic functionals, the second variation of a functional. Special conditions, conjugate points, Jacobi's condition, sufficient
and multivariable theoretical distribution and its characterizing functions; linear regression; general theory of statistical inference; topics from sequential analysis. Prereq: 4510-20-30. Must be taken in sequence.

5810-20-30 Number Theory (3, 3, 3) Arithmetic functions, distribution of primes, Diophantine equations, approximation theory, primes in arithmetic progressions, Dirichlet's theorem, prime-number theorems. Prereq or coreq: 5510 for 5810; 5520 for 5820.


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 (1-3)

5992 Seminar Topology (1-3)

5993 Seminar Algebra (1-3)

5994 Seminar Foundations (1-3)

5995 Seminar Applied Mathematics (1-3)

6000 Doctoral Research and Dissertation

5210-20-30 Linear Analysis (3, 3, 3) Algebraic and topological properties of linear spaces, emphasis on normed spaces; linear functionals and dual spaces; linear transformations; special topics (spectral theory, ergodic theory, semi-groups of transformations); applications to problems in analysis. Prereq: 4150-60 and 5210-20-30. May be taken in sequence.

6450-60-70 Partial Differential Equations (3, 3, 3) Advanced topics in classical and modern theoretical partial differential equations. Prereq or coreq: 5110-20-30 and 5210-20-30 or consent of instructor.

6510-20-30 Modern Algebra (3, 3, 3) Intensive study of some major branch of algebraic theory. Subject matter will vary according to interests and preparation of students. Prereq: 5510-20-30.

6540-50-60 Introduction to Algebraic Topology (3, 3, 3) Introduction to algebraic and homotopy theories. Topics discussed will be homology and cohomology groups, the Eilenberg-Steenrod axioms, cup and cap products, duality theorems, homology equivalence, higher homotopy groups, fiber spaces, spectral sequences. Prereq: 4150 and 5920.

6991 Seminar Analysis (1-3)

6992 Seminar Topology (1-3)

6993 Seminar Algebra (1-3)

6994 Seminar Foundations (1-3)

6995 Seminar Applied Mathematics (1-3)

Registration for seminars may be repeated with consent of department.

Microbiology

MAJOR

DEGREES

Microbiology

M.S., Ph.D.


Associate Professors: J. Meeker, Ph.D. Cincinnati; T. S. Montez, Ph.D. Maryland; W. S. Rigsby, Ph.D. Yale.


Students planning to major in microbiology are expected to present, as undergraduate prerequisites, a minimum of 1 year of biology, 1 year of mathematics including calculus, 2 years of chemistry, and 1 year of physics.

The student's dissertation committee determines whether a foreign language is required for the Doctor's degree.

3600 Introduction to Microbiology (3) Eucaryotic and procaroytic protists, viruses, microbial growth, bacterial structure, bacterial and viral genetics, pathogenesis, immunity and applied microbiology. Prereq: General Biology. Coreq or General Genetics.

3625 Introductory Microbiology Laboratory (2) Laboratory exercises designed to accompany Microbiology 3600.

3661 Pathogenic Microbiology (3) The disease producing microorganisms including bacteria, rickettsia, chlamydia, and fungi.

3669 Pathology Microbiology Laboratory (2) Techniques for the isolation, cultivation, and identification of pathogenic microorganisms.

3701 Immunology (3) Concepts of antigens and antibodies; molecular aspects of immuno-
5130 Topics in Taxonomy (3) Isolation, cultivation, and taxonomic relationships of schizomycetes, with emphasis upon the less frequently encountered orders. Prereq: 4139. 3 hrs.

5130 Selected Topics in Microbiological Research (3) Literature surveys and laboratory methods for the development and interpretation of microbiological research. May be repeated. 3 hrs.

5360 Topics in Immunology and Immunochemistry (4) Molecular and genetic aspects of immunoglobulin synthesis. Theoretical and practical exercise in immunochemistry. Prereq: 3071, 3072, Biochemistry 4110-20 or equivalent.

5400 Seminar in Microbial Physiology (1) Readings and discussions based on the current literature. May be repeated. S/NC only.

5410 Seminar in Immunology (1) Readings and discussions based on the current literature. May be repeated. S/NC only.

5441-42-44-45-46 Clinical Microbiology (6, 6,6,6,6) Six quarters, six quarter hours each consisting of lectures and clinical laboratory experience. Enrollment by permission of the department head.

5510-20-30 Research Problems (3, 3, 3)

5720 Microbial Physiology (3) Lectures and seminars dealing with current advances in bacterial physiology including growth and cell structure. Prereq: 4111; Biochemistry 4110-20.

5730 Pathogenesis of Infectious Disease (3) Host response to infection. Derangement of host-metabolism stimulated by microbial invasion, exotoxins, endotoxins and other factors related to infections. Alteration of genetic and hormonal controls resulting from progressive infection. Prereq: 3071.

5750 The Oncogenic Viruses (3) Lectures and special laboratory exercises dealing with known tumor-inducing viruses. Prereq: 4521 or consent of instructor. 2 hrs and 1 lab.

5760 The Bacterial Viruses (3) Lectures and discussions dealing with bacterial viruses with emphasis on the biological and chemical consequences of bacteriophage infection. Text will be supplemented by readings from the literature. Prereq: 4521; Biochemistry 4110-20.

5819 Molecular Genetics Laboratory (3) Principles and methods of research in molecular genetics. Fundamental genetic concepts (mutation, complementation, recombination) at the molecular level. Emphasis on studies of the lactose operon of Escherichia coli. Prereq: 4611 and Biochemistry 4110-20 or consent of instructor.

5820 Microbiology of Foods (3) Lectures and seminars dealing with current advances and selected topics in food microbiology with emphasis on analytical methods, safety and preservation. Prereq: 3810; Biochemistry 4110-20. Recommended: Food Technology 4920.

5829 Experimental Microbial Ecology (3) Survey of techniques for the assessment of microbial forms, functions, activities, and interactions in a variety of habitats. Prereq: 3005; Coreq: 4950 or consent of instructor. 1 hr and 2 labs.

5830 Seminar in Microbial Pathogenesis (1) Readings and discussions based on the current literature. May be repeated. S/NC only.

5850 Seminar in History of Microbiology (1) Studies concerned with microbiologists and their achievements from Pasteur to the present. S/NC only.

5910-20-30 General Seminar (1, 1, 1) Reviews and discussions based on the current literature. May be repeated with consent of department. S/NC only.
must submit scores and tape recordings of representative works. All applicants are required to take the Diagnostic Examinations in music theory and music history and literature.

General requirements for the Master's degree begin on page 17 of this catalog.

MASTER OF MUSIC DEGREE 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.

College of Liberal Arts

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5000 Thesis


5002 Non-Thesis Graduation Completion (3) Required for the nonthesis student not otherwise registered during any quarter when such a student uses university facilities and/or courses or their equivalent, exclusive of thesis and dissertation. May not be used toward degree requirements. Maximum 9 hrs.

5002A Non-Thesis Graduation Completion (3) Required for the nonthesis student not otherwise registered during any quarter when such a student uses university facilities and/or courses or their equivalent, exclusive of thesis and dissertation. May not be used toward degree requirements. May be repeated. B/NC only.

**5010 Organ Literature Seminar (3) Topics vary. Prereq: Organ Literature.

**5020 Piano Literature Seminar (3) Topics vary. Prereq: Advanced Piano 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) The study of rehearsal of performance techniques as related to scoring reading and preparation. Topic variation will be permitted for the student. Prereq: Advanced English Literature.

**5070 Opera Production (1-3) Prereq: Consent of instructor.

**5080 Special Topics in Performance (1-3) Prereq: Consent of department head.

**5100 Independent Study in Music Theory (1-3) Prereq: Consent of department head.

5111 Advanced Harmony (3) An analytic survey of harmonic trends in compositions from 1700 to present. Prereq: Consent of department head.

**5112 Proseminar in Music Theory (1) Discussion, analysis, research writing in theoretical topics. Prereq: Consent of instructor.

5114 History of Music Theory (3) A survey of the work and contributions of theorists from ancient Greece to present. Emphasis on 1600 to present. Prereq: Consent of instructor.

5115 Theory of Computers and Music Research (3) Theory of computer applications in music, emphasizing techniques of analysis and indexing. Prereq: Consent of instructor.

5116 Musical Styles (3) The elements of design and their role in the definition of musical styles. Exercises in aural and visual identification. Prereq: Consent of instructor.


5121 Analytical Techniques (3) A survey of analytical techniques with emphasis on contemporary approaches. Prereq: Consent of instructor.

**5125 Practicum in Computers and Music Research (3) Programming languages, design, and implementation of projects in musical analysis, composition and indexing. Prereq: 5115 or consent of instructor.

**5150 Seminar in Music Theory (3) Topics vary. Prereq: Consent of instructor.

**5200 Independent Study in Music History and Literature (1-3) Prereq: Consent of department head.

5210 Introduction to Music Research (3)

5220 Proseminar (3) Research techniques in music emphasizing bibliography, writing of research papers, and presentation of oral reports. Prereq: Consent of instructor.

**5270 Seminar in Musicoology (3) Topics vary. Prereq: Consent of instructor.

5315 Band Literature (3) A study of band literature and the origins of the band emphasizing its important expanded cultivation during the past century in the United States and Europe.

5350 Music in the Middle Ages (3) Emphasis on early Christian chant, medieval secular song, early theory, and the development of polyphony and musical notation.

5352 Music in the Renaissance (3) Survey of music from 1400 to 1600. Mass, motet, chansons, madrigal, and other vocal and instrumental forms and genres.


5355 Music in the Classic Period (3) Preclassic 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 Bass (1-4)

**5555 Percussion (1-4)

**5560 Viola (1-4)

**5565 Violin (1-4)

**5570 Cello (1-4)

**5575 String Bass (1-4)

**5580 Piano (1-4)

**5585 Harpsichord (1-4)

**5590 Organ (1-4)

**5595 Guitar (1-4)

5597 Composition with Electronic Media (1-3) May be repeated. Maximum 9 hrs. Prereq: 3199 and consent of instructor.

**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 Ensemble (1)

**5620 UT Singers (1)

**5630 Chamber Singers (1)

**5632 Collegium (1)

**5634 Saxophone Choir (1)

**5640 Opera Theatre (1)

**5642 Opera Workshop (1)

**5650 Concert Band (1)

**5652 Campus Band (1)

**5654 Varsity Band (1)

**5656 Laboratory Band (1)

**5657 Marching Band (1)

**5670 Symphony Orchestra (1)

**5680 Concert Choir (1)

**5682 University Chorus (1)

**5684 Campus Chorus (1)

**5686 Men’s Glee Club (1)

**5687 Women’s Chorus (1)

**5699 Accompanying (1)

* May be repeated. Maximum 6 hrs.

** May be repeated. ** May be repeated.
but with different subject matter, may be taken with each separate subject description.

MEDICAL ETHICS

The department has an M.A. and Ph.D. program of graduate study with a concentration in Medical Ethics. Details concerning the program can be obtained from the department.

RELIGIOUS STUDIES

The department has an M.A. program of graduate study with a concentration in philosophy of religion and other religious studies. Details concerning the program can be obtained either from the departments of Philosophy or Religious Studies.

3111 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.

3430 Concepts of Woman (4) Examination of some of the theoretical foundations of feminism and anti-feminism.

3440 Social Ethics (4) Ethical theory as related to politics, economics, law, religion and the family.

3510 Existentialism (4)

3550 Marxism as Philosophy (4)

3560 Buddhism as Philosophy (4) (Same as Religious Studies 3660)

3569 Philosophy of Religion (4) Analysis of basic issues of religion. (Same as Religious Studies 3690.)

3720 Science, Technology, and the Modern World: A Philosophical Approach (4)

3740-50 Conceptual History of Science (4, 4) 3740—The Scientific Revolution: historical evolution of thought in astronomy, mechanics and philosophy of nature up to Newton. 3750—The Development and Decline of Newtonian Science: historical evolution of thought on the nature of matter and of light, and on that of life. Prereq: 8 hrs of physical science or consent of instructor.

3770 Introduction to Philosophy of Science (4) Standard topics in philosophy of science: scientific method, nature of laws and theories, problems of induction, explanation, measurement. No background in logic presupposed.

3810 Introductory Symbolic Logic (4) Techniques for formal analysis of deductive reasoning (propositional logic and quantification theory).

3910 Contemporary Aesthetics (4) Philosophical discussion of contemporary art.

4000 Special Topics (4) A student- or instructor-initiated course to be offered at the convenience of the department. Subject matter to be determined by mutual consent of students and instructor with approval of department. Prerequisites to be determined by department.

4111-21 Modern Religious Philosophies (4, 4) (Same as Religious Studies 4111-21).

4310 Intermediate Ethics (4) Topics in meta-ethics or ethics. Prereq: Elementary Ethics.

4370-71 Theoretical Issues in Medical Ethics (4, 4) Prereq for 4370: Elementary Ethics or Religious and Philosophical Issues of Medical Ethics or consent of instructor. Prereq for 4371: 4370 or consent of instructor. (Same as Religious Studies 4370-71).

4410 Plato (4) Prereq: 8 hrs of philosophy or consent of instructor.

4420 Aristotle (4) Prereq: 8 hrs of philosophy or consent of instructor.

4430 Medieval Philosophy (4) Prereq: 8 hrs of philosophy or consent of instructor.

4450 Continental Rationalism (4) Prereq: 8 hrs of philosophy or consent of instructor.

4460 British Empiricism (4) Prereq: 8 hrs of philosophy or consent of instructor.

4470 Kant (4) Prereq: 8 hrs of philosophy or consent of instructor.

4480 Advanced Topics in Existentialism and Phenomenology (4) Prereq: 8 hrs of philosophy or consent of instructor.

4490 Process Philosophy (4) Prereq: 8 hrs of philosophy or consent of instructor.


4511 Advanced Topics in Logic (4) Prereq: Consent of instructor. May be repeated.

4610 Philosophical Analysis (4) Prereq: 8 hrs of philosophy or consent of instructor.

4820 Philosophy of Mind (4) Problems of mind and body in relation to consciousness and personal identity. Prereq: 8 hrs of philosophy or consent of instructor.

4830 Philosophy of Language (4) Prereq: 8 hrs of philosophy or consent of instructor.

4710 Philosophy of Natural Science (4) Consideration of standard topics pertinent to natural science including reduction of theories and teleological explanation. Familiarity with symbolic logic is recommended. Prereq: 3770 or 2 yrs of natural science.

4720 Philosophy of Social Science (4) Examination of methods of inquiry and modes of explanation in social sciences. Prereq: 3770 or 2 yrs of social science.

4810 Metaphysics (4) Prereq: 8 hours of philosophy or consent of instructor.

5000 Thesis

5050 Symbolic Logic (4)

5080 Philosophy of Science (4) Nature of logic: epistemological, metaphysical and axiological assumptions and Implications in various theories of logic. Prereq: 4510 or its equivalent.


5250 Studies in the History of American Philosophy (4) Intensive, critical work on a major philosopher or a school.


5370 Topics in Medical Ethics (4) Prereq: 4370 or permission of the Medical Ethics Committee.

5410 Philosophy of History (4) Theories of history and historical processes.

5420 Philosophy and Literature (4) Mutual influence of philosophy and literature, the possibility of a philosophy of literature, the philosophy of criticism.

5450 The Problem of the Self (4) Current studies in sociology, social psychology, and philosophy are used to amend and elucidate traditional philosophical treatments of the problem of the self.

5450 Philosophy of Mind (4) An examination of the relation of the mental to the physical and of the role of words in discourse for mental activities such as thinking and feeling.


5550-60 Philosophy of Science (4, 4) The nature of the subject matter and method of the sciences. 5550—Natural sciences. 5560—Social sciences.

5610 Recent Developments in Philosophy of Religion (4)

5710 Studies in Metaphysics (4) Metaphysics of a philosopher or systematic philosophic tradition.

5810 Social and Political Philosophy (4)

5910-20-30 Research (4, 4, 4) Independent study under the direction of a member of the department.

5950 Clinical Practicum in Medical Ethics (4-12) Prereq: Permission of the Medical Ethics Committee. Open only to students concentrating in medical ethics.

6000 Doctoral Research and Dissertation

6110-20-30 Seminars in the History of European Philosophy (4, 4, 4)

6150-50 Seminars in the History of American Philosophy (4, 4)

6250 Seminar in the History of Philosophy (4)

6310 Seminar in Axiology (4)

6370 Advanced Topics in Medical Ethics (4) Prereq: 5370 or permission of the Medical Ethics Committee.

6510 Seminar in Epistemology (4)

6550 Seminar in Philosophy of Science (4)

6950 Advanced Residence in Medical Ethics (4-12) Prereq: Permission of the Medical Ethics Committee. Open only to students concentrating in medical ethics.
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 comprehensive examinations in undergraduate physics during the fall quarter registration period.

Masters' Program

The Physics department has a Master's degree program—thesis and non-thesis. The program is primarily designed for students intending to go into industrial or governmental laboratories as physicists. The course requirements include 36 quarter hours in such courses as Physics 4510-20-30, 4610-20-30, 5110-20-30, 5210-20-30, 5310-20-30, 5610-20-30 and appropriate courses in related fields. Each candidate must present an acceptable thesis, equivalent to 9 hours of credit, and pass an oral examination on course material and thesis.

The non-thesis program is primarily designed for students intending to teach in colleges or universities on the elementary or intermediate level, or for students specifically intending to work toward a Ph.D. Students seeking an M.S. in physics by this method must apply to the department's graduate committee for permission to enroll under this program. The requirements for the M.S. under this method are the satisfactory completion of 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.); 9 hours in a minor field (e.g., mathematics); and 9 hours from other courses in physics numbered above 4000 (preferably advanced laboratory nature). In addition, the candidate must pass a comprehensive examination administered by the committee.

The Physics department is also participating in 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 requires 15 more hours of credit, making a total of 60 quarter hours. Nine of these hours are elected from any of the physics courses numbered 4110-20-30, 4210-20-30, etc.; 9 hours in a seminar course dealing with special problems in the teaching of physics; and 3 hours in a seminar course dealing with the history and philosophy of physics. The other 6 hours of course work may be elected from any of the physics courses numbered above 5000. During the two-year program leading to the M.A.C.T. degree, the candidate will be continually engaged in supervised teaching activities.

DOCTORAL PROGRAM

All students are expected to take Physics 4510-20-30, 4610-20-30, 5110-20-30, 5210-20-30 and 5310-20-30. Physics 6210-20-30 are normally required of students specializing in nuclear physics, Physics 6500-10 of students in plasma physics, Physics 6610-20-30 of students in health physics. Physics 6710-20-30 of students in solid state physics and research work in areas pertinent to atmospheric and space flight are available at the Space Institute, Tullahoma.

4040 Foundations of Physics (3) Development of concepts and principles of classical and modern physics; their use in constructing a world view of physics. Prerequisites: application to atomic, molecular, and nuclear physics. Prereq: Fundamentals of Physics or equivalent, advanced calculus and differential equations.

4140 Elementary Nuclear Physics (3) General properties of nuclei, two-nucleon systems, nuclear forces, nuclear models, nuclear reactions, nuclear disintegrations and beta-decay, nuclear spin and magnetism. Prereq: 3750 or 4120.

4150 Physical Acoustics (4) Considerations fundamental to detailed investigation of any branch of acoustics; propagation of acoustic waves in a variety of media, including the atmosphere, the sea, and the human ear; the propagation of sound in the atmosphere; and the use of sound waves in the study of other media.

4210-20-50 Electricity and Magnetism (3, 3, 3) Intermediate level electrodynamics; steady and transient fields; electromagnetic waves, including the propagation of light; the theory of waves and heat; the theory of the propagation of light; the theory of the propagation of heat; and the theory of the propagation of sound.

5210-20-30 Introduction to Quantum Mechanics (3, 3, 3) Introduction to fundamental principle of quantum mechanics, including the interpretation of quantum mechanics, the Schrödinger equation, and the solutions of the Schrödinger equation for various potentials.

5440 Experimental Methods of Infrared and Millimeter Waves (3, 3, 3) Experimentation in presentation of physics topics, including the experimental methods of infrared and millimeter waves.

5610-20-30 Mathematical Methods in Physics (3, 3, 3) Vector and tensor analysis; linear algebra, matrices, vector spaces; Fourier series and integrals; spherical harmonics; Bessel functions; linear algebraic systems; and differential equations.

5720 Physics of Polytatomic Molecules (3) Introduction to the study of polyatomic molecules and the physical processes of luminescence of these molecules; theoretical and experimental aspects of the study of polyatomic molecules; and intramolecular interaction energy transfer and charge transfer; application of excitations energy transfer and charge transfer in such fields as organic molecular reactivity and organic scintillation.

5910-20-30 Special Problems (3, 3, 3) Special problems in the Teaching of Physics (1, 1) Design of physics experiments, demonstrations, and analysis of physics tests and examinations.

5911-31 Special Problems (3, 3, 3) Special problems in the Teaching of Physics (1, 1) Design of physics experiments, demonstrations, and analysis of physics tests and examinations.


6000 Doctoral Research and Dissertation

6110-20-30 Quantum Mechanics (3, 3, 3) Mathematical principles, linear operators, and principal approximation methods. Applications to atomic, molecular and nuclear physics, Dirac equation; quantum electrodynamics; quantum chemistry; and other problems. Prereq: consent of instructor. Maximum 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; nuclear models; nuclear spectroscopy; special nuclear models; theory of nuclear reactions; theory of beta-decay. Prereq 6110-20-30, 6120-20-30.

6310 Electromagnetic Theory of Light (3) Classical electromagnetic theory including theories of line breadth, dispersion and absorption; scattering of light and X-rays; dielectric and magnetic properties of gases and solids. Optical properties of electromagnetic waves in isotropic and anisotropic media; reflection and polarization and also theory of diffraction. Prereq: 20-30.

6320 Special Relativity (3) Lorentz transformation; Einstein postulates; relativity theory; special relativity mechanics; classical mechanics; electromagnetic theory. Prereq: 6310-20-30, 6410-20-30, 6310-20-30.
Political Science

MAJOR

Political Science M.A., Ph.D.
Public Administration M.P.A.

Professors:
T. D. Unger (Head), Ph.D. Iowa; R. S. Avery, Ph.D. Northwestern; D. H. Garaile, Ph.D. North Carolina; L. S. Greene* (Emeritus), Ph.D. Wisconsin; V. R. W. Reddell, Ph.D. Chicago; D. V. D. Nimmo, Ph.D. Vanier/BBases, Ph.D. Utah; N. M. Robinson, Ph.D. Syrcause; D. H. Stephens, Ph.D. Johns Hopkins; D. M. Welnbo, Ph.D. Texas.

Associate Professors:

Assistant Professors:
B. P. Greene, Ph.D. Indiana; F. R. Insche, Ph.D. SUNY (Buffalo); W. Lyons, Ph.D. Oklahoma; G. J. Rathi, Ph.D. Michigan State; H. Robson, Ph.D. Maryland; B. Rogers, Ph.D. Indiana; P. Schullman, Ph.D. Johns Hopkins.

Registration in any courses in the 5000-6000 series may be repeated for credit with consent of the department.

THE BUREAU OF PUBLIC ADMINISTRATION

The University maintains in the College of Liberal Arts a Bureau of Public Administration for the purpose of promoting sound governmental administration through research, publication, and consultation. The staff includes the following faculty members: Professors: Plaas (director); Professors Plaas (associate director), Kronenberg (associate director, Nashville); Robson (assistant director); Assistant Professors Inocho (Nashville), Rogers (Nashville), Greene (Nashville); Research Associates Rawson, Smith, Thomas.

MASTER'S PROGRAM

See general requirements on page 17.

MASTERS IN PUBLIC ADMINISTRATION PROGRAM

The department offers 2 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 Tennesee 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 UT and MTSU institutions and pass a qualifying examination, if required.)

Specific requirements for graduation include:

* Distinguished Professor.
PSYCHOLOGY

MAJOR

DEGREES

Psychology

M.A., Ph.D.

Professors:

W. H. Calhoun (Head), Ph.D. California (Berkeley); G. M. Burghardt, Ph.D. Chicago; J. F. Byrne, Ph.D. Tennessee; H. J. Findlay; Ph.D. Syracuse; L. Handler, Ph.D. Michigan State; J. F. Lubar, Ph.D. Chicago; K. R. Newton, Ph.D. Tennessee; H. R. Poole, Ph.D. Michigan; N. L. Rasch,* Ph.D. Pennsylvania; R. R. Shadrak, Ph.D. Tennessee; F. Samejima, Ph.D. Keio; W. S. Verplanck, Ph.D. Brown; R. G. Wahler, Ph.D. Washington; J. A. Wiberaly, Ph.D. Syracuse.

Associate Professors:

H. S. Bacon,* Ph.D. Tennessee; C. P. Cohen, Ph.D. Kansas; L. F. Droppeleman, Ph.D. Catholic; H. R. Friedman,* Ph.D. Tennessee; J. E. Lawler, Ph.D. North Carolina; S. J. Handel, Ph.D. Johns Hopkins; M. G. Johnson, Ph.D. Minnesota; R. J. Flam, Ph.D. University of Washington; Ph.D. Yale; J. C. Maloney, Ph.D. Duke; W. G. Morgan, Ph.D. Tennessee; W. M. Simmons, M.S.S.W. Tennessee.

Assistant Professors:


The Psychology department emphasizes doctoral degree programs with specializations in clinical, school, industrial-organizational and general psychology. Some students complete a Master's degree as part of the doctoral program. For detailed information on graduate programs and admissions requirements, write: Graduate Secretary, Department of Psychology, University of Tennessee, Knoxville, TN 37916.

THE PSYCHOLOGICAL CLINIC

The Psychological Clinic supports graduate training in clinical psychology. Psychological diagnosis and psychotherapy are offered on an outpatient basis, with medical consultants, to the general public as well as to University students, on referral by a physician.

1407 Experience in Individualized Instruction (1-2) Supervision in clinical practice as an Individualized instruction. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

1420 Topics in Social Psychology (4) Intensive study of selected research topics. Prereq: 3120 and Sociology 3130 (Same as Sociology 4120.)


5429 Laboratory in Sensory Processes and Perception (2) Prereq or coreq: 4230. 2 periods.

4460 Organizational-Industrial Psychology (3)

4510 Personality Theories (4) Prereq: Abnormal Psychology or equivalent.

4519 Research in Personality (4) Discussion and administration of research on individual as it relates to major theoretical issues and to substantive areas of investigation. Prereq: Descriptive Statistics or equivalent.

4520 Personality and Social Systems (4) Prereq: Abnormal Psychology.

4510 Group Processes (3) Study and experience of theory and techniques of group processing and facilitation. Those participating in 4510 are expected to continue into 4620 and 4630. Prereq: Human Relations and consent of instructor.

5620-30 Seminar in Group Processes (0, 6) Didactic and laboratory experience for those qualified for further training as group facilitators. Prereq: 4610 and consent of instructor. No credit given until sequence is completed.

4540 Psychological Tests and Measures (4) Theory and construction of individual and group measures, techniques of assessment of intelligence, personality, special abilities, and educational achievement. Prereq: Psychological Statistics.

4560 Symbolic Processes (4) The logic of symbolic structures, symbols, distributed and associative thinking, memory, problem solving, and concept-formation; the nature, use and development of language. Prereq: Learning and Thinking or consent of instructor.

4660 The Psychology of Language (4) Theories and descriptions of phonology, syntax, and semantics as applied to psychology and related disciplines. Recommended: 4650 or linguistics background.

4710 Physiological Psychology (4) Nervous system and physiological correlates of behavior. Prereq: 1 year of biology or zoology and Biological Foundations of Behavior.

4719 Physiological Psychology Laboratory (4) Coreq: 4710.

4720 Comparative Animal Behavior (4) Methods and principles. (Same as Zoology 4720.)

4729 Comparative Animal Behavior Laboratory (4) Laboratory and studies. Coreq: 4720. (Same as Zoology 4729.)

4750 Evolution and Ontogeny of Social Behavior (4) Genetic, evolutionary, ecological, and developmental processes as they apply to social organization and dynamics of vertebrates. Prereq: Consent of instructor.

4830 History and Systems of Psychology (4) Prereq: 9 hrs of upper division psychology.

4850 Learning Theories (4) Historical and theoretical development of learning models. Prereq: Learning and Thinking.

4850 Programmed Learning (3) (Same as Curriculum and Instruction 4850.)

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 Afro-Americans. Prereq: Consent of instructor. (Same as Cultural Studies 4880.)

4900 Aspects of Urban Environment (4) Interdisciplinary course in urban problems. Prereq: Consent of instructor. (Same as Architecture 4900, Political Science 4900, Real Estate 4900.) S/N only.
admitted to the doctoral program in school psychology who are assigned to program approved field settings. May be repeated. Maximum 6 hrs or the equivalent S/NC only. (Same as Ed. Psych. 5319.)

5340 Group Dynamics (3) (Same as Educational Psychology 5340.)

*5350-60-70 Seminar in Psychology (3, 3, 3)

5400 Psychometrics and Scaling Methods (3) Prereq: 4239, 4490.

5420-30-40 Advanced Psychological Statistics (3, 3, 3) Must be taken in sequence.

5445 Advanced Correlational Methods (3) Bivariate, tetrachoric, and polyserial correlation; partial and multiple correlation and regression; stepwise regression and cross-validation; simple discriminant analysis; rank correlation methods. Prereq: 5430.

5450 Human Problems in Administration (3) (Same as Industrial Management 5530.)

5460 Personnel Research Seminar (3) (Same as Industrial Management 5540.)

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 must be admitted to the course. Prereq or Coreq: 5502.

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.


5560-70 Seminar in Social Psychology (3, 3) Prereq: 5505. May be used for credit in sociology. May be repeated. Required of all Ph.D. students.

5580 Theories of Personality (3)

5581-82-83 Clinical Psychology I: Human Development and Personality (2, 2, 2) First quarter of the doctoral program in clinical psychology. Each quarter year students take the 3-2-3 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 upon the origins of behavior. Prereq: 5580.

5591-92-93 Clinical Psychology I: Patterns of Adaptation (2, 2, 2) Second quarter of the doctoral program in clinical psychology. Students take the 3-2-3-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: 5580.

5601-02-03 Clinical Psychology II: Behavioral Deviance and Psychopathology (2, 2, 2) Third quarter 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: 5310 or Educational Psychology 5370.

5650 Ethics and Professional Practices (1) A review and discussion of problems faced in the practice of clinical psychology. Offered in alternate years. Prereq: M.A. in psychology or equivalent.

5670 Advanced 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 clinical psychology. Prereq: 5500. May be repeated. S/NC only.

5700 Ethological Psychology (3) Evolutionary and physiological basis of comparative psychology and implications for human behavior. Prereq: Introductory Biology and graduate standing.

5760 General Vertebrate Neuroanatomy (3) Lecture and laboratory dealing with structure and function of the central and peripheral nervous system. Prereq: 4710, 4719 or consent of instructor. (Same as Zoology 5760.)

5769 Advanced Techniques in Physiological Psychology (3) Animal and human laboratory procedures central to research in physiological psychology. Prereq: 4710, 4719 and consent of instructor. May be repeated with consent of instructor.

5770 Seminar in Psycholinguistic Concepts in Speech Pathology (3) (Same as Speech Pathology 5770.)

5810-20-50 Techniques of Psychological Examination (3, 3) Development of skill in administration of basic examination techniques. Intended primarily for students in fields related to psychological testing and assessment procedures. Prereq or Coreq: 4540 or equivalent and consent of instructor.

5819-29 Practicum in Techniques of Psychological Examination (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) Projective and objective tests, criticism of assessment and evaluation packages, each of which develops a skill in the appraisal of personality. Prereq: 4560 or equivalent.

5859-69-79 Practicum in Psychological Appraisals (2, 2, 2) Ordinarily to be taken concurrently with introductory courses in psychological human development and crisis. Ordinarily to be repeated. Maximum 6 hrs. Prereq: 5819-29; Prereq or Coreq: 5840 or equivalent and consent of instructor.

5890 Counseling Techniques (3) (Same as Educational Psychology 5890.)

5950-60-70 Consultation in Human Development Settings (3, 3, 3) Study of issues, models, and evaluation of the process of consultation in settings where human developmental needs and crises are managed by persons who seek aid from psychologists. Must be taken in sequence. (Same as Ed. Psych. 5950-60-70.)
4370-71 Theoretical Issues in Medical Ethics (4, 4) (Same as Philosophy 4370-71.)

4410 American Religious Thought (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: Introduction to 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: 6500-60. May be repeated. Maximum 12 hrs.

4810-20-30 Readings and Research in Religious Studies (3-4, 3-4, 3-4)

4840 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 construction of a theory of religion 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. (Same as Sociology 4960.)

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

5310-20 Topics in Religion and Society (4, 4)

5510-20 Topics in the History of Religion (4, 4)

5710-20 Topics in Religious Thought (4, 4)

Romance Languages

MAJORS DEGREES

French M.A.C.T.

Romance Languages M.A., Ph.D.

Spanish M.A., Ph.D.

Professors:

H. C. Rutledge (Head), Ph.D., Ohio State; W. R. Averett**, A.M., Texas; C. W. Cobb, Ph.D., Tulane; J. P. Cooper, Ph.D., Columbia; W. R. Heilman, Jr., Ph.D., North Carolina; T. E. Irving, Ph.D., Princeton; H. E. Lewald, Ph.D., Minnesota; F. D. Maurino, Ph.D., Columbia; A. M. Vazquez-Biggi, Ph.D., Minnesota; A. H. Weisgerber, Ph.D., North Carolina.

Associate Professors:


Assistant Professors:

M. Handler, Ph.D., Florida; K. D. Levy, Ph.D., Kentucky; C. Pinsky, Ph.D., California (Berkeley).

The Department of Romance Languages offers three advanced degrees: the Master of Arts in College Teaching (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 6 credits in supervised instructional experience. French or Spanish must be selected as the major subject, and at least 36 hours of graduate work, including 9 hours of thesis and 9 hours of linguistics and philology, and 3 hours of problems in language teaching, must be completed in it. In addition, civilization courses are strongly recommended. Spanish or French must be selected as the minor subject, and at least 18 hours of graduate work must be completed in it.

THE MASTER OF ARTS PROGRAM

The student may select either Plan A or B:

Plan A

1. Completion of a minimum of 36 quarter hours of which 24 must be taken in courses numbered above 5000, including 5011 (French or Spanish, as appropriate).


3. A written examination covering the course work and selected items from a master reading list.

4. A final oral examination covering the thesis.

Plan B

1. Completion of 45 quarter credits of which 33 must be in courses beyond 5000, including 5011 (French or Spanish, as appropriate).

2. Three term papers that have been accepted as satisfactory by the Advisory Committee.

3. A written examination covering the course work and selected items from a master reading list.

THE DOCTORAL PROGRAM

Residence and Course Work:

Completion of at least 3 consecutive quarters of full-time residence, a minimum of 81 credit hours in course work beyond the Bachelor's degree, an equivalent, and a dissertation (36 credit hours).

No less than 54 quarter hours should be taken in courses pertaining to the student's major field; of these a minimum of 18 hours are to be taken in courses above 6000. A maximum of 12 hours may be taken in courses of the 4000 level and the rest in courses above 5000. All students must complete the series in methods of research (5151-61-71) for a total of 3 credits. The minor shall consist of at least 18 hours of which at least 12 hours must be numbered above 5000 and the rest above 4000, and should represent a meaningful complement to the student's area of concentration. In addition 9 hours of courses above 4000 in a related discipline are required. In special cases the latter requirement may be waived in favor of additional course work in the major field.

Language Requirements:

Students are expected to demonstrate written and oral fluency in Spanish as well as knowledge of 2 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, 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 the dissertation in a final oral examination.

For additional information on the program, consult pages 20-22.

Arabic

3510-20 Intermediate Modern Standard (4, 4)

3610 Islamic Literature in English Translation (4) Survey from origins to modern period of major Islamic literatures, especially Arabic, Persian, and Turkish. Readings include The Arabian Nights, The Rubaiyat of Omar Khayyam and Gibran's The Prophet.

5070-80-90 Hispano-Arabic Literature and Culture (3, 3, 3) (Same as Spanish 5070-80-90.)

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

French

3010-20-30 Elements of French for Upper Division and Graduate Students (3, 3, 3) Elements of language, elementary and advanced readings. Open to graduate students preparing for language examinations, and upper division students desiring reading knowledge of the language. Undergraduate credit only. No credit for those having had Elementary French. No auditors.
4100 Masterpieces of French Literature in English Translation (3) No foreign language credit.

4020 Masterpieces of French Drama in English Translation (3) No foreign language credit.

4110-20-30 French Literature of the Seventeenth Century (3, 3, 3) Prereq: Intermediate French (3rd quarter) or equivalent.

4150 Theatrical French (1-3) Performance in one or more French plays may be repeated with consent of department. Prereq: 1 year of Intermediate French or equivalent and consent of 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 French (3rd quarter) or equivalent.

4250 Introduction to Descriptive Linguistics (3) Phonetics and phonemics, morphology and syntax. Types of languages, linguistic groups, dialects and dialect geography. The application of descriptive linguistics—field linguistics, dialect study; its practical use in learning languages and in language teaching. An intensive course in explication de texte. Prereq: 9 hrs of upper division French, or 9 hrs of upper division courses in a modern or ancient language (exclusive of German and French literature). Courses on 3000 level, in Latin and Greek requiring no knowledge of these languages, or consent of the department. (Same as German, Spanish and Russian 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 Spanish 4270.)

4310-20-30 French Literature of the Eighteenth Century (3, 3, 3) Prereq: Intermediate French (3rd quarter) or equivalent.


4410-20-30 French Civilization (3, 3, 3) Prereq: Intermediate French (3rd quarter) or equivalent.

4510-20-30 French Literature of the Nineteenth Century (3, 3, 3) Prereq: Intermediate French (3rd quarter) or equivalent.

4640-50-60 French Literature of the Sixteenth Century (3, 3, 3) Prereq: Intermediate French (3rd quarter) or equivalent.

4710-20-30 French Literature of the Twentieth Century (3, 3, 3) Prereq: Intermediate French (3rd quarter) or equivalent.

5000 Thesis

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

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.

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-3) See page 146.

5110-20-30 Old French (3, 3, 3) Medieval French language and literature.

5121 College Teaching of Romance Languages (3) Seminars, demonstrations, and practical applications of techniques and procedures for teaching and evaluating basic language skills, cultural aspects, and beginning literature. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships. Some of those whose previous training or experience warrants their being excused by the department.

5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as Italian and Spanish 5151-61-71.) S/NC only.

5210-20-30 French Literature of the Sixteenth Century (3, 3, 3)

5310-20-30 French Directed Readings (3, 3, 3)

5350-60-70 The Philosophes (3, 3, 3) Textual analysis of the works of Voltaire, Diderot, Rousseau, and other 18th-century writers.

5410-20-30 The French Novel (3, 3, 3)

5450-60 Lyric Poetry of the Nineteenth Century (3, 3) 5450—German and English influences on French Romanticism and the generation of the poets of "le mal du siècle," 5460—VICTOR HUGO; the PARNASSIANS.

5470 Baudelaire and the Symbolists (3) A study of Les Fleurs du mal et Petits poèmes en prose with emphasis upon the theories of color and "correspondances" and their influence on the Symbolist school.

5510-20-30 The French Drama (3, 3, 3)

5610-20-30 Trends in Contemporary French Literature (3, 3, 3)

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) Topics vary. May be repeated with permission of the department. Prereq: 4270 or its equivalent. (Same as Spanish 5670.)

5710-20-30 Seminar in French Literature (3, 3, 3) Topics vary. May be repeated with consent of department.

5910 Literary Criticism: The Foundations of Romance Criticism (3) (Same as Spanish 5910.)

Italian

3210-20-30 Civilization and Culture (3, 3, 3) Prereq: Intermediate Italian (3rd quarter) or equivalent.

3310-20-30 Italian Language in English Translation (3, 3, 3) 3310—The Sicilian School; the Florentine School, Dante, Petrarich, Boccaccio, Machiavelli, Ariosto, Tasso. 3320—The Baroque through the eighteenth century, commedia dell'arte, Vico, Leopardi, 3330—Twentieth century, Carducci, Pirandello, Quasimodo, D'Annunzio, Croce, Moravia. No foreign language credit. No change in credit hours after add deadline. Option of 4 hours credit must present appropriate amount of extrawork above that required for 3 hrs.

3510-20 Aspects of Italian Literature (4, 4) Prereq: Intermediate Italian or equivalent. Recommended for literature majors.

4010-20 Italian Drama in English Translation (3, 3, 3) 4010—La commedia dell'arte and major works of Machiavelli, Metastasio, Alfieri, Goldoni. 4020—Twentieth-century theatre: opera della, the Grotesco, Pirandello, D'Annunzio, Flotti. No foreign language credit. No change in credit hours after add deadline. Option of 4 hours credit must present an appropriate amount of extrawork above that required for 3 hrs.

4050-60-70 Dante and Medieval Culture (3, 3, 3) Readings and lectures in English for students majoring or minoring in other departments. (Same as Comp. Lit. 4050-60-70.)

4160-70-80 Advanced Conversation (2, 2, 3) 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 Petrarich (3) Prereq: 3520 or equivalent.

4230 Boccaceio (3) Prereq: 3520 or equivalent.

4330 History of the Italian Language (3) Prereq: 3520 or equivalent.

4410-20-30 The Literature of the Rinascimento (3, 3, 3) From Pulci to Tasso, the Quattrocento, and the Cinquecento. Prereq: 3520 or equivalent.

4530 The Modern Novel (3) Prereq: 3520 or equivalent.

4540 The Modern Theatre (3) Prereq: 3520 or equivalent.

4610 Contemporary Theatre (3) Prereq: 3520 or equivalent.

4630 Contemporary Poetry (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 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as French and Spanish 5151-61-71.) S/NC only.

5160-20-30 Readings in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of the department.

5710-20-30 Seminar in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of the department.

Portuguese

3510-20 Aspects of Portuguese Literature (4, 4) Prereq: Intermediate Portuguese or equivalent. Recommended for literature majors.

4310-20-30 Directed Readings in Brazilian and Portuguese Literature (3, 3, 3) May be repeated with consent of instructor.

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

Spanish

4030 Masterpieces of Spanish Literature in English Translation (3) No foreign language credit.

4040 Masterpieces of Spanish Drama in Translation (3) No foreign language credit.

4050-60-70 Hispano-Arabic Literature and Culture (3, 3, 3)

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. Pre-
a student uses university facilities and/or

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.)

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.)

4450-60-70 Studies in Modern Spanish Style (3, 3, 3) Prereq: Intermediate Spanish (3rd quarter) or equivalent.

4470-20-30 Spanish Literature of the Twentieth Century (3, 3, 3) 4710—Non-dramatic prose fiction. 4720—Drama. 4730—Poetry.


5000 Thesis

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

5011 Techniques in Literary Analysis (2) Required for either Plan A or Plan B of the M.A. program. An intensive course in explication de texte.

5070-80-90 Hispano-Arabic Literature and Culture (3, 3, 3) 5070—General culture history in Arabic in Spain. 5080—Development of the traditional marketplace story, or episodic prose narrative, into the modern novel of character after the invention of printing. 5090—Mutual influence of traditional Arabic poetry and the popular and native Spanish choral lyric; development of the classical muwashash, the colloquial zayal, and the later villancicos. Readings in Arabic and Spanish. (Same as Arabic 5070-5080-5090.)

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

5110-20-30 Old Spanish (3, 3, 3) Medieval Spanish language and literature.

5121 College Teaching of Romance Languages (3) Seminar demonstrations, and practical applications of techniques and procedures for teaching, and evaluating basic language skills, including conversations and beginning literature. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships except those whose previous training or experience warrants their being excused by the department.

5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as French and Italian 5151-61-71.) B/NC only.

5211-21 Don Quixote (3, 3) Must be taken in 5211-21 Don Quixote (3, 3) Must be taken in 5212-22-32 Golden Age Prose (3, 3, 3) 5212—La Celestina; critical study of Fernando de Rojas' life and work. The Celestina genre; Feliciano de Silva's Segunda Celestina; 5220—Spanish philosophical thought; mystical prose; satiric works; 5250—Guzman de Alfaroche and the Spanish picaresque genre.

5231 The Exemplary Novels, Peralles y Sigismunda (3)

5250-60 The Generation of '98 (3, 3) Angel Gavier, Giner de los Rios, Baroja, Unamuno, Valle Inclan, Benavente, Azorin, Perez de Ayala.

5270 The Contemporary Novel (3) The Civil War and post-Civil War period.

5310-20-30 Directed Readings (3, 3, 3)

5311-21-31 Special Topics in Spanish or Spanish American Literature (3, 3, 3) May be repeated.

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 Romanticism. 5520—From Realism through the Generation of 1898. 5530—Contemporary theatre.

5550-60 The Golden Age Theatre (3, 3, 3) 5550—Introduction to the Spanish theatre, Lope and Tirso. 5560—Castro, Mira de Ame,sou and Alarcon. 5570—Rojas Zorrilla, Moreno, and Calderon.

5610 Spanish American Prose to 1900 (3) Novel, chronicle, essay.

5611-21 Spanish American Lyric Poetry (3, 3)

5620-30 The Modern Novel in Spanish America (3, 3)

5631 Spanish American Essay (3)

5632 The Spanish American Short Story (3) The short story as a major literary genre in Spanish America. Reading and criticism of the works of authors such as Dario, Quiroga, Borges, Arreola, and Rulfo.

5633 Twentieth-Century Latin American Theatre and Film (3) Readings from the works of such playwrights as Carlos Solerozno, Rodolfo Usigli, Conrado Nalé Roisto, Roberto Cossa, René Marques and Sebastián Salazar Bondy. Presentation of films as adaptations of classical such as Doña Bárbara, Los de abajo and Don Segundo Sombra as well as exponents of the experimental cinema of today.

5640 Latin American Women Writers (3) An 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 Alfon-sina Stormi, Dolmira Angustini, 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 different types of compositions, sketches and original stories.
sociology must be passed prior to admission to candidacy. This examination must be passed not later than one academic year before the date on which the degree is granted.

3. No later than one month before granting of the degree, the candidate will be required to pass an oral examination on the doctoral dissertation. At the oral examination the candidate will be expected to show a thorough knowledge of sociological theory and methodology related to the research.

4030 Sociology and Law (4) A general treatment of the social origins and consequences of law and the legal process. Particular emphasis is placed on problems of law and social change, and on the structure and functioning of legal sanctions. Some attention is paid to 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) This course deals with correctional processes, and the development of 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 revivals, social area analysis, and cognitive symbolic ecology emphasized.

4410 Educational Sociology (3) (Same as Curr. and Inst. 4410.)

4530 Community Organization (4) Structure; function; linkages; change and development; important community studies are reviewed and discussed. Emphasis on sociological analysis, not on the implementation of change.

4540 Social and Religious Change (4) (Same as Religious Studies 4540.)

4550 Formal Organization (4) Analysis of the bureaucratization process, division of labor, delegation of authority, channelled communication under a system of rationality.

4820 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.

4930 Social Movements (4) Development, organization, and function of social movements; attention is given to the ideology, leadership and organization of political, religious and other types of social movements.

4940 Sociology of Religion (4) Interrelationship of society, culture, and religion. (Same as Religious Studies 4940.)

4960 Tradition, Change and Modernity in Asia (4) (Same as Religious Studies 4960.)

5000 Thesis

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

5040 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, 5420-30 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; reliability, 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 Seminar in Community (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) Relations between formal sociological models and substantive theories of mental illness. Historical development of theoretical 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; unemployment 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) Structure and function of human groups, with special attention to voluntary associations and administrative organizations.

5720 Small Group Theory and Research (3) A critical assessment, through reading and actual research of contemporary theoretical orientations to the study of small groups. Research will be designed to test selected theoretical problems. May be repeated for credit.

5730 Seminar in Research Problems in Inter-
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; bureaucracy; functions of theoretical models of organizations; major organizational variables; organizational authority patterns; communication in formal organizations. 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) Individual and social psychology; 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. Prerequisite: Social Psychology or Psychology 5550.

6840-50 Social Change (3, 3) Major theories, methods, and researches.

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

DEGREES

Speech and Theatre M.A., M.A.C.T.

Professors:

R. G. Allen (Head), D.F.A. Yale; T. P. Cooke, Ph.D. Florida or 6640 or P. M. Carthan; H. W. Henshaw, Ph.D. Pittsburg; P. L. Soper, Emeritus (Ph.D. Cornell; G. A. Yeomans, Ph.D. Louisiana State.

Associate Professors:


Assistant Professors:


MASTER’S PROGRAM

The departmental requirement for the M.A. degree in Speech and Theatre is 45 quarter hours (inclusive of hours taken toward a minor), at least 22 hours of which must be earned in courses numbered 5000 or above.

For the degree of Master of Arts in College Teaching, 57 quarter hours are required, in addition to 5110-20-30, Com-

ting and Higher Education. Students seeking the M.A.C.T. degree are allowed to substitute nine quarter hours of course work for the Master’s thesis.

Speech and Theatre 5110 is required of all M.A. and M.A.C.T. students.

Speech

3011 Persuasion (4) Persuasive discourse: its psychological, sociological and cultural dimensions.

3012 Group Communication (4) Communication theory in its application to small groups, especially discussion groups; communication barriers, nonverbal communication, business communication.

3031 Nonverbal Communication (4) An exploration of nonverbal communication from the human communication perspective: origins and research, usage and coding of non-verbal behavior, research strategies and theoretical approaches.

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.

4611 Advanced Phonetics (4) Phonetic aspects of contemporary dialects of the English language. Prereq: Consent of instructor.

4911-21 History of American Public Address (4, 4) 4911-Colonial period to 1865. 4921-1866 to present.

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. (Same as 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.

5340 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 Recorded Discourse (3) May be repeated. Maximum 9 hrs.

5560-70 Studies in Persuasion (3, 3, 3)

5750-60-70 Studies in Rhetoric (3, 3, 3)

5911 Directing the Forensic Program (4) Philosophy and methods of directing co-curricular and extracurricular forensic activities in high schools and colleges: competitive and non-competitive approaches to directing debate, oral interpretation and public speaking events. (Same as Curriculum and Instruction 5911.)

Speech and Theatre

4170-80-90 Film History and Theory (3, 3, 3) Analysis of cinematic forms and styles. 4170—Narration. 4180—Expression and persuasion. 4190—Experimental forms; films and other media.

4551 Theories of Oral Interpretation (4) Theories 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

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

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 (1-4, 1-4)

3153 Outdoor Repertory Production (4)

3221-22 Introduction to Scene Design (4, 4) Descriptive drawing as an approach to three-dimensional design; theatrical graphic standards; problems in stage design with reference to lighting, movement, scale and style. Prereq: Stagecraft or consent of instructor.


3231-22 Introduction to Lighting Design (4, 4) Mechanics of stage lighting; elementary theory; problems in basic lighting practice. Prereq: Stagecraft or consent of instructor.

3451-52 Play Directing (4, 4) Must be taken in sequence. Prereq: Acting.

3511-12 Introduction to Theatre Costume Design (4, 4) Costume as an expression of character on stage; the application of costume history to specific design projects. Prereq: Basic stage costuming 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 (1-4, 1-4) 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 for 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: 3321-22 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: 3551 or 3512.

4751-52 Dramatic Theory and Criticism (4, 4) Taught from Aristotle to Lessing. Prereq: Consent of instructor.

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 Play Directing (3) May be repeated. Maximum 9 hrs.

5640 Projects in Scene Design (3) May be repeated. Maximum 9 hrs.

5650 Projects in Costume Design (3) Problems of play interpretation and theatrical costume design 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 5 hrs.

5912 Play Production in Secondary Schools (4) Production techniques and methods for directing high school dramatic programs. (Same as Curriculum and Instruction 5912.)

5950-50-70 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; R. C. Fraser, Ph.D. Minnesota; R. F. Greif, Ph.D. Tennessee; B. Hochman, Ph.D. California (Berkeley); J. C. Howell, Ph.D. Cornell; K. W. U. J. Kennedy, Ph.D. Iowa; H. G. Welch, Ph.D. Florida; M. C. Whitson, Ph.D. Indiana.

Associate Professors:

R. M. Bagby, Ph.D. Illinois; K. D. Burnham, Ph.D. State University of Iowa; D. A. Ebert, Ph.D. Indiana; J. R. Kennedy, Ph.D. Iowa; H. G. Welch, Ph.D. Florida; M. C. Whitson, Ph.D. Indiana.

Assistant Professors:

P. B. Coulter, Ph.D. Illinois; A. C. Echinorich, Ph.D. Kansas; J. D. Fox, Ph.D. Johns Hopkins; M. A. Handel, Ph.D. Kansas; A. M. Jungreis, Ph.D. Minnesota; J. A. MacCabe, Ph.D. California (Davis); M. L. Pan, Ph.D. Pennsylvania; S. E. Rich, Ph.D. Wisconsin; V. 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 8 semester hours; (2) upper division zoology, 18 quarter or 12 semester hours; (3) chemistry, 2 years including 12 quarter or 8 semester hours of general inorganic and organic chemistry, 9 quarter or 6 semester hours including differential and integral calculus; (5) physics, 12 quarter or 8 semester hours; (6) Graduate Record Examination scores in verbal, quantitative and advanced biology; and (7) a grade point average of 3.0 out of a possible 4.0. Otherwise superior students, deficient in one or more of the above requirements, may be admitted at the discretion of the Graduate Affairs Committee.

Preparation for Thesis or Dissertation: During the first year a written examination and a special research project in each of two faculty members' laboratories will determine the student's preparation for thesis or dissertation study.

DOCTORAL PROGRAM

Special requirements in zoology are as follows: (1) course requirements shall be determined by the student and his faculty committee; (2) the preliminary examination will be an oral and written examination in zoology and allied fields in which the candidate has had training; (3) the candidate for the degree must possess a reading knowledge of at least one foreign language in which there exists a sizeable amount of literature relevant to the major field of study. The student has the option of demonstrating a reading knowledge of this foreign language by (a) passing the official reading examination given by the language department or (b) earning at least a B in 3030 language courses. This requirement for the first language must be fulfilled before the student can take the preliminary examination.

The student's faculty committee may require of the student 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 Vertebrates (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 organs of fishes, amphibians, reptiles, birds, and mammals. 2 hrs and 2 labs.

3071 Immunology (3) (Same as Microbiology 3071.)

3080 Principles of Animal Physiology (5)

Physiology of organ systems of animals including man. Prereq: Cell Biology. Coreq: Chemistry 3221. Recommended: Elements of Physics. 3 hrs and 1 lab.

3110 General Entomology (5) Introduction to insects; basic structure, development, behavior; classification of insect orders and representative families; interpretation and use of keys. Prereq: General 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.)


3410 Bioethics (3) Relationship between biological discoveries and human values. Open discussion of selected dilemmas arising from new knowledge about medicine, behavior, resources, and technology.

4007, 4010-4017 Minicourse in Zoology (2) Selected advanced topics in zoology, concentrated in time and subject matter. Consult departmental listing for topics to be offered. Prereq: As posted. May be repeated.


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 application of zooology in community, institutional, and 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.

4230 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.

4240 Cell Physiology (5) Development of modern concepts in cell physiology from point of view of information and control which examines kinetics and integration of cellular activities. Prereq: Cell Biology or any physiology and general chemistry. Recommended: Biochemistry. 3 lectures and 1 lab.

4240 Animal Ecology (4) Environmental factors determining the distribution and numbers of animals; infraspecific relations; problems and methods. Prereq: General Ecology. 2 hrs and 2 labs.

4269 Comparative Animal Physiology Laboratory, I (1) Coreq: 4250.
4269 Comparative Animal Physiology Laboratory, II (1) Prereq: Principles of Animal Physiology and consent of instructor. Coreq: 4260.
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 and Hormones and 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, populations, evolution, field identification. 2 hrs and 2 labs or field periods.
4510 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.
4520 Microtechnique (4) Prereq: 3320 recommended prereq: General Genetics. 2 hrs and 2 labs.
4569 General Genetics Laboratory (2) Experiments designed to illustrate basic principles of inheritance. Prereq: General Genetics. 2 labs.
4410 General Parasitology (4) Morphology, taxonomy and ecology of parasitic worms and protozoa, with emphasis on host-parasite relationships. 3 hrs and 1 lab.
4450 Protozoology (4) Morphology, taxonomy, and physiology of protozoa in relation to fundamental biological concepts. 2 hrs and 2 labs. Recommended prereq: Cell Biology.
4610-20 Comparative Animal Pathology, I (2, 2) Abnormal morphological changes and their causes. 4610—Cell and tissue changes. 4620—Organ, organ system, and organism changes. Recommended: 3080, 3080, 3220.
4619-29 Comparative Animal Pathology Laboratory (2, 2) 4619—Cell and tissue changes. 4629—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, productivity and 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, scorpions, and relatives. Prereq: 3110, or 3150. 2 hrs and 2 labs.
4720 Comparative Animal Behavior (4) Methods and principles. (Same as Psychology 4720.)
4729 Comparative Animal Behavior Laboratory (4) Laboratory and field studies. Coreq: 4720. (Same as Psychology 4720.)
4810-20-30 Insect Morphology and Taxonomy (4, 4, 4) 4810—Internal morphology of both generalized and immature 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
5080 Graduate Research Participation (3) Advanced research techniques are studied under the supervision of a staff research director whose research area coincides with the interests of the student. Open to all graduate students in good standing. Consent of department and research director. Course may be repeated with consent of the department. S/NC only.
5110-20-30 Special Problems (2, 2, 2)
5150 Zoological Bibliography (1) Study and practice in preparing annotated and using zoological literature, bibliographies, and abstracts, and of preparing bibliographies and scientific papers.
5160 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, I (4, 4, 4) Advanced vertebrate cellular and systemic physiology; 5220—Membrane, blood, immune, 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 Neurumuscular 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: 4160, 1 yr General Chemistry or consent of instructor. 2 hrs and 2 labs.
5290 Quaternary Problems (4) (Same as Geology 5290.)
5310-20 Seminar in the Teaching of College Zoology. 2-5 hrs. Prereq: Consent of instructor in the teaching of zoology; modern techniques and instrumentation; supervised application of teaching principles and methods. Must be taken in sequence. Prereq: Consent of instructor. S/NC only.
5350 Biometry (3) Statistical methods used in analysis of quantitative biological data. Prereq: 1 quarter statistics or consent of instructor.
6610 Seminar in Ornithology (2) Prereq: 4300. May be repeated. Maximum 6 hrs.
6550 Seminar in Aquatic Biology (2) Prereq: Any 2 of 4220, Freshwater Fishery Biology, 4660-70, Botany 5061, or consent of instructor. May be repeated. Maximum 6 hrs.
6710 Seminar in Ecology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
6810 Seminar in Entomology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
6910 Seminar in Radiation Biology (2) Prereq: 5610, Coreq: 5620. May be repeated. Maximum 6 hrs.

Interdepartmental Program in Radiation Biology
John R. Totter, 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 crossing both departmental and institutional lines. Included on the Institute staff are certain scientists from the Departments of Biochemistry, Botany, Chemistry, Microbiology, Physics, Zoology and the Memorial Research Center and the Comparative Animal Research Laboratory of The University of Tennessee, the Biology and Environmental Sciences Divisions of the Oak Ridge National Laboratory, and the Medical Division of Oak Ridge Associated Universities.

Regular attendance at the weekly Radiation Biology Seminar or an appropriate field of interest and plans for a career determine these requirements. The more important courses from which selection may be made are advanced courses in biochemistry, botany, chemistry, electrical engineering, mathematics, microbiology, physics, and zoology.

Interdepartmental Program in Radiation Biology Seminar or an appropriate field of interest and plans for a career determine these requirements. The more important courses from which selection may be made are advanced courses in biochemistry, botany, chemistry, electrical engineering, mathematics, microbiology, physics, and zoology.

Courses are available in The University of Tennessee Graduate School of Biomedical Sciences at Oak Ridge. (2) The preliminary examination will consist of oral and written portions in radiation biology and in allied fields in which the candidate has received training. (3) Candidates will be required to pass, before the preliminary examination is taken, the official reading examination of the University in at least 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 field of interest and plans for a career determine these requirements. The more important courses from which selection may be made are advanced courses in biochemistry, botany, chemistry, electrical engineering, mathematics, microbiology, physics, and zoology.

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 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.
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 individual needs, with the aim of giving: (1) strength in the basic sciences; (2) perception of the biomedical sciences as a whole; and (3) experience and training in a chosen specialty.

The research areas available for Masters and Ph.D. thesis work are biochemistry, biophysics, carcinogenesis, cell biology, genetics, and physiology. Included are such subjects as microbiology, immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation biology, virology, developmental biology, plant physiology and photosynthesis, experimental pathology, microbial and mammalian genetics, mutagenesis, and problems of aging.

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. Completed applications, Graduate Record Examination scores and letters of reference should be sent to the address below. The student will need previous training in biology, 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 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 core courses or their equivalent: Biochemistry (5110-20); Biophysics (5140); Genetics (5160); Molecular Genetics (5170); Cell Biology (5160-90); Mammalian Physiology (5200) and Statistics for Biologists (5720).

2. Three quarters of Biomedical Sciences Laboratory (5310-20-30-40).

3. Participation in Biomedical Sciences Seminar (5350-60-70) for one year.

4. Participation in at least three formal courses in the advanced area of the student's interest.

5. Pass a written examination. 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.

6. Pass an oral examination by 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.

7. A dissertation reporting the results of original and significant scientific research. A minimum of 36 quarter hours of course 6000 is required.

8. A final oral examination on the dissertation.

9. A formal seminar presentation of the dissertation research.

SPECIAL MASTER OF SCIENCE DEGREE PROGRAM

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

Requirements for the M.S. degree are:

1. Graduate credit or a proficiency in the following core courses: Biochemistry
148 Graduate School of Biomedical Sciences

(5110-20); Cell Biology I (5180); Cell Biology II (5190); plus any three of the following four courses: Biophysics (5140); Genetics (5160); Molecular Genetics (5170); and Mammalian Physiology (5200). Additional credits may be obtained (six to 15 credit hours) with electives. The student will need previous training in biology, calculus, physics, organic and physical chemistry.

2. 45 credit hours of approved graduate courses including a minimum of nine quarter hours for thesis (maximum 18 quarter hours of credit for course 5000).

3. For admission to candidacy; Completion of any required prerequisite courses and one quarter of graduate coursework with a B average. Admission to candidacy forms must be filed at least one full quarter prior to receipt of degree.

4. A Master's Committee of three appointed faculty members upon admission to candidacy.

5. A thesis reporting results of original and significant scientific research.

6. Pass a final oral (or oral and written) examination as determined by the student's committee.

Full-Time Faculty

Professors:
D. Bilen (Director), Ph.D. Tennessee; D. E. Olin, Ph.D. Rockefeller.

Associate Professors:
F. H. Gaertner, Ph.D. Purdue; F. D. Hambuch, Ph.D. Pittsburgh.

Assistant Professor:
N. W. Revis, Ph.D. Glasgow, Scotland.

Research Assistant Professor:
C. T. Hadden, Ph.D. Washington.

Shared Faculty


Courses

5000 Thesis

5070-80 Physical Chemistry for the Life Sciences (3, 3) Thermodynamics; phase equilibria; chemical equilibria; electrochemical force; surface charge; electrolyte solutions; kinetics; conductance; viscosity; diffusion.


5140 Biophysics (3) Energy levels and excited states of large molecules; optical instrumentation; adaptations to system perturbations; properties of macromolecules in solutions; molecular outnumbering; intramolecular forces; physical principles of microscopy. Prereq: 5070-80.

5160 Genetics (5) Mendelian genetics, mitosis and meiosis; genetics of phage, bacterial and eukaryotic organisms; mapping and linkage; mutation; cytogenic inheritance; mechanism of recombination; chromosome structure, replication, and segregation.

5170 Molecular Genetics (3) Molecular biology of genetic processes. Gene regulation; coding; protein synthesis; suppression of missense and nonsense mutations; mutagen mechanisms; complementation; recombination. Prereq: 5110-20.

5180 Cell Biology I (3) Structure and composition of major nuclear and cytoplasmic organelles; nerve cells; structure of nerve cells; principal instruments and techniques; differentiation; mitosis and meiosis; cell cycle; chromosome structure; nuclear RNA metabolism; ribosomes; biogenesis; survey of specialized cells. Structure of genetic transcription and translation in bacteria. Coreq: 5110.

5190 Cell Biology II (3) Comparative biochemical approach to cell structure and function. Membrane systems and metabolism; development and function of mitochondria, chloroplasts, and other organelles as related to metabolism and regulation; transport phenomena; cell cycle. Prereq: 5110, 5180; Coreq: 5120.

5200 Mammalian Physiology (4) Survey of mammalian organ systems and their functions. Nervous, muscular, endocrine, digestive, respiratory, circulatory, reproductive, and excretory systems will be included; interrelationships of these systems will be discussed. 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 (1, 1) Critical analyses of current journal publications in a selected area of modern biology. Written evaluations of papers and oral presentations by each student. Required of all first-year students.

5370 Biomedical Sciences Seminar (1) Basic principles of scientific writing. Research articles; grant proposals; abstracts; review articles; progress reports. Required of all first-year students.

5430-60-90 Graduate Research Participation (3, 6, 9) Special advanced research project covering an area not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

5520-40 Special Topics in Biomedical Sciences (3, 3, 3, 3) Given either as tutorials or as formal lectures. Potential topics for such courses include: X-ray diffraction and crystallography; excitable biological systems; physical chemistry of macromolecules; computer science; pathology; cytology and cytochemistry; mammalian genetics; human genetics; cancer research; plant physiology; radiation biology; aging research. Additional courses can be developed on a course-by-course basis, depending upon the curricular needs and interests of 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 variances; confidence intervals; tests of significance for comparing samples; analysis of variance; contingency tables; chi-square tests; correlation and association. Prereq: Introductory Statistics or consent of instructor.

5750 Experimental Design in Biomedical Research (3) Requirements for a valid experiment: design for reduction of error; inclusion of blinded comparisons, randomized blocks, and Latin squares; use of supplementary observations to reduce errors; randomization; investigating several variables simultaneously by factorial and nested designs, and by replication; determining the number of observations. Prereq: 5740.

5830 Physical Biochemistry (3) Methods and concepts relevant to the determination of size, structure, and function of proteins.
shape and molecular weight of biological macromolecules. Discussion of optical activity and light scattered by macromolecules in solution. Prereq: 5070-80, 5110-20, 5140.

5840 Biogenic 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 bacteriophage 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.

5920 Mammalian Genetics (3) Orderly presentation of known genetic variants affecting each of the organ systems of experimental mammals, especially the laboratory mouse. Prereq: 5170.

5940 Classic Experiments in Genetics (3) Original papers presenting new and lasting concepts in genetics will be read and discussed. Prereq: 5170.

6000 Doctoral Research and Dissertation.

6110 Seminar in Plant Physiology (1) May be repeated. Maximum 12 hrs. S/NC only.

6120 Seminar in Cellular and Developmental Biology (1) May be repeated. Maximum 12 hrs. S/NC only.

6130 Seminar in Genetics (1) May be repeated. Maximum 12 hrs. S/NC only.

6140 Seminar in Mammalian Research (1) May be repeated. Maximum 12 hrs. S/NC only.

6150 Seminar in Immunology (1) May be repeated. Maximum 12 hrs. S/NC only.

6160 Seminar in Biophysics (1) May be repeated. Maximum 12 hrs. S/NC only.

6170 Seminar in Biochemistry (2) May be repeated. Maximum 24 hrs. S/NC only.

6180 Advanced Seminar in Biomedical Sciences (1-3) Presentation, evaluation and discussion of current research in the various areas of the biomedical sciences, including cell biology, genetics, biophysics, and biochemistry. Prereq: Consent of Instructor. May be repeated. S/NC only.

6190 Seminar in Animal Virology (1) Discussion of experimental data and review of active research problems in virology through use of literature. May be repeated. Maximum 12 hours. S/NC only. Prereq: Microbiology 4521 or equivalent and consent of instructor.

6200 Nucleic Acid Chemistry (3) Chemistry of nucleotide-derived materials covering topics including alkylation, solvolysis, oxidation-reduction, polymerization, synthesis, denaturation and other structure perturbants. The reaction of nucleic acids in the above systems will be examined with emphasis on the relationship of structure and reactivity. Prereq: 5110-20. Coreq: 5080.

6210 Protein Chemistry and Enzyme Mechanisms (3) Theoretical and practical aspects of protein chemistry including chemical and physical characterization of proteins, chemical modification of proteins, and structure-function relationships. The latter will emphasize enzymes and will include approximation of subunit-basis, covalent catalysis, general acid-base catalysis, and strain and distortion of substrates. Prereq: 5110-20.

6220 Enzyme Regulation and Kinetics (3) Kinetics of catalysis; inhibition by product, substrate and dead-end inhibitors; stimulation and inhibition of allosteric enzymes; types of feedback regulation; role of subunits in enzyme regulation; multifunctional enzymes. Prereq: 5110-20.

6240 Chemistry and Metabolism of Lipids (3) Nomenclature, chromatographic isolation, chemistry, physical properties, and enzymology of lipids. Hormonal action of prostaglandins and the role of lipids in membranes, enzymatic expression, and nervous tissue. The main emphasis is on lipid biochemistry of mammals, although comparative aspects, particularly the lipid pathways in bacteria and yeast are also described. Prereq: 5110-20.


6260 Advances in Animal Virus Research (3) Mechanisms of infection, replication, and maturation; alternatives of host cell structure and function; host immunological responses; oncogenesis; pathogenesis; genetics; interferon. Prereq: 5110-20, 5180-90.

6270 Viral Carcinogenesis (3) History of viral oncology and descriptive catalog of tumor viruses. The biology of normal and transformed cells. DNA tumor viruses; replication cycle; transformation; genetics; natural history. RNA tumor viruses; endogenous and exogenous states; genetics; induction; transformation; natural history.


6290 Cancer Biology and Biochemistry (3) Pathology and nomenclature of cancer. Tumor immunology and immunotherapy. Biochemistry of tumor cells; enzymology, metabolism; membranes; DNA repair; regulation; strategies in chemotherapy.

6300 Mutagenesis (3) Course will include basic mechanisms in chemical and radiation mutagenesis and dosimetry in a variety of systems including bacteria, fungi, Drosophila, and mice.

6510-20-30-40 Advanced Topics in Biomedical Sciences (3, 3, 3, 3) Emphasis on current and future research developments. Offered on the topics listed under the Special Topics Courses and can be taken either as tutorials or as liberal arts survey courses requiring substantial student participation. May be repeated.
Graduate School of Library and Information Science

Gary R. Purcell, Director

MAJOR
Library Science

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:
E. E. Mauldin, M.S.L.S. Illinois; G. R. Purcell (Director) Ph.D. Case Western Reserve.

Associate Professor:

Assistant Professors:
J. Knightly, Ph.D. Texas; W. Robinson, Ph.D. Illinois; G. M. Sinkankas, Ph.D. Pittsburgh; P. Wilson, Ph.D. Michigan.

Courses

4140 Libraries and Librarianship (3) Librarianship as an occupation: its organization, responsibilities, problems, and prospects.

4150 School Library Administration (3) Objectives, functions, and place of the school library; relationship to local and state services; cooperative planning for quarters and materials; evaluation. (Same as Curriculum and Instruction 4150.)

4270 Organization of Library Collections I (6) Acquisitions, cataloging and maintenance of library collections.

4330 Introduction to Reference Materials (3) Basic information sources and services for all libraries.

4750 Audiovisual Methods and Techniques (3) (Same as Curriculum and Instruction 4750.)
5000 Thesis

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

5110-20-30 Problems in Library Science (3, 3, 3) (May be repeated with consent of the school.)

5140 Research Methods in Library Science (3) Research methods applicable to librarianship. Emphasis on the process and conduct of research; includes analysis of published research.

5200 Subject Reference and Bibliography (3) General patterns of bibliographical organization and basic information sources in subject fields including non-English materials; experiences in bibliographic methods and search techniques. Prereq: 4330.

5210 Sources and Services for the Social Sciences (3) Study and use of English and non-English literature and bibliographical sources in education, economics, political science, history, geography, anthropology, psychology, and sociology; emphasis on organization of collections for optimum use. Prereq: 5200.

5220 Sources and Services for the Natural Sciences (3) Use of English and non-English literature and bibliographical sources in mathematics, physics, astronomy, chemistry, geology, biology and medicine; emphasis on organization of collections for optimum use. Prereq: 5200.

5230 Sources and Services for the Humanities (3) Use of English and non-English literature and bibliographical sources in literature and language, fine arts, music, philosophy and religion; emphasis on organization of collections for optimum use. Prereq: 5200.

5240 Organization of Library Collections II (3) Construction and maintenance of the library 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: 4270.


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, standards, quality 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. Primary attention will be given to the design and analysis of existing systems within the academic or special library sphere.

5330 Academic Libraries (3) Discussion of persistent and current problems. Topics vary depending upon needs and interests of the group.

5350 School Libraries (3) Discussion of persistent and current problems. Topics vary depending upon needs and interests of the group.

5360 Technical Libraries and Information Centers (3) Purpose, functions and organizational characteristics of those libraries and information centers, private and public, which offer scientific and technical information services. Problems related to the acquisition, organization and servicing of technical information collections.

5370 The Library in the Community (3) Public library as a social agency; its role in the education and communication systems of the community.

5380 Seminar: Academic, Public, School or Special Libraries (3) Prereq: Consent of instructor.

5400 Library Facilities (3) Problems inherent in the planning and construction of library quarters. Examination of the interrelationships of staff, materials and user space requirements.


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 techniques 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, interests, abilities of different age and socioeconomic groups. Prereq: 5640 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 Narrative (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.

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.
Graduate School of Planning

J. A. Spencer, 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. Applicants are also encouraged to submit a statement of career goals in support of their application.

Applications will be acknowledged upon receipt. The applications will then be held by and reviewed in the Graduate School of Planning. The applicant should not anticipate an immediate response in regard to admissibility. 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 hours credit including at least 36 hours at the 5000 level or above.

Each student will be required to demonstrate competence in individual research. This may take either of two forms.

Plan I—Complete a thesis for nine hours credit.

Plan II—Complete a major study with acceptable documentation. In order to be eligible for the major study the student must have earned a grade of B+ or higher in Research Methods II, have a 3.5
cumulative grade point at the time of approval of the major study proposal, and have completed at least 24 hours of graduate study. The student meeting these criteria may present a proposal for a major study which will include at least nine hours of elective course work in an area of concentration. The proposal shall justify the area of study, the approach to approval of the major study proposal, and have completed at least 24 hours of course work. In addition to testing the knowledge of the student, the information thus obtained will be taken into account in advising students concerning the study program they should undertake during the balance of their academic program to remove any indicated deficiencies.

Each student will be encouraged, but not required, to complete a work internship equivalent to at least two and one-half months of full-time work in a planning agency at approximately the mid-point in course work.

**Faculty**

Professors:  

Associate Professors:  
J. A. Spencer, M.C.P. Ohio State; R. L. Wilson, M.R.P. North Carolina.

Assistant Professors:  

**Courses**

4100 Introduction to Planning (3) History of planning, familiarization with the operations of contemporary planning, the concept of systems, current trends and issues. Emphasis on the relationships between planning and the society in which it occurs.

4200 Planning Communications (1) Graphic, oral and written communication of information and recommendations.

5000 Thesis

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

5100 Theory of Planning (4) Analysis of the means and objectives of the planning process. Emphasis on the role of the planner and the planning function in public decision making. Prereq: 4100.

5130 Planning Research Methods I (3) Research techniques in subject areas associated with city and regional planning. Research tools, data collection, analysis and projection as a basis for planning and decision making. Coreq: 4100 or consent of instructor. (Same as Water Resources Development 5150.)

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.)

5250 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: 5160.

5270 Planning and Transportation (3) (Same as Civil Engineering 5270.)

5280 Planning Methods (5) Tooling up studies; methods for preparation of land use and public facility elements of comprehensive development plans, including visual aspects. Prereq: 5130.

5300 Regional Planning (3) Making the planning process operative in an intergovernmental context. Theories of regions and analysis of metro-planning, area planning, regional planning by states, single-purpose agency planning, and the TVA. Prereq: 5160.

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: 5160.


5350 Urban Spatial Structure (2) An examination of past, present, and possible future patterns of urban spatial structure as determined by changing technology, interaction, and socioeconomic environment, drawing on contemporary theories, models, empirical research. Prereq: Consent of instructor.

5360 New Towns (2) Historical development of planned new towns and implications for a national urbanization policy in the United States; the process by which new towns are being created, from the establishment of objectives to the administration of 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) 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. Extended laboratory experience. Fees. Prereq: 5340.

5670 Social Planning (3) Theory, philosophy and implications of programs for planned social change. Consideration of major social planning issues in diverse fields of service (aging, corrections, education, health, manpower, mental health, social services, etc.). Prereq: Consent of instructor. (Same as Social Work 5670.)
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 illness, 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 the commitment to the values and goals of the profession. The student must be able to think independently and analytically in order to use the skills and knowledge for purposeful and effective intervention at all societal levels.

THE PROFESSIONAL CURRICULUM

The curriculum offered during the first two quarters of the first year, the Core Curriculum, is required for all students. This Core Curriculum is designed to provide students with knowledge and skills that are common to social work practice at the 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, (5) field instruction. Human behavior and social environmental 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
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. This Accelerated Program is approved by the Council on Social Work Education.

Students who qualify for the Accelerated Program must:
1. Have maintained a 3.0 or above grade point average (on a 4.0 scale) in undergraduate work.
2. Have an undergraduate major in social work which included a supervised field practice component, or have two years full-time practice in the field of social work.
3. Pass a qualifying examination administered by the UTSSW faculty.

The twelve-month program begins in June with an intensive ten-week term from June with an intensive ten-week term from June to August, offering courses in the core curriculum. The remaining eight months are devoted to the completion of the MSSW degree.

GENERAL REQUIREMENTS

Admission to the professional curriculum is based on the following requirements:
1. A Bachelor's degree from an accredited college or university with a minimum grade point average of 2.5 on a 4.0 scale. Those with other academic backgrounds may request consultation regarding ways in which they might be admitted.
2. A grade point average of 2.5 on a 4.0 scale, with those falling below the average to be admitted on supplemental grounds. The University of Tennessee School of Social Work allows a maximum of 45 credit hours of graduate course work taken at another accredited institution to be transferred into the student's program. Such work must have been taken for graduate resident credit and passed with a B or better. In addition, it must be part of an otherwise satisfactory graduate program (B average) and 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.

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
<td></td>
</tr>
<tr>
<td>5070 Social Work Research I</td>
<td>3</td>
</tr>
<tr>
<td>5110 Social Welfare Policy and Services I</td>
<td>3</td>
</tr>
<tr>
<td>5210 Human Behavior and Social Environment I</td>
<td>3</td>
</tr>
<tr>
<td>5410 Social Work Practice I</td>
<td>3</td>
</tr>
<tr>
<td>5910 Field Practice</td>
<td>8</td>
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<tr>
<td>TOTAL QUARTER HOURS</td>
<td>15</td>
</tr>
<tr>
<td>Winter</td>
<td></td>
</tr>
<tr>
<td>5080 Social Work Research II</td>
<td>2</td>
</tr>
<tr>
<td>5120 Social Welfare Policy and Services II</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL QUARTER HOURS</td>
<td>15</td>
</tr>
</tbody>
</table>

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

5390 Field Practice
5930 Social Work Practice II
5940 Specialization Course and Electives...
TOTAL QUARTER HOURS...14

Fall Quarter, Second Year

5950 Field Practice...
5961 Integrative Seminar...
One Elective...
TOTAL QUARTER HOURS...

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 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.
5081 Evaluative Research in Social Work (2-3)

An advanced research course. Topics will include the socio-political and organizational context of research design and methodology appropriate to evaluative research, and the utilization of research findings. Prerequisite: Completion of core or consent of instructor.

5082 Practicum in Social Work Research (3-9)

Supervised practice in the application of research methods and tools to a social welfare program. Prerequisite may be generated by the faculty, other qualified students with an intensive academic background, or consent of instructor.

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.

5110 Social Welfare Policy and Services I (3)

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 level. An examination of the contribution to social work professionals make to the formal policy making process which by which social change is effected, and through which aggregate social welfare services are proposed, authorized, financed, and programmed. Policy lab may be used to focus on beginning skill development.

5120 Social Welfare Policy and Services II (3)

An examination of theories of complex organizations as applied to social welfare service delivery settings. The transformation of collective social welfare resources into divisible and indivisible social welfare benefits through organized instrumental action of a professional nature.

5130 Social Policy Analysis (2-3) "Policy science" techniques are considered for their appropriateness in assessing the social, political, and economic implications of social policy proposals. Prerequisite: Completion of core or consent of instructor.

5161 Social Welfare Seminar (2-3)

A problem area of social welfare is studied using substantive knowledge about a social problem or condition and the interrelationships among political, social, legal, and policy social welfare program, and social work practice. Fields such as health, mental health, child and family services, 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.

5210-20 Human Behavior and Social Environment I and II (3, 2-3)

Examination of theories pertaining to the individual, family, and small group within the context of their functions, structures, roles and processes. Behavior of these systems are conceptualized along a functional-dysfunctional and normal-deviant continuum. Organizing themes are stress, development, adaptivity and defensive mechanisms. An open system approach is used to understand the interrelationship of biological, psychological, and social variables within systems. Emphasis is given to the implications of culture and ethnicity.

5290 Special Accelerated Program in Social Work (15)

A ten-week program providing qualified students with intensive academic and field experience that qualifies them to enter into the second year of graduate study upon successful completion of this term. S/NC only.

5310 Human Behavior and Social Environment (2-3)

Deals with the student's knowledge of the ontological basis of social work practice and the continuum of behavior from optimum social functioning through pathology. Prerequisite: S/NC only.

5311 Imaginative Perspectives on the Human Condition (2-3)

Examination of the usefulness to social work students of prose, drama, and poetry, which may illuminate and expand the knowledge and appreciation of every person's humanness. Adaptive and maladaptive responses to ordinary and extraordinary life circumstances and events, as portrayed by creative writers, are considered. The artistic 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 the instructor.

5312 Psychopathology and Social Deviance (2-3)

Deals with theories of and research in the etiology of psychic dysfunction and social variance. The categorical approach to psychopathology will be examined and differentiated from other approaches to human behavior. Prerequisites: Completion of core or consent of instructor.

5314 Comparative Theories of Personality (2-3)

Examines those personality theories that are most relevant for social work practice with individuals, groups, or families. Prerequisite: Completion of core or consent of instructor. Taught at branches only. Available at UT as Psychology 4510.

5315 Human Sexual Problems (2-3)

Differentialization and resensitization of personal and social attitudes toward sexual behavior, clinical problems, and approaches designed to make 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, patterns of employment, and the characteristics of work environments for the individual and community, interdependence of individual and organization, meaning of work in the development of mental health. Prerequisite: Completion of core or consent of instructor.

5410 Social Work Practice I (3)

Basic theory, values and beginning skills development generic to social work intervention at various system levels. Combines classroom skills and laboratory experiences.

5420 Social Work Practice II (3)

Assessment, planning, methodology and skills development fundamental to social work intervention. Combines classroom skills and laboratory experiences.

5440 Family Therapy in Social Work Practice (2-3)

Application of practice theory designed to assist in the development of skills necessary to 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 technique of transactional analysis. Lectures, discussion, and experiential methods facilitate acquisition of the knowledge and skills to use transactional analysis in a variety of settings. Prerequisite: Completion of core or consent of instructor.

5442 Short-Term Treatment (2-3)

Considers the theory and practice of short-term treatment, focus on the nature of methods, characteristics of clients responsive to this
approach, and designs of programs providing short-term assistance. Specific techniques of assessment and treatment are presented as they relate to social work purpose and values and the development of administrative principles that make provision for the effective provision of welfare services.

5701 Administration in Social Work (2-3) Introduces the student to the field of administration as it relates to the nature of social welfare agencies, the legal and political environment in which social work operates, and the administration of other social welfare programs. Prereq: Completion of core or consent of instructor.

5702 Organizational Design of Social Welfare Agencies (2-3) Critical problems of adapting organizational structure and functional patterns to the need for efficient production and distribution of services. Prereq: Completion of core or consent of instructor.

5704 Seminar on Behavior Therapy (2-3) Behavior modification methodology as applied to clinical assessment, choice of designs to assess treatment interventions, skill in evaluating data on effectiveness of treatment interventions. May be repeated. Maximum 6 hrs. Prereq: Completion of core or consent of instructor.

5741 Supervision in Social Work (2-3) Dual roles of the supervisor in various settings, and supervision will be distinguished from case management, and executive will be considered. Emphasis on integration of theory and experience for development of practical skills for coping with a variety of situations. Prereq: Second-year administration or community organization students, or consent of instructor; Social Work 5761 or equivalent.

5742 Consultation in Social Work (2-3) Constellation of roles, relationships, and behaviors required of a consultant. Consultation as distinguished from supervision, administration, and direct practice. Types of consultation considered in relation to various settings and levels of personnel. Prereq: Completion of core or consent of instructor.

5742 Consultation in Social Work (2-3) Constellation of roles, relationships, and behaviors required of a consultant. Consultation as distinguished from supervision, administration, and direct practice. Types of consultation considered in relation to various settings and levels of personnel. Prereq: Completion of core or consent of instructor.

5743 Management of Human Resources in Social Welfare (2-3) Examination of the personnel function in administration of human services programs and agencies. Topics include personnel recruitment, selection, appointment, and supervision; staff development, training, and evaluation; salary and benefit systems; employer-employee relations; and fair employment practices. Prereq: Completion of core or consent of instructor.

5744 Education and Training in Social Welfare (2-3) Examines philosophies and practices of teaching and learning as they relate to adult learning and the need for training and development. Prereq: Completion of core or consent of instructor.

5745 Professional Leadership in Social Work (2-3) Examination of leadership in social welfare. 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.

5761 Social Welfare Administration and Planning (3) An initial sequence course in social welfare administration and planning which examines the major issues and the role of the administrator in managing and planning programs, and program evaluation. Prereq: Completion of core or consent of instructor.

5762 Seminar in Social Welfare Administration and Planning (3) Designed to assist students in acquiring specific administrative and planning techniques appropriate for social welfare agencies and programs. Prereq: Completion of core or consent of instructor.

5771 Information Systems and Decision-Making (2-3) Explores decision making in human services organizations, the utilization of information in policy formulation, delivery of services, and client group performance. Information generation, collection, processing, storage, retrieval, and utilization as considered. Prereq: Management of human resources in social welfare or completion of social work management, control, evaluation and forecasting. 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 in social service organizations. Technical aids to budgetary choice and other aspects of financial management will be examined for the utility, parsimony, and feasibility. Prereq: Completion of core or consent of instructor.

5800 Management of Residential Settings (2-3) Issues related to management and programming 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 (2-3) Aspects of the Juvenile Justice System: overview of juvenile delinquency, introduction to the delinquent child, police in detecting delinquency and apprehension of delinquent offenders, police procedures, role of the juvenile law, and police in institutions, correctional institutions, aftercare programs, and preventive strategies. Prereq: Second-year standing.

5820 Social Aspects of Illness (2-3) Social, economic, and emotional problems arising from or related to illness and disability as they affect the individual, the family, and the community.

5824 Social Work Practice with the Poor (3) Focuses on the development of knowledge and skill in the use of group methods in social work practice with emphasis on organizing and structuring the group, structuring group tasks and experiences, understanding and enhancing group functioning, enabling problem-solving effectiveness, facilitating transfer and forming the group, structuring group interventions. 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 patterns that affect while marriage, concepts regarding contemporary marriage styles, problem areas in marriages, and approaches to social work in intervention and treatment. 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 societies; and other problems of a legal nature that affect social work.

5834 Social Gerontology (2-3) Physical, psychological, and social aspects of aging; economic and health status of the aging; the role of the family; community programs for aging; retirement—phenomenon of modern society.

5855 The Roles of Women (2-3) Roles and statuses of women, with the emphasis on the contemporary American scene. Includes a study of empirical research as well as the popular literature. Ascribed and achieved facets of women’s statuses are explored.

5910 Field Practice (3, 4) Instruction and supervised practice in methods of social work with individuals, groups and communities. Prereq: Admission to the school; 5410 concurrently or prior to 5910; 5910 may be repeated. Prereq: Consent of instructor. Required course. S/NC only.
Graduate School of Social Work

5930-40-50 Field Practice (4, 8, 8) Specialized instruction and supervised practice in methods of social work treatment, administration, and planning in community health and welfare programs and agencies. Prereq: Admission to the school. To be taken in sequence. S/NC only.

5961 Integrative Seminar (3) 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/her education and professional development. S/NC only.

5970 Outcomes in Social Work Practice (2-3) Application of substantive knowledge to comprehensive problem-solving within existing service and community systems. Critical appraisal of functional relationships between problem, policy, planning, practice, and outcomes. Examination of problems from practice to determine key elements of optimal services and implications for policy decisions. S/NC only.

5980 Practicum in Governmental Social Welfare Policy Making (2-3) Practical introduction to the process of legislative and/or administrative policy making at the state or local governmental level, through assignment of students to the offices of elected or appointed proximate policy makers. Limited social welfare policy research activities. Seminar used to present normative and descriptive theory about the policy-making process, and models of policy analysis. May be repeated. Prereq: Social Work 5110 and consent of instructor.