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: Agricultural Experiment Station, Agricultural Extension Service, and College of Agriculture.

In 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.

Agricultural Experiment Station
D. M. Gossett, Dean
T. J. Whatley, Associate Dean
J. I. Sewell, Assistant Dean

The Agricultural Experiment Station was established by the University’s Board of Trustees on June 8, 1862, five years before the passage of the Hatch Experiment Station Act by the U.S. Congress. The University was one of the first five institutions in the U.S. to establish an Agricultural Experiment Station. Since its beginning the Station has given first attention to investigations of concern to the agriculture of Tennessee. The investigations of the Station follow a systematic method of gaining and applying knowledge efficiently to the biological, physical, and economic phases of producing, processing, and distributing farm and forest products; to the social and economic aspects of rural living; and to consumer health and nutrition. Both farm and urban populations gain from the accomplishments of the Agricultural Experiment Station. Examples of some of these accomplishments are new and improved varieties of crops, new and better methods of controlling crop and livestock pests, more efficient production of crops and pasture through improved fertilization and mechanization, and more efficient feeding and management of livestock.

The program is designed and administered through sixteen subject matter departments located statewide. 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-DOE Comparative Animal Research Laboratory is located about twenty miles west of Knoxville near Oak Ridge, where a program of radiobiological research in the field of agriculture is carried out by the Agricultural Experiment Station under contract to the Department of Energy. The program includes research with farm and laboratory animals, with soils, and in applied radiobotany and plant breeding.

Agricultural Extension Service
M. L. Downee, Dean
T. W. Hinton, Associate Dean
M. F. Clarke, Assistant Dean
B. G. Hicks, Assistant Dean

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

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

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

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

College of Agriculture
O. Glen Hall, Dean

Graduate programs of the College of Agriculture are designed to prepare men and women for positions of leadership in industry, state and federal government, teaching, research, and extension.

The graduate student is expected to demonstrate a thorough knowledge of the subject matter in his/her specialized field of study and its relationship to the sociological, economic, and environmental impact on society. The student must demonstrate the ability to plan, conduct, analyze, and report original research. More importantly, emphasis is given to intellectual growth and to the development of scholarly habits of study, reasoning and analysis to the end that the graduate will continue to grow and develop professionally throughout his/her career.
MASTER OF SCIENCE PROGRAMS

Programs of graduate study leading to the Master of Science degree are offered through all departments in the College of Agriculture. The general rules of the Graduate School apply to all graduate work in the college. The graduate program may be entirely in one major subject or may include subject matter areas related to the major. Both majors and minors are available in Agricultural Economics, Agricultural Engineering, Agricultural Extension, Agricultural Mechanization, Animal Science, Entomology and Plant Pathology, Food Technology and Science, Ornamental Horticulture and Landscape Design, and Plant and Soil Science. Majors only are available in Entomology and Plant 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 general requirements of the college. 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 the student’s advisory committee to meet the student’s background, interests, and professional objectives. For example, a student majoring in Forestry and Wildlife or Plant Pathology may pursue work in an emphasis either in the area of plant pathology or economic entomology.

Normally, graduate programs will include the thesis requirement. There is, however, a non-thesis option in the Department of Agricultural Economics and Rural Sociology and the Department of Forestry, Wildlife and Fisheries. The non-thesis option with a major in Agricultural Economics has the following requirements: 48 hours of course work which 24 hours must be at the 5000 level; 18 hours in agricultural economics; 9 hours of economic theory; 6 hours in quantitative methods in agricultural economics, statistics, or mathematical economics; final comprehensive written and oral examinations.

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 permission, faculty advisory committees, residence, grades, research, and admission to candidacy for degree apply to all doctoral programs. Special departmental requirements are listed in the following paragraphs.

Agricultural Economics

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

A: A major area of concentration to be selected from the following:
   1. Agricultural policy
   2. Agricultural marketing and price analysis
   3. Farm management and production economics
   4. Natural resource economics
   5. Rural development
B: The core areas:
   1. Agricultural economics
   2. Economic theory
   3. Mathematical and quantitative methods in agricultural economics

Course Requirements: A minimum of 36 quarter hours credit beyond the Bachelor’s degree, exclusive of credit for the Master’s thesis, is required in the doctoral program. Of this total, 36 hours in doctoral research and dissertation are required. At least 30 hours of course work shall be in agricultural economics and 15 hours in economics. Excluding the dissertation, a minimum of 21 hours in agricultural economics and 36 hours in agricultural economics 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:

A: Agricultural power and machinery
B: Soil and water conservation engineering
C: Agricultural structures
D: 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 specific course requirements for the degree of Doctor of Philosophy degree in Agricultural Engineering 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.

Animal Science

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

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

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

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

1. Minimum of 108 quarter hours credit in courses beyond the Bachelor’s degree, exclusive of credit for the Master’s thesis. Of this number, students are required to complete a minimum of 36 quarter hours in 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 animal science.

The specific program of a candidate for the degree of Doctor of Philosophy in Animal Science depends upon the student’s background, interests, and professional objectives. Actual course content of the program is planned with the student’s 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 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

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

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

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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 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

4. Electric power and processing

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

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

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

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3. The program of each candidate shall consist of a major and supporting studies in one or more additional areas. The major shall

4. Electric power and processing

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

1. Minimum of 108 quarter hours credit in courses beyond the Bachelor’s degree, exclusive of credit for the Master’s thesis. Of this number, students are required to complete a minimum of 36 quarter hours in 6000 Doctoral Research and Dissertation.
2. At least 36 quarter hours credit in courses numbered 5000 and 6000, exclusive of Doctoral Research and Dissertation.
3. A minimum of 24 quarter hours credit must be completed in related fields outside animal science.

The specific program of a candidate for the degree of Doctor of Philosophy in Animal Science depends upon the student’s background, interests, and professional objectives. Actual course content of the program is planned with the student’s 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 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

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

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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 animal science.

The specific program of a candidate for the degree of Doctor of Philosophy in Animal Science depends upon the student’s background, interests, and professional objectives. Actual course content of the program is planned with the student’s faculty advisory committee to meet requirements in the various areas of concentration.
The specific program of a candidate for the degree of Doctor of Philosophy in Plant and Soil Science will depend upon the interest and previous training of the candidate. The program of courses and research will be planned with the student in consultation with a faculty advisory committee. The major professor will serve as chairperson of the faculty advisory committee and will direct the research and the preparation of the dissertation.

Departments of Instruction

Agricultural Economics and Rural Sociology

MAJORS

DEGREES

M.S., Ph.D.

Professors: J. A. Martin (Head), Ph.D. Minnesota; M. H. Busey, Ph.D., J. R. Brooker, Ph.D. Florida; D. W. Brown, Ph.D. Iowa; C. L. Cleland, Ph.D. Wisconsin; J. J. McDow, Ph.D. Clemson; S. D. Mundy, Ph.D. Tennessee; R. H. Orr, Ph.D. Illinois; R. W. Todd, J.D. Tennessee; B. J. Trevena, Ph.D. Tennessee; O. N. Walker, Ph.D. Ohio.

Associate Professors: C. M. Cuskaden, Ph.D. Michigan State; T. H. Klimpt, Ph.D. Kentucky; C. L. McMenemy, Ph.D. Michigan; G. D. Whipple, Ph.D. Washington State.

Assistant Professors: W. W. Park, Ph.D. Virginia Polytechnic Institute; C. D. Whipple, Ph.D. Washington State.

The department has programs for the Doctor of Philosophy degree and the Master of Science degree with a thesis or non-thesis option.

Agricultural Economics

4120 Farm Management (3) Principles of farm organization and operation; allocating land, labor, and capital, changing technology, tenure arrangements and use of credit; risks; measures of success. Use and analysis of records; exercises in decision making. Prereq: Agriculture 1110 and Economics 2120. 2 hrs and 1 lab. F, Sp.

4140 Introduction to Agricultural Production Economics (3) Resource allocation, product selection, scale of operation of agricultural firms; aggregate policies, market implications. Use and analysis of records; exercises in decision making. Prereq: Agriculture 1110 and Economics 2120. F

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. Prereq: Agriculture 1110 and Economics 2120. F

4610 Management of Farm Supply and Marketing Firms (3) Operation of firms selling farm supplies and markets; marketing of agricultural products. Emphasis on accounting data and economic theories for decision making. Prereq: Agriculture 1110 and Economics 2120. F


5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Prereq: 4140 or equivalent. 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 requirements are fulfilled. Award of degree requirement may be repeated. S/NC only. E

5101 Special Problems in Lieu of Thesis (3) E

5120 Agricultural Price Analysis (3) Analysis and interpretation of factors affecting agricultural prices; price trends and cycles; application of economic theory to agricultural prices. Prereq: 3120 and Statistics 4310 or equivalent. W

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

5210 Seminar: Agricultural Policies (3) Sp

5220 Seminar: Methodology of Research (3) W

5230 Seminar: Adjustments to Industrialization (3) F

5310 Research (3) Special research problems in agricultural economics and rural sociology. Gathering, tabulating and interpreting data and report writing. May be repeated. Maximum 9 hrs. S/NC only. E

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

5420 Land Economics (3) Problems in land tenure, land use, and conservation in United States and selected foreign countries. Prereq: 4330 or equivalent. F

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

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

5710 Quantitative Methods in Agricultural Economics (3) Linear statistical techniques with empirical applications, made to problems of maximizing, profit, minimizing cost, firm growth, transporta- tion, and related applications. Prereq: Economics 4180 or consent of instructor. W

6000 Doctoral Research and Dissertation (3-15) E

6120-30 Seminars in Agricultural Economics (3, 3) Topics selected from the areas of economic production, consumption or distribution in agriculture and related industries and public policies concerned with agricultural and related industries. F, Sp

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

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

6420 Marketing and Resource Use (3) Institutional settings for research and policy formulation. Analytical tools to measure efficiencies of marketing and resource use. Wastes management in marketing systems to conserve resources and environment. Prereq: 5410 or consent of instructor. W

Rural Sociology

3420 Rural Sociology (3) Nature of rural society; social systems concept; rural-urban differences; nature of social relations and associations; movement; problems of rural people; tenancy, farm labor, health, services, educational facilities, churches, local government; impact of industrialization. F, W, Sp

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

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

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

5450 Advanced Rural Sociology (3) Application of sociological concepts to analyze changing structure and function of rural life; rural social values, attitudes, and norms that influence the family, formal and informal groups, population shifts and changing farm technology. Prereq: 3420 or equivalent. F

5470 Research Problems in Rural Communities (3) Emphasis on problems that arise in survey research in rural areas. Sampling procedures, questionnaire construction, interviewer selection, training, control, and legitimation needs. Prereq: Undergraduate course in statistics. Sp

5480 Rural Population Analysis (3) Analysis of U.S. and world population changes and determinants of fertility, migration and urbanization. Integration with emphasis upon changes in rural sector. Prereq: Sociology 4110 or equivalent. W

Agricultural Engineering

MAJORS

DEGREES

M.S., Ph.D.

Agricultural Engineering

Agricultural Mechanization

M.S.


Assistant Professors: Z. A. Henry, Ph.D. North Carolina State; C. H. Parsons, Ph.D. Virginia Polytechnic Institute; F. D. Tompkins, Ph.D. Tennessee; L. R. Wilharm, Ph.D. Tennessee, P.E.
Assistant Professors:

C. O. Baxter, M.S. Missouri; L. M. Safely, Jr., Ph.D. Cornell.

Agricultural 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) Earth dams, irrigation, drainage, land grading, hydraulic transport of wastes, and application of wastes on agricultural land. Prereq: 3610 or consent of instructor. 2 hrs and 1 lab. F, W

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

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

4640 Design of Agricultural Machinery (3) Functional requirements of agricultural machinery, elements of design, component design; synthesis of mechanisms, mechanical and hydraulic drives. Team effort in completing machine design project. Prereq: 4630 or consent of instructor. 1 hr and 2 labs. Sp

5000 Thesis (1-15) E

5240 Environmental Control in Agricultural Structures (3) Engineering analysis of factors related to processes of plant and animal life; basis for development and design of facilities and structures for confined housing of animals, controlled environment for plant growth, and storage facilities for plant and animal products. Prereq: Agricultural Mechanization 3220. Mechanical Engineering 3110 or consent of instructor. 2 hrs and 1 lab. F

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: 3610, introductory hydrology; Forestry 4020, or consent of instructor. 2 hrs and 1 lab. F

5440 Instrumentation in Agricultural Systems (3) Analysis of specific instrumentation needs in agriculture; industry and research problems; principles and design in utilization of specialized instruments. Prereq: 3640. Engineering electronics or consent of instructor. 2 hrs and 1 lab. Sp

5540 Engineering Properties of Agricultural Materials and Products (3) Fundamental engineering properties of agricultural products and materials related to handling, processing, and utilization. Prereq: Processing and materials handling systems and Environmental Science and Mechanics 3110. 2 hrs and 1 lab. Sp

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

5710-20 Similitude in Design and Research (3, 3) Dimensional analysis in development of models; theory of models, prediction equations; interpretation of data; applications to machinery, soil and water structures, agricultural buildings, and other agricultural engineering-related problems. Prereq: Engineering Science and Mechanics 3130 and 3311. 2 hrs and 1 lab. F, W

6000 Doctoral Research and Dissertation (3-15) E

6110 Seminar (1) Current research and literature relating to extension engineering in agriculture. May be repeated. Maximum 3 hrs.

6310 Engineering Systems Analysis in Agriculture (3) Systems approach to design of engineering equipment and applications to include linear programming, computer applications, statistical evaluations, and feedback control in agricultural problems. Prereq: Prerequisites: 6500 or 4710. Coreq: 6510 or 4710. 2 hrs and 1 lab. F

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. F

Agricultural Mechanization

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

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. F

4180 Equipment and Techniques for Application of Agricultural Chemicals (3) Equipment 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. F

4210 Agricultural Machinery and Tractors (4) Agricultural machinery and power units; adaptation to agricultural practices; field efficiencies, capacities, adjustment and servicing. Prereq: Mathematics 1550. 3 hrs and 1 lab. W

5000 Thesis (1-15) E

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 Electromechanical Systems in Agriculture (3) Integration of electric power, mechanical equipment, structures, and environmental systems in animal and plant production, crop processing, and materials handling. Prereq: 3220 and 3510. 2 hrs and 1 lab. Sp

5410 Agricultural Machinery Systems Analysis (3) Analysis of field machinery, adaptation planning for sequential operations; machinery for unique and alternate production and harvesting systems; operational management. Prereq: 4510. 2 hrs and 1 lab. Sp

5610 Selected Topics in Agricultural Mechanization (3) Lecture, group discussion, and individual study on specialized agricultural mechanization developments. May be repeated. Maximum 9 hrs. F

Animal Science

MAJOR DEGREES

Animal Science

M.S., Ph.D.

Professors:

R. R. Johnson (Head), Ph.D., Ohio State;
K. M. Barth, Ph.D., Rutgers;
M. C. Bell, Ph.D., Oklahoma State;
J. K. Bieleski (Emeritus), P.H. Ohio State;
C. C. Chamberlin, Ph.D., Iowa State;
O. H. Duer (Emeritus), Ph.D., Iowa State;
S. H. H. Hansard (Emeritus), Ph.D., Florida;
H. M. Jamison, Ph.D., Tennessee; E. R. Lidvall M. S., Tennessee; J. B. McLaren, Ph.D., Auburn;
G. M. Merriman, D.V.M., Michigan State;
J. M. Montgomery, Ph.D., Wisconsin;
R. L. Murphee, Ph.D., Wisconsin;
D. L. O. Svard (Emeritus), Ph.D.;
H. V. Shirley, Ph.D., Illinois; R. R. Shrode, Ph.D., Iowa State; W. E. Swanson, Ph.D., Missouri;
R. L. Tugwell, Ph.D., Kansas State; G. E. Wylie (Emeritus), A.M. Missouri.

Associate Professors:

W. R. Backus, Ph.D., Tennessee;
G. Bratton, D.V.M., D.V.M.;
A. M. W. T. Butts, Ph.D., Tennessee; H. Elter, D.V.M., Ph.D., Illinois;
J. P. Hitchock, Ph.D., Michigan State; J. H. Holloway, Ph.D., Oklahoma State; F. B. Massincupp, Ph.D., Kansas State; D. V. Merkle, Ph.D., D.V.M., Ph.D., Purdue; M. Sims, Ph.D., Aubhurn.

Assistant Professors:

R. E. Carter, D.V.M., Kansas State;
D. C. Doyle, D.V.M., Ph. D. Cornell;
R. N. Hofmann, Ph.D., Maine;
H. J. Horsch, Ph.D., Polytechnic Institute;
S. Kincard, D.V.M., Ph.D.;
K. R. Robbins, Ph.D., Illinois; R. Schaub, Ph.D.;
W. R. Smelcer, Ph.D., Illinois; J. D. Smilling, Ph.D., Texas A. & M.

3210 Anatomy and Physiology of Farm Animals (4) Skeleton and joints, skeletal muscles, blood and microcirculation, and respiration; describing data to respiratory, digestive, renal and endocrine systems; demonstrations of physiochemical phenomena. Prereq: Biology 1210 or Agricultural 1130. 3 hrs and 1 lab. F, W, Sp.

3220 Physiology of Reproduction (3) Comparative anatomy and physiology of reproductive systems of higher vertebrates; endocrinology; endocrinology of reproduction, implantation, prenatal growth, parturition and initiation of lactation; endocrine regulation of reprodu-
tive phenomena. Prereq: 3210 or consent of instructor. (Same as Zoology 3220) 2 hrs and 1 lab. F, W, Sp

3320 Animal Nutrition (3) Properties, functions, utilization and deficiency symptoms of essential nutrients; intake, absorption and use. Prereq: Agriculture 1130 and one quarter of organic chemistry. F, W, Su

3330 Feeds and Ration Formulation (4) Feeds, additives, and their effects; feed rationing and formulation for beef and dairy cattle, sheep, horses, swine, poultry and laboratory animals. Prereq: 3210 or consent of instructor. W, F, Sp, Su

3410 Heredity in Animals (3) Basic chromosomal mechanism of heredity with emphasis on Mendelian principles and exceptions such as linkage and cytoplasmic inheritance. Illustrations of applications to the biochemical basis of heredity and to quantitative inheritance. Illustrations of principles related to species familiar to agriculture students. Prereq: Agriculture 1130. 2 hrs and 1 lab. F, W, Sp

3420 Principles of Animal Breeding (3) Genetic principles in the breeding of economic species. Genetic basis of variation; quantifying variations and characterizing various species of heredity and the possible differences existing among the various species. Selection and its consequences. Mating systems and their effects on populations. Planning breeding programs. Prereq: 3410 or equivalent. 2 hrs and 1 lab. W

3510 Animal Hygiene and Sanitation (4) Parasitic, viral and bacterial organisms in farm animals; immunization; control and protection against disease; veterinary aspects of anthrax, swine and poultry quarantine; herd health programs. Prereq: Microbiology 2910-11 or 2910-19 or consent of instructor. 3 hrs and 1 lab. F, W, Sp

3520 Avian Diseases (3) Major diseases; characteristics, prevention and treatment, management practices and systems for domestic birds, upland game birds, and water fowl. 2 hrs and 1 lab. Sp, A

3810 Nutrition and Management of Laboratory Animals (3) Principles of feeding, breeding, and handling and caring for laboratory animals; application of specific species' requirements, peculiarities, and research for which best fitted; laws governing use and handling of laboratory animals. Prereq: Agriculture 1130 and consent of instructor. 2 hrs and 1 lab. W

4210 Physiology of Lactation (3) Development, anatomy, and function of mammary glands; endocrine interactions for mammary development and milk secretion; factors affecting yield and composition of milk. Prereq: 3210. W

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

4230 Applied Reproduction in Farm Animals (3) Application of methods and techniques in collect- ing, evaluating, processing, and preserving semen; insemination of females; pregnancy determination; gestation and parturition; Male and female infertility. Prereq: 3320, F, Sp

4330 Feeding Applications for Farm Animals (3) Detailed application of feeding principles designed to allow student to discover and explore feeding options available to producers through problem solving. Prereq: 3330. 1 hr and 2 labs. Sp

4340 Experimental Animal Nutrition Laboratory (2) Laboratory feeding trials to demonstrate basic animal nutrition concepts including preparation and feeding of experimental diets. Prereq: 3330. 1 hr and 2 labs. Sp

4410 Applied Animal Breeding (3) Principles studied in 3420. Team taught by specialists in breeding of dairy cattle, meat animals, and poultry. Prereq: 3420. 2 hrs and 1 lab.

4410 Beef Cattle Production and Management (4) Principles of nutrition, physiology, and breeding in a complete beef cattle management program. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives 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. F, Sp, A

4820 Dairy Cattle Production and Management (4) Principles of nutrition, physiology and breeding in a complete dairy cattle management program. Structure of industry, enterprise establishment, systems of production, production practices, and herd improvement programs. Alternatives 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) Integration of principles of selection, nutrition, breeding, physiology and marketing in a complete pork production and management program. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives 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 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. W

4850 Light Horse Production and Management (4) Integration of principles of nutrition, physiology and breeding in a complete light horse production and management program. Structure of industry; systems and practices of production; individual animal and herd improvement programs; performance records; marketing and facilities for both pleasure and commercial producers. Alternatives in terms of pleasure, recreation and economic aspects of the industry. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4860 Lamb and Wool Production and Management (4) Integration of the principles of nutrition, breeding. physiology and marketing into complete lamb and wool production and management program. Structure of industry, enterprise establishment, systems 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.

5000 Thesis (1-5 E) 5011 Problems in Lieu of Thesis (1-6) May be repeated. Maximum 6 hrs. E

5110. Special Problems in Animal Science (1-6) May be repeated. Maximum 15 hrs. E

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

5230 Advances in Mammalian Reproduction (3) Germ cell development, maturation, transport mechanisms, and preservation; fertilization and embryo implantation. Prereq: 3220 or 4230. 2 hrs and 1 lab. W, A

5420 Advanced Studies of the Secretion of Milk (3) Effect of endocrine and nutritional factors on mammary gland development; initiation and maintenance of lactation. Prereq: 4210. 2 hrs and 1 lab. Sp, A

5511 Analytical Techniques in Animal Nutrition (3) Physical and chemical analyses of feeds, ingredients, and biological fluids associated with nutrition research, 1 hr and 2 labs. F, Su

5332 Advanced Experimental Animal Nutrition (3) Animal experimental techniques for digestion, absorption, nutrient balances and radioisotope tracer techniques. Prereq: 5311. 1 hr and 2 labs. Sp

5333 Nonruminant Animal Nutrition (4) Physiological development and facilities for nonruminant animal of the life cycle. Concepts and methodology concerning nutrient requirements, interactions, availability and deficiencies of nutrients. Nonnutritive additives, toxins, poisons, and disease effects; nutritional effects on productivity. Prereq: 3330 or consent of instructor. 3 hrs and 1 lab.

5344 Ruminant Animal Nutrition (3) Digestive physiology of the ruminant stomach, rumen fermentation, determination of nutrient requirement and feed intake regulation of ruminant animals. Prereq: 3330. F

5410 Genetics of Animal Populations (3) Population and individual, gene and zygotic frequencies; statistical description and analysis of genetic changes; application to animal breeding. Prereq: 3420 or consent of instructor. 2 hrs and 1 lab. F

5510-20 Advanced Animal Physiology (5, 5) Advanced animal physiology (primarily mammalian physiology). 5510-Membrane neuron, central nervous system, muscular and cardiovascular system. 5520—Respiratory, renal, gastrointestinal and reproductive physiology, acid base mechanisms, and metabolism. Should be taken in sequence if both courses are taken. Prereq: General undergraduate anatomy and physiology and Biochemistry 4110 or equivalent or consent of instructor. Biochemistry 4120 also recommended. (Same as Zoology 5510-20). 4 hrs and 1 lab. W, Sp

5710 Methods of Evaluating Experimental Data in Animal Science (3) Interpretation of data from experiments in animal science based upon such statistical procedures as analysis of variance, covariance, linear regression and correlation, and multiple regression. Prereq: Statistics 5251 or equivalent. 2 hrs and 1 lab. W

5720 Design and Interpretation of Experiments in Animal Science (5) Principles and experimental design and application to research in animal science analyzing data from experiments with unique and dispersed populations, specific situations and procedures for use of computers in statistical analyses. Prereq: 5710. 2 hrs and 1 lab.

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

6000 Doctoral Research and Dissertation (3-6 E) 6150 Topics in Milk Constituents (3) Properties of milk constituents and relationship to milk and dairy products. Sp

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

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

6220 Environmental Physiology of Farm Animals (3) Environmental factors and measurement; physiological mechanisms of response to environmental factors and measurement; interrelationship of animals and environment in terms of productivity and health. Prereq: Consent of instructor. 2 hrs and 1 lab. W, A

6230 Animal Growth and Development (3) Physiological and nutritional aspects of growth of farm animals; effects of growth rates on physiological and productive functions. Prereq: 5344, 5510, 5520 or consent of instructor. Sp, A

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

6322 Advanced Animal Nutrition (3) Chemical factors; digestion, absorption, intermediary metabo-lism, deficiencies, excesses and interaction of nutrients. Energy; proteins; vitamins; and minerals. Prereq: 5333 or 5344 and 5510 or consent of instructor 5110; or consent of instructor. May be repeated. Maximum 15 hrs. F, Sp

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

6420 Animal Breeding Research Methods and Interpretation of Data (3) Breeding parameters in animal breeding studies; least squares adjustment of data; partition of variance; phenotypic, genetic, and environmental correla-
6811 Advanced Topics in Animal Products (1-6)
Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs.


### Entomology and Plant Pathology

**MAJOR**
Entomology and Plant Pathology

**DEGREE**
M.S.

Professors:
- C. J. Southard (Head), Ph.D. North Carolina State; J. W. Hily, Ph.D. Ohio State; L. F. Johnson, Ph.D. Louisiana State; C. D. Fiesa, Ph.D. Clemson.

Associate Professors:

Assistant Professors:
- E. C. Bernard, Ph.D. Georgia; M. R. McLaughlin, Ph.D. Illinois.

4101 Biology of Soil Microorganisms (4) Morphology, physiology, and roles of soil organisms, decomposition of organic matter, chemical transformations, and interactions between soil organisms and higher plants. Prereq: 3150. 3 hrs and 1 lab.

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

5000 Thesis (1-15) E

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.

5110 Plant Disease Diagnosis (3) Diagnosis of plant diseases, disease symptoms, causal agents and control measures. Prereq: 3150.

5120 Insect Diagnostic Clinic (3) Identification of insects and insect damage to crops, livestock and residences. Obtaining of insects and damaged specimens; diagnostic characteristics and control measures. Prereq: 3210 or Zoology 3110.

5210 Plant Parasitic Nematodes (4) Morphology, physiology, taxonomy, and ecology of plant parasitic nematodes with emphasis on host-parasite relationships. Prereq: 3 hrs biological science or consent of instructor. (Same as Zoology 5210). 2 hrs and 2 labs.

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 Plant Virusology (4) Symptomatology, cytology and epidemiology of virus infection; structure, morphology, replication, transmission, purification, characterization, and classification of plant viruses; serology; plant pathogenic viroids, mycoplasmas and viroids. Prereq: 3130 or consent of instructor. 2 hrs and 2 labs.

5250 Medical and Veterinary Entomology (4) Morphology, taxonomy, biology, and control of arthropod parasites and vectors of pathogens of humans and animals. Ecology and behavior of vectors in relation to pathogen transmission and control. Prereq: 3210, general entomology, or consent of instructor. 3 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.

5410 Seminar (1) Review of literature and current research in plant pathology and economic entomology. May be repeated. Maximum 3 hrs.

### Food Technology and Science

**MAJOR**
Food Technology and Science

**DEGREE**
M.S.

Professors:
- T. E. Miles (Head), Ph.D. Wisconsin; J. L. Collins, Ph.D. Maryland; H. O. Jaynes, Ph.D. Illinois; C. C. Molton, Ph.D. Kansas State; W. W. Overcast, Ph.D. Iowa State.

Assistant Professors:

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

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


4020 Dairy Products II (4) Principles in the manufacture of butter, cheese and special dairy products. Prereq: 3020. 3 hrs and 1 lab. Sp. A

4130 Food Chemistry I (3) Minerals, fats, oils and vitamins in food as affected by processing and storage. Prereq: Nutrition 3320 or equivalent. 2 hrs and 1 lab. Sp.

4140 Food Chemistry II (3) Reactions of proteins, carbohydrates and natural food colorants in food materials. Protein structure, food enzymology and browning reactions. Effects of storage and processing on proteins and carbohydrates with emphasis on nutritional value and functionality. Prereq: Nutrition 3320 or equivalent. 2 hrs and 1 lab. Sp.

4200 Food Processing I (4) Prevention of deterioration and spoilage of foods. Methods of preservation and packaging. Prereq: 2200 and Agricultural Mechanization 3510. 2 hrs and 1 lab. W.

4210 Food Additives (3) Substances used in food manufacturing with emphasis on properties and functions. Prereq: Nutrition 3320 or equivalent. 2 hrs and 1 lab. W.

4300 Food Processing III (3) Water, sanitation and waste control in food industry. Prereq: Agriculture 1150 and Microbiology 2910-19 or equivalent. W.

4410 Food Crop Products (3) Foods products from crops with emphasis on types, manufacturing systems, quality attributes, and utility. F.

4420 Bakery Products (3) Baking ingredients and their interactions during production and storage of bakery products. Prereq: 4130 and Chemistry 2230 or equivalents. 2 hrs and 1 lab. Sp.

4810 Microbiology in Food Manufacturing (3) Qualitative and quantitative characteristics of meat and poultry related to palatability, cookery, preservation, packaging and merchandising. Prereq: 3840. F.

5000 Thesis (1-15) E

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

5120 Food Color (3) Chemistry of natural food pigments and measurement, notation, and preservation in food. Prereq: Nutrition 3320. 2 hrs and 1 lab. W.


5140 Food Flavors (3) Food flavor maintenance and improvement. Natural and synthetic compounds in manufacture of foods with predictable consumer acceptance. Technology of flavor formulation and manipulation. Techniques for determining flavor profile. Prereq: 4210. 2 hrs and 1 lab. W, A.

5150 Fats and Oils (3) Application of scientific principles to commercial technology of fats and oils. Prereq: 4130. 2 hrs and 1 lab. W.

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

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

5320 Food Thermobiology (3) Fundamentals of heat transfer as related to rate of destruction of microorganisms and to rate of loss of food quality through calculation of minimum safe thermal processes for hermetically-sealed packages of foods, Prereq: 4200. 2 hrs and 1 lab. W, A.

5420 Advanced Food Quality Assurance (3) Applications of current instrumental methods used to control food manufacturing processes. Prereq: 4140. 2 hrs and 1 lab. F.

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

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

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

### Forestry, Wildlife and Fisheries

**MAJORS**
Forestry, Wildlife and Fisheries

**DEGREES**
M.S.

M.S.

**FOREST生态学**

**Graduate School**

**Institute of Agriculture**
Forestry

3220 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 characteristics 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 second half of semester plus one weekend field trip. 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 forest populations; growth and potential production. Prereq: Plant and Soil Science 3610 and Computer Science 1410 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 among different interest and institutional systems. Application of economics to forest resource decision making in private and public sector. Prereq: Economics 2120.

3220 Forest Products and Utilization (3) Harvesting, processing, marketing factors in stand conversion, intermediate and harvest cuts. Prereq: 3120.

3230 Principles of Silviculture (3) Influence of site factors on reproduction, growth, development, and character of forest vegetation; classification of forest structure; silvicultural laws. Prereq: 3020, 3040, Plant and Soil Science 2130.

3730 Conservation (3) Forest resources of state, nation, and world; forests in soil and water conservation; wildlife management and recreation; conservation programs. W

4002 Utilization (3) Wood-using industries; processing forest products—sawmills, tree-log/lumber grading; pulpwood operations, flooring plants, treenail 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 and Agricultural Mechanization 3140.

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

4006 Silvicultural Methods (4) Methods and application of intermediate and regeneration cuttings; site preparation and plantings; modifications of cutting methods to obtain desired goals and benefits. Prereq: 3320, 4002, 4003. Sp.

4020 Forest Watershed Management (3) Water as a forest resource; role of forests in the hydrologic cycle; control of water quantity, quality, and regimen; watershed planning. Prereq: 3220 or consent of instructor. Two overnight field trips.

4210 Forestry Organization and Administration (3) Planning, organizing, and leadership concepts and cases; problem analysis and decision making in forest resource management. Prereq: Consent of instructor. 2 hrs and 1 lab.

4220 Forest-Resource Management (4) Forest as an integration of resource units; review of traditional silviculture and its relationship to multiple-use concept; valuation of forest resources for decision making and planning; taxation of forest firm. Prereq: 4210.

4230 Forest-Resource Management Plans (4) Field problems and case studies in forest-resource management; the forest as a system: management of forest resources, and the interactions; services, watershed services, and wildlife; producing multiple services; preparation of a complete plan based on optimizing forest uses. Prereq: 4210.

4240 Interpreting Forest Resources (3) Principles and techniques of interpreting forest resources; importance of environment; interpretation of management of forest resources; development and administration of interpretive services. Possible overnight field trips required. Prereq: 3240 or equivalent. 2 hrs and 1 lab.

4330 Forest Policy (3) History of forestry in United States with emphasis on development of forest resource policies; current policies influencing development and management of forest resources; brief survey of policy implications of forest resource organizations in public and private sectors. Prereq: 4004.

4340 Aerial Photography in Forest-Resource Management (3) Use of conventional aerial photographs in forest management; interpretation of detail, aerial inventories, preparation of cover-type maps, uses of other remotely sensed imagery. Prereq: Forestry 4220. 2 hrs and 2 labs. F

4420 Forest Tree Improvement (3) Forest tree improvement related to silviculture, nature and purposes of tree improvement and forest genetics; principles and methods of tree improvement; significance, importance of seed source, selection of superior phenotypes and development of seed orchards; hybridization; seed certification. Prereq: 4006 or consent of instructor. 2 hrs and 1 lab.

4430 Regional Silviculture of the United States (3) Forest regions; vegetation; history of development of important tree species in North America; characteristics of forests in this region; classification, distribution, and management of game birds, fish, and wildlife. Prereq: 4400 or consent of instructor. 1 hr and 2 labs.

4450 Forest Recreation (3) Forest lands as a recreation resource; the interrelationships of forest recreation and other management activities; development and planning of recreation areas; socioeconomic and political determinants of recreation development and management. Prereq: 6 hrs sociology and/or economics. 2 hrs and 1 lab.

4550 Recreational Behavior in Forest Environments (3) Review of sociological and psychological theories relevant to forest recreation planning, management, and administration. Implications and application of behavioral concepts to forest recreation areas; research applications; development and testing of rec-creating behavior into recreation. Prereq: 3240 and 6 hrs in behavioral psychology and/or sociology, or consent of instructor.

5000 Thesis (1-15) E

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

5011 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resource management. Identify, analyze, and prepare written report on a problem. Topic and report must have approval of all committee members. Formal presentation to faculty and students. Available only to students in the non-thesis option for the M.S. in Forestry.

5110 Special Problems in Forestry (1-5) May be repeated. Maximum 2 hrs. E

5220 Seminar in Forest Tree Biology (3) Growth, reproduction, and physiology of forest trees; forest ecology; variability and taxonomy of forest trees. Prereq: 1 yr of biology.

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

5340 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, Biology 3110, and consent of instructor. W, A

5260 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. Overnight field trips may be required. 2 hrs and 1 lab.

5280 Seminar in Forest Biogeography (3) Theory and applications of forest biogeography; classification of trees and other plant groups; classification and distribution of forest birds in North America. Prereq: 3230 or 1 yr of zoology. 2 hrs and 1 lab.

5310 Seminar (1) Current developments in forestry. Required of each graduate student in residence Winter Quarter. May be repeated. Maximum 2 hrs. S/NC only. W
Ornamental Horticulture and Landscape Design

MAJOR
Ornamental Horticulture and Landscape Design

DEGREE
M.S.

Professors:
D. B. Williams (Head), Ph.D. Pennsylvania State; R. H. Schmidt, Ph.D. Rutgers.

Associate Professors:
W. M. Springer (Emeritus), Ph.D. California State; J. E. Reynolds, Ph.D. Wisconsin; R. A. Fribourg, Ph.D. Washington State; L. N. Skoold, M.S. Kansas State; H. A. Fribourg, Ph.D. Iowa State; G. L. McDaniel, Ph.D. Iowa State; L. M. Josipovici (Emeritus), Ph.D. Wisconsin; W. Parks, Ph.D. Purdue; J. D. Wolf, Ph.D. Purdue; D. R. West, Ph.D. Nebraska; J. D. Wolf, Ph.D. Nebraska; L. S. Jeffery, Ph.D. California (Berkeley); H. D. Swingler (Emeritus), Ph.D. Louisiana State.

Assistant Professors:
D. E. Dayton, Ph.D. North Carolina State; W. J. McSorley, Ph.D. Louisiana State; D. R. West, Ph.D. Nebraska; J. D. Wolf, Ph.D. Auburn.

3000 Plant Physiology (3) Principles of plant physiology. 4 hrs and 2 labs. F


3120 Grain and Oil Crops (3) Distribution, improvement, management, and utilization of agricultural crops. 2 hrs and 1 lab. W

3140 Forage Crops (4) Characteristics, adaptation, improvement, management, and utilization of grasses and legumes for pastures, hay, and silage. Prereq.: 2130. 8 hrs biological science. 2 hrs and 1 lab. W

3160 Cotton and Tobacco (4) Characteristics, adaptation, improvement, culture, harvesting, and marketing of cotton and tobacco. Prereq.: 2130. 8 hrs biological science. 3 hrs and 1 lab. F

3180 Fruit Crops Management (4) Soils, plant, and soil relationships in commercial fruit production systems. 3 hrs and 1 lab. F

3220 Soil Management (4) Soil management for crop production including cropping systems, fertilization, and tillage operations for specified soil conditions. 3 hrs and 1 lab. W

3550 Seminar (1) Current and future developments in ornamental horticulture and landscape design. 3 hrs. F, W

5610 Advanced Nursery Production (4) Preparation and growing media for woody ornamental plants; nutrition of ornamental plants including diagnosis, prevention and correction of mineral deficiencies. Prereq.: 3510. 9 hrs and 1 lab. W

Institute of Agriculture
and farming conditions. Prereq: 2130. 3 hrs and 1 lab. F, Sp

3250 Soils in Forestry (3) Soil as a medium for tree growth; relation of physical, chemical, and biological properties to growth and management of forest stands. Soil properties of importance in road location, recreational development, and watershed management. Prereq: 2130, Forestry 3320. 2 hrs and 1 lab. W

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

3610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Mathematics 1550. F, W

3710 Principles of Weed Science (4) Basic principles of weed science, history, ecology, economic losses, means of control, types of herbicides, and specific molecules for various crops and non-crop uses. Prereq: 8 hrs biological science and 1 yr organic chemistry. 3 hrs and 1 lab. Sp

4110 Soil Chemistry (4) Colloidal systems: properties and behavior of colloidal soil materials; relation of soil properties to plant nutrient availability. Prereq: 2130 and Physics 1210. 3 hrs and 1 lab. F

4120 Principles of Crop Breeding (4) Genetic principles and techniques used in crop improvement. Prereq: 8 hrs biological science or consent of instructor. 3 hrs and 1 lab. W

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

4320 Soil Formation, Morphology, and Classification (4) Soil formation; properties, distribution, and classification of soils; interpretation of modifications of soil profile; principles of soil survey. Prereq: 2130. 3 hrs and 1 lab. Sp

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

5000 Thesis (1-15) E, may be repeated. Maximum 9 hrs. E

5000 Thesis (1-15) E

5000 Thesis (1-15) E

5000 Thesis (1-15) E

5000 Thesis (1-15) E

5000 Thesis (1-15) E

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

5710 Advanced Plant Genetics (3) Importance of polyplody 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. F

5720 Quantitative Genetics (3) Genetic constitution of populations and changes in gene frequency; recognition and measurement of continuous variation; estimation of variable components and genetic advances under different breeding procedures. Prereq: Basic genetics or consent of instructor. W, A

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. W

5810 Crop Climatology (4) Meteorological factors affecting agricultural production, crop distribution and centers of origin; general and specific climatic, weather, and vegetative systems; microclimatic influences on plant growth. Prereq: 3000, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab. F, A

5820 Advanced Crop Physiology and Ecology (4) Historical development of research in crop physiology and ecology. Interrelationships between physiological processes and environmental factors. Crop adaptation to specific environmental conditions. Prereq: 3210 and Botany 4110 or consent of instructor. 3 hrs and 1 lab. W

5850 Mechanisms of Herbicide Action (3) Principles of the uptake, translocation, mode of action and basis of selectivity of herbicides. Effects of herbicides on plant physiology, metabolic systems and enzymatic activities. Prereq: Botany 3210 and Biochemistry 4110 or consent of instructor. Sp, A

6000 Doctoral Research and Dissertation (3-15) E

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

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

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

6410 Experimental Designs (3) Principles and techniques of experimental designs used in agricultural research. Completely randomized, randomized complete block and lattice designs; factorial experiment and confounding, lattice designs, and covariance. Prereq: 3510, F, A

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

6600 Seminar (1) May be repeated. Maximum 3 hrs. E

College of Veterinary Medicine

H. Kitchen, Dean, C. F. Reed, Associate Dean
W. H. Grau, Jr., Associate Dean

The College of Veterinary Medicine, established in 1974, is organized into six academic departments: Animal Sciences (jointly with the College of Agriculture), Environmental Practice, Microbiology (jointly with the College of Liberal Arts), Pathobiology, Rural Practice and Urban Practice. The College administers a professional curriculum leading to the degree of Doctor of Veterinary Medicine (see the General Catalog and a graduate program involving all departments and leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees). The instructional program of the College also includes internship and residency training programs in various clinical specialties in the departments of Environmental Practice, Urban Practice, Rural Practice, and Pathobiology. (For details write the Director of Residencies and Internships, College of Veterinary Medicine.) Because of the interdisciplinary departmental administration of the College of Veterinary Medicine, the faculty have opportunities in the graduate programs of other instructional units, including Animal Science (nutrition and physiology), Microbiology (bacteriology, virology and immunology), Ecology, environmental toxicology), Public Health, and Comparative and Experimental Medicine. (Refer to other sections of this catalog for a full description of these programs.) The majority of the graduate students and graduate and graduate faculty of the College of Veterinary Medicine are involved in the Comparative and Experimental Medicine program (see page 21). This program provides a wide spectrum of interdisciplinary training that prepares graduates to assume positions in biomedical environments and in teaching or research capacities involving humans or animals.

Faculty

Environmental Practice

Professor: H. Kitchen, D.V.M., Ph.D. Florida.

Assistant Professors: J. W. Oliver, D.V.M., Ph.D. Purdue.


Pathobiology


Associate Professors: M. D. McCracken, D.V.M., Ph.D. Purdue; C. S. Patton, D.V.M. Ohio; R. G. Scholten, D.V.M. Michigan.


Rural Practice

Professor: H. Kitchen (Head), D.V.M. Texas A & M.

Associate Professors: D. O. Goble, D.V.M. Kansas; F. M. Hopkins, D.V.M. Georgia.

Urban Practice


Illinois: A. M. Legendre, D.V.M. Auburn;
R. R. Paddleford, D.V.M. Missouri; R. E. Roberts,
D.V.M. Texas A & M; R. R. Selcer, D.V.M.
Texas A & M.

Animal Science/Veterinary Medicine

Professor:
R. R. Johnson (Head), Ph.D. Ohio.

Associate Professors:
G. R. Bratton, D.V.M., Ph.D. Texas A & M;
H. Eiler, D.V.M., Ph.D. Illinois;
R. Schaumb, Ph.D. Washington; M. H. Sims,
Ph.D. Auburn.

Assistant Professors:
R. E. Cartee, D.V.M. Kansas; D. Doyle,
B.V.Sc., Ph.D. Cornell; S. A. Kincaid,
D.V.M., Ph.D. Purdue.

Microbiology

Professors:
A. Brown (Head), Ph.D. Chicago; R. W. Beck,
Ph.D. Wisconsin; B. T. Rouse, Ph.D.
Guelph; J. M. Woodward, Ph.D. Kansas.

Associate Professor:

Courses

5010 Comparative Pathology (5) Lectures and lab.
Emphasis on pathogenic mechanisms. Comparative
aspects considered. Lectures reinforced by lab
study of gross, microscopic and ultrastructural les-
ions. Prereq: Zoology 3060, 3320.

For specific course listings please see
College of Agriculture, Department of Animal
Science, and College of Liberal Arts,
Department of Microbiology.
School of Architecture

Roy F. Knight, Dean
William J. Lauer, Associate Dean

Professors:
G. I. Anderson, M.Arch. Illinois;
G. Conley, M. Arch. Harvard; A. J. DeLong,
Ph. D. Pennsylvania State; J. W. Fortey, P. E.
Doctorat d'Universite de Toulouse (France);
F. Grieuter, M. Arch. Pennsylvania;
J. A. Kersavage, D.Sc. S. California;
W. J. Lauer, M.S. Arch. Eng.;
Iowa State; R. M. Perkins, J. D. New York,
D. K. Ruth, M. Arch. Harvard;
W. S. Shell, M.S. Arch. Columbia;
L. M. Wodehouse, M. Arch. Cornell.

Associate Professors:
J. Burin, M. Arch., Academy of
Fine Arts (Prague); A. Darman, Ph.D.
Pennsylvania State; R. M. Kalse, M.S.
Tennessee; A. J. Lester, B. Arch.
North Carolina State; W. E. Martella, B.Arch.
California (Berkeley); M. S. Moffett, Ph.D.
Massachusetts Institute of Technology;
R. T. Quinn, Ph.D. Lehigh.

Assistant Professors:
R. E. Childress, M.Arch. Pennsylvania;
L. D. Grieve, B. Arch. Tennessee;
S. I. Hankins, III, B. Arch. Clemson;
V. Nanarcic, B. Arch. Belgrades;

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

4031 Accelerated Historical Studies I (4) Introduction to evolution of architectural periods with selected illustrations from local examples. Advanced examination of relationship of historical and cultural developments to the built environment from antiquity through Byzantine period with applications to present-day design issues. Independent student projects on topics related to course material. Prereq: Admission to accelerated core program. F

4032 Accelerated Historical Studies II (4) Advanced examination of relationship of historical and cultural developments to the built environment from Romanesque period through neoclassicism with applications to present-day design issues. Study of historical research methods and analysis. Independent student projects on topics related to course material. Prereq: 4031. W

4033 Accelerated Historical Studies III (4) Advanced examination of historical and cultural events of Industrial Revolution which gave rise to modern movements in architecture and design with applications to present-day design issues. Changing concepts of ethics, aesthetics, and architectural theory. Independent student projects on topics related to course material. Prereq: 4031 and 4032. Sp

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

4175 Technology of Preservation (4) History of technology and materials, methods analysis and dating, techniques of preservation. W

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. F, W, Sp


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


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

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

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

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

4940 Proxemics (4) Seminar for graduate students and upper division students. Introduction to proxemic research. Definition of proxemic variables. Proxemic notation exercises. Analysis of etic data and the identification of emic categories. Observer bias and methods of bias reduction. Members of seminar required to design, conduct, and present original proxemic research. Prereq: 2000 or consent of instructor.

4950 Environment as Code (4) Advanced lecture of graduate students and upper division students. Advanced lecture course of theoretical issues involved in considering environment as a medium of human communication. Codes and nature of coding behavior in animals and humans. Relationship between coding behavior and the organization of the central nervous system. Coding and social behavior. Communication process as a generic model of human environment relations. Hierarchical aspects of environmental communications. Prereq: 2000 or consent of instructor.
College of Business Administration

C. Warren Neel, Dean
John R. Moore, Associate Dean
Francis A. Chamblin, Assistant Dean for Graduate Programs
Liston M. Fox, Assistant Dean for Undergraduate Programs
John A. Bachmann, Assistant Dean for External Affairs, Director, Management Development Programs
David A. Hake, Director, Center for Business and Economic Research

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 intellectually 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 seven advanced degrees: the Doctor of Business Administration, the Doctor of Philosophy with majors in Economics and in Management Science, the Master of Arts and the Master of Business Administration. The Department of Management and the Department of Psychology in the College of Liberal Arts jointly offer an intercollegiate program in Industrial and Organizational Psychology leading to the Master of Science and Doctor of Philosophy degrees. (See page 97). Also, the Department of Management Science offers an intercollegiate program leading to the Master of Science degree. (See page 98).

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.

Academic Common Market. An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UTK on an in-state tuition basis. Programs in the College of Business Administration available to residents of the states indicated include: DBA (all concentration areas)—West Virginia; MBA (Transportation and Logistics)—Virginia and West Virginia; Industrial and Organizational Psychology (M.S. and Ph.D.)—Alabama, South Carolina, and Virginia. Additional information may be obtained from the Graduate Programs office of this college.

The MBA Program

The MBA program is designed for students with undergraduate degrees in the social and natural sciences, the humanities, and professional fields such as engineering, business, agriculture, and architecture. A full-time student can complete the program in six academic quarters. Those with degrees in business earned at an institution accredited by the American Assembly of Collegiate Schools of Business (AACSB) should be able to complete the program in five quarters.

The complete MBA program with a concentration in management is offered by the regular graduate faculty of the College for part-time students on the Knoxville campus, at Oak Ridge and at the Kingsport University Center. The part-time student carries two courses per term in classes scheduled in the evening hours and, like the full-time student, typically is enrolled in each of the four quarters of the year.

The program consists of the MBA core (twelve to nineteen courses depending upon exemptions based on prior studies and/or proficiency examinations) and a concentration/electives block of eight courses. Each course is 3 quarter hours of graduate credit. Thus, the total program may consist of from 60 to 81 quarter hours.

Prerequisites. Upon matriculation, the student must have received a bachelor's degree from a regionally accredited institution, but there are no specific course prerequisites required to begin the program except college level mathematics through at least one course in calculus. Those electing the management science or statistics concentration must have completed two years of college level calculus. Those admitted to the accounting concentration should plan on up to two additional quarters for undergraduate prerequisite courses that are taken during the first year of the program. Although not required, completion of undergraduate courses in certain areas may qualify the student for exemption from some core courses. (See information under "Exemption from Core Courses" on page 37).

MBA Core. The following courses are required in each student's program unless an exemption from one or more courses is granted as provided below under the heading "Exemption from Core Courses." All courses are 3 credit hours. The core courses are:

Accounting 5010, 5020, 5030; Business Administration 5310, Business Law 5010; Economics 5010, 5020, 5030; Finance 5010, 5020; Management 5010, 5020; Management Science 5010, 5020; Marketing 5010, 5020; Mathematics 5052; Office Administration 5050; Statistics 5010, 5020.

*Accounting 5020 and 5030 are waived for students who complete the concentration in accounting.

**See notation under the heading "MBA Concentration" in the Management Science Program section (page 44).

***See notation under the heading "MBA Concentration" in the Statistics Department section (page 46).
### Prerequisite Relationships of MBA Core Courses

Read across table to identify prerequisites/corequisites for courses listed in left column

|                        | BLaw 5010 | Acct 5010 | Econ 5010 | Mgmt 5010 | OAdm 5050 | Math Prep* | Math 5052 | Stat 5010 | Stat 5020 | MSci 5010 | Acct 5020 | Econ 5020 | Acct 5030 | Econ 5030 | Mktg 5010 | Mktg 5020 | Fin 5010 | Fin 5020 | Mgmt 5020 | BAdm 5310 |
|------------------------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| BLaw 5010              |           |           |           |           |           |            |           |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| Acct 5010              | √         |           |           |           |           |            |           |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| Econ 5010              |           | √         |           |           |           |            |           |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| Mgmt 5010              |           |           | √         |           |           |            |           |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| OAdm 5050              |           |           |           | √         |           |            |           |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| Math Prep*             |           |           |           |           | √         |            |           |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| Math 5052              |           |           |           |           |           | √          |           |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| Stat 5010              |           |           |           |           |           |           | √         |           |           |            |           |           |           |           |           |           |           |           |           |           |           |
| Stat 5020              |           |           |           |           |           |           |           | √         |           |            |           |           |           |           |           |           |           |           |           |           |           |
| MSci 5010              |           |           |           |           |           |           |           |           | √         |            |           |           |           |           |           |           |           |           |           |           |           |
| Acct 5020              |           |           |           |           |           |           |           |           |           |            | √         |           |           |           |           |           |           |           |           |           |           |
| Econ 5020              |           |           |           |           |           |           |           |           |           |           |           | √         |           |           |           |           |           |           |           |           |           |
| Mktg 5010              |           |           |           |           |           |           |           |           |           |           |           |           | √         |           |           |           |           |           |           |           |           |
| Mktg 5020              |           |           |           |           |           |           |           |           |           |           |           |           |           | √         |           |           |           |           |           |           |           |
| Fin 5010               |           |           |           |           |           |           |           |           |           |           |           |           |           |           | √         |           |           |           |           |           |           |
| Fin 5020               |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           | √         |           |           |           |           |           |
| Mgmt 5020              |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           | √         |           |           |           |           |
| BAdm 5310              |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           | √         |           |           |           |

*UTK Math 1550, 5051 or equivalent.

### Concentration and Electives

An applicant for admission must select a concentration area. However, a change to another area may be requested at any time after entering the program. Among the 8 courses in the concentration/electives block, at least 4 but not more than 6 must be in one of the following concentration areas (for specific courses required in some concentration areas, see departmental sections on following pages):

- Accounting
- Economics
- Finance
- Forest Industries Management
- Governmental Financial Administration Management
- Management Science
- Marketing
- Real Estate and Urban Development
- Statistics
- Transportation and Logistics

The remaining elective courses (2 to 4) must be in fields outside the concentration area, normally selected from MBA courses offered in other departments of the College, and may comprise a second concentration area of 4 courses. Up to 2 courses (6 hours) in this block may be taken outside the College of Business Administration. No more than 3 courses numbered below 5000 may be included in this 8-course block. Courses numbered below 4000 normally are not approved for the MBA program. Before beginning the concentration/electives part of the curriculum the student must have his/her program approved by the appropriate faculty advisor.

### Exemption from Core Courses

A student may be exempted from certain core courses on the basis of having recently completed equivalent undergraduate courses in these subjects with grades of C or higher at a regionally accredited institution. "Recently completed" means, for mathematics, completion of the last course or regular use of math tools within three to four years of matriculation, and for other areas within five to six years of matriculation. Courses in this category (and the approximate undergraduate equivalent work) are:

- Accounting 5010 (6 quarter hours, fundamentals of financial accounting)
- Business Law 5010 (6 quarter hours, the legal and social environment of business)
- Economics 5010 (9 quarter hours, principles of economics—macro and micro)
- Mathematics 5052 (12 quarter hours, including college algebra and calculus. See topics included in Mathematics 5051 and 5052)
- Office Administration 5050 (3 quarter hours, introductory course in computer science with programming).

In addition to the above, a graduate of an AACSB accredited undergraduate business program may request exemption from one or both of the core courses in the area of his/her undergraduate major field, provided at least 30 quarter hours (20 semester hours) of course work were completed in the major area no more than five years prior to matriculation, and a grade average of 3.0 or higher (on a 4.0 scale) was earned for all courses in the major. Students requesting such an exemption must petition the appropriate department head. The department head may require the student to pass a proficiency examination over any course for which exemption is requested. (See page 37).
A minimum of 60 quarter hours of graduate credits is required to earn the degree. If a student qualifies for exemption from a course in addition to those provided for in the two categories described above, whether by proficiency examination or otherwise, an additional elective course approved by the student's advisor will be included in the student's curriculum for each such exempted course so as to meet the 60-hour minimum requirement. Students holding degrees from foreign institutions normally may not be exempted from taking core courses.

**Transfer Credits.** Graduate level courses taken at other AACSB accredited institutions may be credited toward MBA degree requirements within the following limits:
- MBA Core: 6 hours
- Concentration Area: 3 hours (provided at least 12 hours of course work at this institution are included in each concentration area)
- Elective Area: 3 hours

The maximum number of hours that may be transferred is 9 quarter hours.

**Other Requirements.** The Application for Admission to Candidacy (see page 19) must be approved by both the student's advisor and the Assistant Dean for Graduate Programs in the College of Business Administration, signed by the department head, and submitted to the Vice Chancellor for Graduate Studies and Research.

To qualify for the degree, the student must achieve a B average (3.00) or above in MBA core courses required in his/her program, a B average in the concentration area(s) and a B average or higher in the overall program. In lieu of passing a written comprehensive examination the student must satisfactorily demonstrate his/her ability to analyze and solve multi-functional problems of the administrative processes and policy determination and to integrate the concepts of the various disciplines embodied in the curriculum of the program. The student is tested in these areas in the courses of the MBA core, particularly in the capstone course, Business Administration 5310—Business Policy, as well as in work required in the concentration areas.

**Application and Admission.** Application materials may be requested from the Graduate Programs Office, College of Business Administration, The University of Tennessee, Knoxville, Tennessee 37916. Applicants whose programs will include Accounting 5010, Economics 5010 and Office Administration 5550 must begin either in the summer or fall term. Those who are exempted from these courses and who are prepared to take Mathematics 5052 may begin either in the fall or winter quarter. There are three rounds of admissions, with special considerations for each entry quarter. The application deadlines shown below are the dates when the GMAT must have been taken and all other required documentation must be in the Graduate Business Programs Office. Application materials should be requested well in advance of these dates.

### Application Deadlines

<table>
<thead>
<tr>
<th>Period</th>
<th>Summer</th>
<th>Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Round</td>
<td>Nov. 1</td>
<td>Feb. 15</td>
<td>Apr. 1</td>
</tr>
<tr>
<td>Second Round</td>
<td>Feb. 15</td>
<td>Apr. 1</td>
<td>Aug. 1</td>
</tr>
<tr>
<td>Late Round</td>
<td>Apr. 1</td>
<td>Aug. 1</td>
<td>Nov. 1</td>
</tr>
</tbody>
</table>

For admission to the MBA program, consideration is given to the applicant's academic record with particular attention to the last two years of undergraduate work and previous graduate studies, to scores on the Graduate Management Admission Test (GMAT) and the Test of English as a Foreign Language (TOEFL) for those whose native language is not English, to work experience and other activities which demonstrate potential for leadership, and recommendations from professors or work supervisors. The admission decision is based on all factors which make up the total application; therefore, there is no automatic cut-off for either grade point averages or GMAT scores.

**Dual J.D.-MBA Program**

The College of Business Administration and the College of Law offer a coordinated dual program leading to the conferral of both the Doctor of Jurisprudence and the Master of Business Administration degrees.

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

Students who have been accepted by both colleges may apply for approval to pursue the dual program anytime prior to, or after, matriculation in either or both colleges. Such approval will be granted, provided that dual program studies be started prior to entry into the last 28 semester hours (42 quarter hours) required for the J.D. degree and the last 24 hours quarter required for the MBA degree.

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

The College of Law will award up to 8 semester hours (12 quarter hours) of 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 University of Tennessee, Knoxville, Tennessee 37916.

### 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 not be counted toward 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 DBA Program**

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

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

### Foundation Requirements.

Although the program is designed for students who have completed an accredited MBA (or equivalent) degree program, those with outstanding undergraduate records in any area may be admitted directly to the DBA program and may, if they desire, earn the MBA degree in a coordinated program of study. Program prerequisites include completion of college mathematics, including a course in calculus, a course in statistics, knowledge of computer programming, and intermediate economic theory (micro and macro). See page 37 for MBA degree requirements.

Entering students deficient in any of these facets of the dual program by taking courses in both colleges and completing the requirements.

### The DBA Program**

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

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### Foundation Requirements.

Although the program is designed for students who have completed an accredited MBA (or equivalent) degree program, those with outstanding undergraduate records in any area may be admitted directly to the DBA program and may, if they desire, earn the MBA degree in a coordinated program of study. Program prerequisites include completion of college mathematics, including a course in calculus, a course in statistics, knowledge of computer programming, and intermediate economic theory (micro and macro). See page 37 for MBA degree requirements.

Entering students deficient in any of these
areas may enroll in courses designed to meet these requirements.

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

A. Business Functional Areas. One graduate level course in each of the following areas must be completed: managerial accounting, financial management, marketing management, organization theory and behavior, and business policy. Students who have earned an MBA degree at an accredited institution may enroll in courses designed to meet these requirements. Others may include appropriate courses in their programs as approved by their academic committees.

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

- **Economics**: 3 courses (5110, 5120, 5170, 5180)
- **Behavioral Science**: 1 course (5610, 5620)
- **Quantitative Science**: 2 courses (12 quarter hours in one or a combination of two of the following areas: statistics, management science, econometrics, or computer science. Approval of student's committee is required.

C. Concentration Area. This is the focal point of the program and the area in which the student expects to do his/her research and dissertation. A minimum of 24 quarter hours of course work is required, including 9 hours of doctoral seminars taken at this University. A study of research methodology of the discipline is included. Graduate work in the field taken at other institutions is considered by the student's committee in determining additional course work required. Available concentration areas are:

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

D. Supporting Area. A minimum of 12 quarter hours of college level calculus and be proficient in a computer language.

Minimum Academic Performance Standards

A graduate student in the College of Business Administration whose grade point average at any point after 12 hours is below 3.0 shall be placed on probation. A student on probation shall be dropped from the program unless his/her cumulative graduate grade point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next 12 quarter hours of 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 MBA and DBA applicants are required to take the Graduate Management Admission Test (GMAT). Applicants for programs in economics, management science, and statistics may submit results of either the GMAT or the Graduate Record Examination (GRE) aptitude portion. Applicants for management science and statistics programs must complete the last two years of college level calculus and be proficient in a computer language.

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 (pages 12-13), MBA and DBA applicants must submit additional information on forms provided by the College of Business Administration. The application for all programs and supporting materials should be submitted at least three months prior to desired entry date.

The College of Business Administration is associated with other leading graduate schools of business as a member of the Graduate Management Admission Council.
Center for Business and Economic Research

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

Management Development Programs

The Management Development Programs Department offers a wide variety of programs ranging from two- to three-day public seminars and customized "in-plant" programs to the four-week 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 for comprehensive decision making and leadership. Other major aims of the TEDP are to teach the fundamentals of analytical thinking and the use of the decision tools, and to examine the economic, political, technological and other environmental factors affecting the firm's operations.

The TEDP limits enrollment to thirty-six 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 outstanding practitioners in their fields of business and industry.

Departments of Instruction

Accounting and Business Law

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

Accounting

MAJOR

Accounting

DEGREE

M. Acc.

Professors:

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

Associate Professors:

H. C. Herrin, Ill, Ph.D. Alabama, C.P.A.;
G. E. Nichols, Ph.D. Louisiana State, C.P.A.;
J. A. Rosey, M.S. Tennessee, C.P.A., C.M.A.;
J. H. Scheider, Ph.D. Ohio State, C.P.A.;
W. L. Sheep, M.A. Tennessee, C.P.A.;
K. G. Stanga, Ph.D. Louisiana State, C.P.A.;
R. L. Townsend, Ph.D. Texas, C.P.A.

Assistant Professors:

W. J. Gelasas, Jr., Ph.D. Massachusetts; M. C. Letsinger, M.S. Tennessee, C.P.A.

THE MASTER OF ACCOUNTANCY PROGRAM

The objective of the Master of Accountancy (M.Acc.) program is to provide persons having an undergraduate accounting background and a high level of ability and motivation with the depth and understanding of accounting which will enhance their probability of success in a career in professional accounting. Moreover, the student's educational background should develop perspective toward the discipline of accounting in a manner that will enable the student to spearhead innovation and change in response to needs in public accounting, business, industry or government.

Foundation Requirements. Although the program is designed for students who have completed an accredited baccalaureate degree program with a major in Accounting, those with outstanding undergraduate records in any area may earn the M.Acc. degree by completing prerequisites in accounting and by including courses in other business and related disciplines to supplement the applicant's undergraduate background.

Course Requirements for the M.Acc. Program. A student's program encompasses 51 quarter hours of graduate course work. Specifically, the student must complete courses in selected business disciplines and in the areas of accounting as indicated below. Each course is 3 quarter hours of graduate credit.

Business Core (21 quarter hours)1:
Economics 5030; Finance 5010; Management 5010; Management Science 5010; Marketing 5010; Statistics 5010, 5020.

Accounting Core (15 quarter hours):
Accounting 5110, 5120, 5220, 5420, 5950.

Accounting Electives (Select five) (15 quarter hours):2

1Where prior course work and/or experience justifies, substitutions may be made in the core business course upon approval of the M.Acc. program advisor.

2Students with credit for 4990 must substitute 5130 or 5140 upon approval of the M.Acc. program advisor.
5340 Consolidations and Business Combinations (3) Theory and practice of accounting for integrated business entities—domestic and foreign. Not intended for persons who have credit for a course with a similar content. Prereq: 3130.

5420 Tax Research (3) Development of expertise in tax research utilizing tax service, tax periodicals, legal cases and other available sources. Includes individual research projects. Prereq: 4430 or equivalent.

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

5440 Taxation of Estates and Gifts (3) Transfers at death, inter vivos transfers, life insurance, annuities and employee death benefits, marital and other deductions and exemptions, and estate and gift tax returns. Prereq: 4430 or 5330 and 5420. (Not available to students with credit for 4440.)

5510 Not-for-Profit Accounting (3) Theory and practice of budgetary and fund accounting, financial reporting, measures of output and accomplishment, and financial and performance auditing for non-profit entities. Prereq: 9 hours of accounting and consent of instructor.

5630 Accounting Systems and EDP Concepts and Controls (3) Introduction to the design and implementation of computerized business environment. Analysis, design, implementation, documentation and control of accounting systems. Emphasis on knowledge and computer programming language.

5640 Seminar in Accounting Information Systems (3) Literature on accounting information systems and current trends in systems analysis and design concepts. Informational needs of other functional areas of business and interfacing of these areas. Prereq: 4630 or equivalent.

5910-30-30 Accounting Seminar (1, 1, 1) Research and discussion of contemporary issues in practice of accountancy. May be repeated. Admission by consent of department head. S/NC only.

5950 Seminar in Accounting Research (3) Integration of areas of financial, managerial, tax and auditing, including directed problem-oriented research in selected topics. Prereq: 5110, 5120, 5210, 5420. (Not available to MBA students.)

5990 Individual Research in Accounting (3) Directed research in a topic of mutual interest to student and faculty member. Prereq: Consent of department head. May be repeated. Maximum 6 hrs.


Business Law
Professors:

5010 Legal and Social Environment of Business (3) Survey of legal and quasi-legal institutions with emphasis on those which have particular significance to business; basic legal notions and principles that pertain to business management. Not available to students with credit for 4110-20 or equivalent.

Business Administration
MAJOR DEGREES Business Administration MBA, DBA

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 are developed; outside coordination; assessing company's situation, determining objectives, developing sound policies, organizing and administering personnel to reach company objectives, continuous administrative reappraisals. Enrollment priority given MBA students in last quarter of their program.

Prereq: ABA core courses. F, W, Su.

5410 Business and Its Societal Environment (3) Analysis of current forces and changes in society and interrelation 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 problems of selected business organizations. Students work in teams under supervision of participating professor. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Business Education
See College of Education

Economics

MAJOR DEGREES Economics M.A., MACT, M.S., Ph.D.

Professors:
- P. D. Qualls (Head), Ph.D. California (Berkeley);
- R. L. Bowlby, Ph.D. Texas, S. L. Carroll,
- Ph.D. Harvard; F. R. Cole, Ph.D. Texas;
- G. R. Feiwel, Ph.D. McGill; C. B. Garrison,
- Ph.D. Stanford; H. W. Hentz, Ph.D. Community;
- D. L. Clark; H. E. Jensen, Ph.D. Texas;
- F. Y. Lee, Ph.D. Michigan State;
- J. R. Moore, Ph.D. Cornell; C. W. Neale,
- Ph.D. London School of Economics; G. A. Spiva,
- Ph.D. Texas; F. B. Ward (Emeritus), Ph.D.
- Pennsylvania State.

Associate Professors:
- H. S. Chang, Ph.D. Vanderbilt; E. Glustoph,
- Ph.D. Stanford; H. W. Hentz, Ph.D. Community;
- Maryland; A. Mayhow, Ph.D. Texas;
- K. E. Phillips, Ph.D. Washington (Seattle);
- A. M. Schottman, Ph.D. Washington (St. Louis).

Assistant Professors:
- D. P. Clark, Ph.D. Michigan State; S. P. Coelen,
- Ph.D. Syracuse; C. B. Dorn, Ph.D.
- Massachusetts Institute of Technology;
- D. L. Kaserman, Ph.D. Florida; N. C. Modeste,
- Ph.D. Florida; G. E. Schuler, Ph.D.
- Houston; E. D. Wickham (part-time), Ph.D.
- Rochester.

THE MASTER'S PROGRAM

The minimum requirements for a graduate major in Economics for the Master of Arts and the Master of Science degrees consist of the following:

1) Economics 5111-12 and 5211-22, (2) 9 additional hours in economics at the 4000 level or above, (3) a thesis, or an additional 9 hours in economics at the 5000 level or above to be concentrated in one field.

Students electing the non-thesis option will be required to pass a final written comprehensive examination.

The requirements for a graduate minor in Economics are as follows: Either (1) 5111-12 and 5211, or (2) 5111 and 5211-22, or (3) with the consent of the head of the economics department, an alternative sequence of 9 hours to meet unusual conditions.

MASTER OF ARTS IN COLLEGE TEACHING DEGREE

The requirements for the MACT degree are listed on page 19. A thesis is required.

THE DOCTORAL PROGRAM

Subject Area Requirements

1. Students will be required to demonstrate their competence in the core subject fields as indicated:
   a. Economics: to pass the preliminary examination or by completion of Economics 5111-12 and 5211-22 with a B average or higher and successful completion of Economics 6111 and 6121.

Alumni Distinguished Service Professor

b. Economic history, by completing 6 hours in economic history at the 4000 level or above with an average grade of B or better or by satisfying an examining committee.

c. History of economic thought, by completing Economics 5150 and 3 additional hours in this area with 6000 level with an average grade of B or better or by satisfying an examining committee.

d. Mathematical and quantitative methods in economics by completing Economics 5420, 5190, and with the average grade of B or better or by satisfying an examining committee.

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

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

Economics Concentration: Economics. 

Course Requirements for MBA Concentration: As approved by the area MBA faculty advisor.

4000 Special Topics (3) Subject generated course offered at convenience of department upon student petition. Subject matter to be approved by students and instructor with approval of the department.

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-16) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

5090 Workshop in Economics (3-9) Special topics in economic education. Not available for credit in any College of Business Administration degree program. Prereq: consent of instructor. May be repeated. Maximum 9 hrs.

5910-30-30 Economics Seminar (1, 1, 1), Research in progress and discussion of selected topics. May be repeated. S/NC only.

6000 Doctoral Research and Dissertation (3-15) E

1410 Managerial Economics (3) Application of economic theory to business decision making; emphasis on profit objectives, measurement and forecasting demand and costs, and capital budgeting. Prereq: 2110-30-30.

1430 Business Cycles (3) Fluctuations in income, employment, prices, and output in the economies
finance

Professors: R. M. Duvall (Head), Ph.D. North Carolina; L. P. Anderson, Ph.D. Wisconsin; R. A. Bohm, Ph.D. Washington (St. Louis); W. W. Dofferwech, Ph.D. Pennsylvania; H. L. Johnson, (On Leave); Ph.D. Virginia; W. A. Lambert, Jr. (Part-time), Ph.D. Pennsylvania; J. M. Wachowicz, Jr., Ph.D. Illinois; W. P. Lau, M.S. Wisconsin; T. P. Boehm, Ph.D. Washington (St. Louis); D. L. Stevens, Ph.D. Michigan State.

Associate Professors: A. L. Auxier, Ph.D. Iowa; J. C. Golden, Ph.D. George Washington; W. C. Goolsby, Ph.D. Wisconsin; R. W. Boling, Ph.D. Stanford; H. D. Dewhirst (Head), Ph.D. Texas; F. A. Chamblin, MBA Indiana; R. W. Boling, Ph.D. Stanford; H. W. Henry, Ph.D. Michigan; R. C. Maddox, Ph.D. Texas; R. T. Ladd, Ph.D. Georgia; J. A. Bachmann, Ph.D. Virginia Polytechnic Institute; R. T. Ladd, Ph.D. Georgia; R. C. Maddox, Ph.D. Texas; J. M. Wachowicz, Jr., Ph.D. Illinois; W. P. Lau, M.S. Wisconsin; T. P. Boehm, Ph.D. Washington (St. Louis); D. L. Stevens, Ph.D. Michigan State.

MBA Concentrations: Finance; Governmental Financial Administration; Real Estate and Urban Development.

DBA Concentrations: Finance

Minimum Course Requirements for MBA Concentrations: Finance—As approved by the area MBA faculty advisor. Governmental Financial Administration—5710, 5720, 5730, 5740; Accounting 5510. Real Estate and Urban Development—Real Estate 5110, 5120, 5130, 5140.

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

6000 Doctoral Research and Dissertation (3-15) E FINANCE AND INVESTMENTS


5120 Quantitative Techniques in Financial Management (3) Applications of mathematics, probability, and statistics to model building and testing in finance. Prereq: Economics 5010; Statistics 5010. F

5130 Financial Administration (3) Cases and readings within firm, refined techniques of analysis, optimal financing decisions; capital cost measurement; utilization of capital markets; general corporate financial theory. Prereq: Economics 5010; Accounting 5020. F, W

5140 Seminar: Managerial Finance (3) Applications of theory and quantitative techniques to solution of current problems in financial management. Prereq: Economics 5010; Accounting 5020. F, W

5420-30 Investments (3, 3) Investment decision process, determining portfolio prices and security prices; financial statement analysis; stock-price valuation models. Must be taken in sequence. F, W

5440 Commodity Futures and Stock Options (3) Trading in commodity futures markets and in "put and call" stock options; factors influencing commodity and stock option prices; option valuation models. Prereq: Economics 5420.

5800 Executive-In-Residence Seminar for MBA (3) For students in the professional area of management and management decision making. Prereq: 5110 or consent of instructor. Sp

6410 Analysis of Financial Decisions (3) Micro and macroanalysis of financial problems and financial decisions. Sp

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

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

7000 Monetary Policy and Financial Institutions

5810 Financial Markets and Intermediaries (3) Capital formation and allocation of capital in U.S. economy and abroad. Process of saving, partial institutionalization of these savings, investments of financial intermediaries, efficiency of allocation process and effect on economy, and impact of financial institutions on financial markets. (Same as Economics 5810.) W

5820 Monetary Theory and Policy (3) Relationship of monetary policy to economic activity. Prereq: Economics 5810 or equivalent. (Same as Economics 5820.) F

5830 Commercial Bank Management (3) Bank management decision-making analysis of changes in balance sheet and capital structure of banks. Financial condition and analysis of management and management of funds; current banking problems. Prereq: Consent of instructor. (Same as Economics 5830.) W

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

1Alumni Distinguished Service Professor.
5002 Non-Thesis Graduation Completion (3-15) E
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. E

5110 Organization Theory and Behavior (3) Basic concepts of both individual and organizational behavior and management processes.

5202 Operations Management (3) Management processes of planning, operating and control of production and service systems. Management concepts and quantitative techniques with systems framework to operating problems. Prereq: 5010; Management Science 5010, 5020, 5030.

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

5130 Managerial Planning and Control (3) Processes of management planning and controlling with emphasis on corporate strategic planning. Sp

5140 Corporate Management Simulation (3) Application of functional areas and strategic concepts to a complex business simulation. Prereq: 5020, Accounting 5030, Finance 5020, Marketing 5020.

5170-90-90 Proseminar in Industrial and Organizational Psychology (1-3, 3, 3) A reading in industrial and organizational psychology. Required of all students in the department during their first year. (Same as Psychology 5170-90-90.) F, W

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

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

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

5250-60 Industrial and Organizational Psychology (1-3) Readings in industrial and organizational psychology. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 6 hrs. S/NC or letter grade.

5280 Independent Study, Project or Research in Management (1-3) Topic of mutual interest to student and faculty member. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 6 hrs. S/NC or letter grade.

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

5350-20-30 Production Management (3, 3, 3) Quantitative approach to solution of production management problems. Prereq: 5020 or consent of instructor.

5360-20 Organizational Behavior (3, 3) Behavioral methodology and perspective, including review of empirical behavioral research in organizations. Must be taken in sequence. F, W

5710 International Business Management (3) Analysis of environment of international business firms and impact of internal and external factors on managerial decisions. Sp

5810 Energy Management: Theory and Practice (3) Advanced problems in energy management. Topics include performance evaluation, executive development, group process, and morale. (Same as Psychology 6250-60-70.)

5830 Seminar in Industrial and Organizational Psychology (3) (Same as Psychology 6830.)

5900 Field Work in Industrial and Organizational Psychology (1-15) Supervised practice. One credit hr for each 30 hrs of such practice. Maximum 15 credits. (Same as Psychology 6900.) E

Management Science

MAJOR
Management Science
Professor: R. E. Rosenthail, Ph.D.; Georgia Institute of Technology.

Management Science Committee: Members of the Management Science faculty and in addition: R. W. Boling, Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; E. Glustof, Economics; W. J. Morse, Accounting; R. E. Shrieves, Finance; C. C. Thigpen, Statistics; M. T. Kusy, Computer Science.

MBA CONCENTRATION
For students whose MBA concentration area is Management Science, the MBA Core is revised as follows: substitute Management Science 5310 for 5010, Statistics 5110 for 5010, and with approval of student's advisor, substitute Statistics 5120 for 5020. The concentration area must include Management Science 5330 and 5340.

MAJOR IN MANAGEMENT SCIENCE

See page 98 for details of the Master of Science program in Management Science.

THE DOCTORAL PROGRAM

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

1) to provide advanced 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 a supporting area to qualify the graduate for a joint faculty position in the supporting area and 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., computer science, statistics, 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 21.

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

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

Qualifying Examinations. The student must demonstrate mastery of probability theory and statistical inference (Statistics 5110-20-30) by passing a written qualifying examination.

Mastery of 18 to 21 quarter hours in mathematics course work must be demonstrated by passing a written qualifying examination. Topics normally include numerical analysis (either Mathematics 4225, 4245, 4060 and 5655, or Mathematics 5655-65-75) and real analysis (Mathematics 4510-20-30). Other options may be approved. In exceptional circumstances the faculty will consider waiving the mathematics and/or statistics qualifying examinations.

There is no foreign language requirement. These requirements generally are completed by the end of the first year of the program.

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

Research and Dissertation. The student must complete 36 quarter hours of Management Science 6000, Doctoral Research and Dissertation (3-15) in 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 joint faculty committees 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 (1-15) E

5002 Non-Thesis Graduation Completion (3-15) E
Required for 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. E

5010 Quantitative Analysis for Management Decisions (3) Assignment, transportation and general linear programming problems; decision theory.
Marketing and Transportation
G. N. Dicer (Head), DBA Indiana.

Marketing
Professors:
D. W. Cravens, DBA Indiana; E. O Dille (Emeritus), Ph.D. Ohio State; E. E. Garrison (Emeritus), M.A., Ohio State; G. E. Hills, DBA Indiana; R. B. Woodruff, DBA Indiana.

Associate Professors:
D. J. Barnaby, Ph.D. Purdue; E. R. Cadotte, Ph.D, Ohio State; R. L. Jenkins, Ph.D. Ohio State; J. R. McMillan, Ph.D. Ohio State; R. C. Ranzen, Ph.D. Cornell; G. D. Sentell, DBA Indiana; R. L. Spino, Ph.D. Georgia.

Assistant Professors:
F. L. Babur, Ph.D. Illinois; L. R. Duft, M.S. Purdue.

MBA Concentration: Marketing.
DBA Concentration: Marketing.
Minimum Course Requirements for MBA Concentration: 5300, 5350, 5400, 5410.

5002 Non-Thesis Graduation Completion (3-15) For the "nonthesis" student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is conferred, courses may be used toward degree requirements. May be repeated. S/NC only.


5210 Sales Force Management (3) Basic communicative strategy affecting objectives and problems of sales force management. Recruitment, selection, training, motivation, evaluation, and control of sales force; sales forecasting, territory design, and routing. Prereq: 5020. F.


5300 Marketing Research (3) Investigation and solution of problems; application of research methods to functional areas of marketing. Research concepts, methods, and techniques. Prereq: 5020; Statistics 5010. F, W.

5350 Buyer Behavior Analysis for Marketing (3) Buyer behavior patterns with emphasis on implications for marketing analysis and executive action. Marketing and behavioral sciences. Prereq: 5020, F, Su.

5400 Analyzing Market Opportunity for Marketing Decisions (3) Basic determinants of opportunity within markets, framework for identifying and organizing information required to assess market opportunity. Approaches to analyzing buyers in markets, forecasting extent of demand, analyzing industry patterns and competitor service. Emphasis on applying market opportunity analysis results to marketing decisions. Prereq: 5020. W.

5410 Advanced Marketing Strategy (3) Components of marketing decisions and development of marketing strategy in a variety of industries. Consideration of alternative strategies, coordination and control of marketing activities. Prereq: 5300 and 5350. Sp.

5450 International Marketing Management (3) Development and management of international marketing programs. Problems involved in marketing goods and services in foreign markets. Political, cultural, and economic conditions in different countries. Prereq: 5020. W.

5900 Research in Marketing (3) Directed research on subject of mutual interest to student and staff member. Prereq: 5020 and 5300. May be repeated. Maximum 6 hrs.

6000 Doctoral Research and Dissertation (3-15) E.

6110-20-30 Models for Production Systems (3, 3, 3) In-depth treatment of professional development of doctoral students. In- depth treatment of professional development of doctoral students. In-

5110 Theory and Functions of Economic Regulation
(3) Development of economic and philosophic basis of regulation. Critical analysis of impact of regulation on managerial options. F

5120 Management and the Pricing Problem
(3) Critical analysis of application of economic theory and regulatory restraints to pricing of carrier services. Sp

5130 Carrier Transportation Management
(3) Analysis of major transportation modes and their managerial strategies. Consideration of how social, technical, legal, and financial environment affects top level decision making. Application of general business, marketing, finance, and statistical decision processes to transportation decision making in uncertain environment. F

5220 Logistics Systems Management
(3) Development of strategy for management of logistical systems. Emphasis on executive level integration of logistics operations with marketing, production, and other decision areas. Practical applications through a case approach and simulation game. Prereq: Management 5020. W

5510 Urban Transportation Policy
(3) Movement of people, goods and information in urbanized areas with special emphasis on formulation of national, state, and local policy. Emphasis on evolving new urban transportation concepts. W

5510 International Transportation Policy
(3) Comparative analysis of transport systems in other countries. Analysis of U.S. policy relative to international transportation. Sp

5910 Advanced Law and Regulation
(3) Legal rights and responsibilities of shippers and carriers. Analysis of decisions of regulatory commissions, courts, and principles of law arising from these decisions. Sp

5990 Independent Study in Transportation/Logistics
(1-3) Directed study in surface and air transportation, national transportation policy, transportation/logistics research developments, or subject of particular interest to student and faculty. May be repeated. Maximum 6 hrs. E

6000 Doctoral Research and Dissertation
(3-15) E

6110 Seminar in National Policy
(3) Critical analysis of contemporary national transportation policy issues. Prereq: G.D. F

6210 Seminar in Transportation and Logistics Models
(3) Analysis of contemporary models and methodologies in transportation and logistics research. Relative emphasis on topical coverage at discretion of instructor. Prereq: Management Science 5010; Statistics 5010 or equivalent. Sp

6220 Research Methodology in Transportation and Logistics
(3) Presentation and design of research in transportation and logistics.

Office Administration
J. Stallard, Program Director

Professors:
E. W. Davis (Emeritus), M.S. New York University;
D. Reese, Ph.D. Iowa; E. H. Smith, Ph.D. Ohio State; R. D. Alexander, M.S. Indiana.

Associate Professors:

Assistant Professors:
P. O. Campbell, M.S. Austin Peay; H. Petrea, M.S. Tennessee.

Courses numbered below 5000 are not available for credit in the MBA program.

4310 Business Letter Writing
(Principles, practices, and mechanics of effective business letters and memoranda; principles applied by solving communication cases; emphasis placed on letters and memos as initial sources of ideas in communication system of the business firm. E

4320 Business Report Writing
(3) Basic principles and procedures of originating and disseminating business reports, both formal and informal in style, writing techniques for short and long reports; graphic presentation and interpretation; use of primary and secondary data for reports. E

4420 Advanced Transcription
(3) Improvement of ability to transcribe, with emphasis on composition of a wide variety of correspondence; emphasis on competencies needed to meet occupational standards. Prereq: K

4510 Office Management
(3) Strategic and operational planning of office objectives; relating tasks and human resources to objectives; recruiting, selection, training, and development of office staff; directing of office staff through leadership, motivation, communications; measurement of office performance, comparison to standards, and corrective actions; and applications of decision making to the office. Sp

4520 Office Systems
(3) Synthesis of systems and subsystems applicable to centralized and decentralized office functions. Emphasis placed on cost analysis in contemporary office environment, technology, and research analysis. Sp

4810-20 Problems in Office Administration
(1-3, 1-3) Subject and title vary each quarter. May be repeated. Maximum 3 hrs. E for each course.

5011 Problems in Lieu of Thesis
(3) W

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

Statistics

MAJOR

DEGREE

M.S.

Statistics

Professors:
C. C. Thrpigan (Head), Ph.D. Virginia Polytechnic Institute; D. S. Chambra, MBA Texas; R. A. McLean, Ph.D. Purdue; J. W. Philpot, Ph.D. Virginia Polytechnic Institute.

Associate Professors:
H. A. Lasater, Ph.D. Rutgers; F. D. Sanders, Ph.D. Texas; D. J. Wheeler, Ph.D. Southern Methodist; M. S. Younger, Ph.D. Virginia Polytechnic Institute.

Assistant Professors:

THE MASTER'S PROGRAM

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

Statistics Major Area
Quarter Hours
Probability theory
Theory of statistical inference
Additional coursework in statistics as approved by the student's committee
Additional coursework as approved by the student's committee
Minor Area
Selected with the approval of both the Department of Statistics and the department in which the work is to be taken
Total minimum hours

MBA CONCENTRATION

For students whose concentration area is Statistics, the MBA Core is revised to substitute Statistics 5110 for 5010. The concentration area must include 5120 and 5130. Normally, Statistics 5250-60-70 are also included which may require a prerequisite. Statistics courses numbered 4000 and above presuppose familiarity with the basic probability distributions in statistics and with the general concepts of statistical estimation and hypothesis testing. Students unfamiliar with these concepts should seek advice from a statistics advisor concerning prerequisite course work.

3450 Statistics for Engineering
(3) Survey of statistical methods with special application for engineering students; frequency distributions, selected sampling distributions, some tests of significance. Cannot be taken for credit concurrently with 5110. Prereq: Mathematics 2840. E

4250 Nonparametric Methods
(3) Measures of association, two-sample tests, analysis of variance with ranked data, paired and multiple comparisons in variance testing; chi-square evaluation. Sp

4310 Regression Analysis
(3) Linear regression and correlation, multiple regression, stepwise methods, polynomial regression, use of dummy variables. Use of standard regression computer programs. Elementary theory and applications. E

4410 Design of Experiments
(3) Principles and procedures for efficient experimental design. Randomization, choice of size and number of experimental units, utilization of blocking arrangements, interpretation of experimental data. W, Su

4415 Sampling Techniques and Theory
(3) Procedures used in probability sampling for a variety of arrangements of statistical universes and development of estimators and standard errors associated with sampling schemes. Some properties of estimators. Determination of sample size. Not available for credit to students with credit for 3410. F, W

5005 Thesis
(1-15) E

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

5010 Probability and Statistical Inference
(3) Fundamentals of probability, discrete and continuous probability models, expectations and confidence interval concerning means. Prereq or coreq: Mathematics 5052 or equivalent and a computer and programming course. May not be taken for credit by students who receive credit for 5110. F, W

5020 Statistical Methods
(3) Regression and correlation models, basic time series analysis and forecasting; indexes, index numbers, hypothesis testing, and tests for independence. Prereq: 5010. W, Sp

5050-60-70 Statistical Analysis for the Behavior Sciences
(3, 3, 3) 5050—Probability distributions, sampling distributions, estimation and hypothesis testing. Parametric and nonparametric procedures. Prereq: 1 yr college mathematics and one course in statistics. 5050—Linear and multiple correlation methods, correlation for ranked and grouped data. Continuation of 5050. 5070—Analysis of variance and covariance; design of experiments. Parametric procedures. A continuation of 5050. F; W

5110 Introduction to Probability Theory
(3) Classical probability and distribution theory. Prereq: Elementary linear algebra and calculus of several variables. F

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

5210 Stochastic Processes I
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. F, Su.


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

6060 Applied Multivariate Analysis (3) Canonical correlation; discriminant analysis for several groups, and for equal and unequal covariance matrices; principal component analysis; Hotelling's $T^2$; multivariate analysis of variance and covariance. Prereq: 1 yr applied statistics including analysis of variance and multiple regression analysis. W.

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

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 M.S. program (professional track) is accredited by the American Council on Education for Journalism. The College is a member of the American Association of Schools and Departments of Journalism and the Broadcast Education Association.

The doctoral program in Communications is listed in the Academic Common Market of the Southern Regional Education Board. Students residing in Alabama, Georgia, Kentucky, South Carolina, Virginia, and West Virginia can normally qualify for in-state fee status by applying to the Academic Common Market coordinators in their state capitals.

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 mass media and other fields of applied communications, or (2) a deeper understanding of the communication process and the social role of the mass media.

The prospective student who is interested in acquiring basic skills in journalism, advertising, or broadcasting is advised to consider a second baccalaureate rather than an advanced degree. (Note: There is no M.S. in Journalism or Advertising or Broadcasting at this institution. Students desiring a major in one of these fields must take the B.S. program.)

Applicants must meet admission requirements of the University Graduate School. In addition they must complete the Graduate Record Examination, the California Psychological Inventory, and application forms as required by the College of Communications. All application materials will be screened by an admissions committee authorized by the Graduate Studies Committee of the College of Communications.

New students may be admitted to the program at any time; however, beginning enrollment is limited to the summer and fall quarters each year. Unless necessary materials are received at least six weeks before registration, applications 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 provisional status.

The student may choose either of two tracks, both leading to the M.S. in Communications and both requiring a thesis:

The academic track is designed for the student who wishes to emphasize advanced study of the theory and effects of communications. A minimum of 45 hours of approved graduate work is required:

- 12 hours of core courses: Communications 5100, 5120, 5140 and 6100,
- the first three of which must be taken during the first two quarters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College. In addition, students who earned their Bachelor's degrees outside the field of Communications will normally be required to add Communications 5130 to their core;
- 24 hours of selected courses within the College, including at least 9 hours at the 5000 level;
- 9 hours of thesis work (Communications 5000).

This track is assumed to be the logical choice for students interested in subsequent entry into a doctoral program. Advising of students in this track is supervised by the Assistant Dean for Graduate Studies for the College.

The professional track is designed for the student who desires the graduate degree but wishes to emphasize a particular professional area, such as advertising, broadcasting, journalism, or public relations. A minimum of 45 hours of approved graduate course work is required:

- 9 hours of core courses: Communications 5100, 5120 and 5140, which must be taken during the first two quarters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College;
- 15 hours in a major area within the College, including at least 6 hours at the 5000 level;
- 9 hours of thesis work (Communications 5000);
- at least 12 hours in a minor area approved by the major advisor, of which at least 6 hours must be at the 5000 level.

In addition, students with Bachelor's degrees in other cognate areas will be required to complete prerequisites as designated by their advisors. Advising for the professional track will be supervised by the chairperson of the appropriate department of the College. Students who have had no courses in their major areas of concentration may expect to spend six or more full-time quarters in the program.

After the formal program of courses and research in either track is completed, the student must pass an oral 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.

The Master's degree is not required for entrance into or continuation 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 appropriate courses. In general, however, the program may be completed within three academic years of full-time study beyond the Bachelor's degree.

The following are normally minimal requirements for admission to full potential candidate status: (a) a 3.0 (4.0 system) grade point average in undergraduate studies, or 3.5 for graduate work if applicant holds a 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 candidate status; (b) completion of the California Psychological Inventory; (c) endorsement by at least three former teachers or professional colleagues about the applicant's candidacy; (d) a statement of the applicant's goals and reasons for pursuing the doctorate. Personal interviews with members of the Ph.D. Admissions 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 requisite academic and/or professional background: (b) core curriculum: 33 hours of course work; (c) primary concentration in communications: 15-18 hours of course work; (d) secondary concentration: 9-12 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: 38 hours of Communications 6000.

The following courses represent the required core curriculum (beyond the Bachelor's degree): Communications 5100, 5120, 5140, 6100, 6200.

One of the following: Communications 6300, 6310, 6320.

For the teaching or administrative technical competence area a one-week, non-credit computer program course and Statistics 5211, or Sociology 5320 and Statistics 4250; for the research technical competence area: Statistics 5010 and 5020.

Continuing and Higher Education 5450.

Two courses in organizational theory from a group approved by the Graduate Studies Committee.

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

REQUIRED SCHOLASTIC AVERAGE

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

Communications Research Center

The Communications Research Center is a vital adjunct to the communications graduate program. Objectives include: (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.

Degrees of Instruction

Planned course offerings in the College of Communications for a full calendar year are published in the College newsletter the preceding November. This information is available from the Dean's Office, 302 Communications Building, 974-3031.

Communications

MAJOR

Communications

DEGREES

M.S., Ph.D.


Associate Professors: G. A. Everett; Ph.D. Iowa; E. F. Shaw, Ph.D. Stanford.

Assistant Professor: J. P. McKena, Ph.D. Minnesota.

5000 Thesis (1-15) E

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

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

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

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

5140 Mass Communication Theory (3) Critical appraisal of selected hypotheses and theoretical orientations in research literature of mass media, introduction to conceptualization and its relationship to research methodology, Application of theory to contemporary mass communication problems. Prereq: 5100. Recommended prereq: 5120, F, W.

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

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

6000 Doctoral Research and Dissertation (3-19) E

6100 Seminar in Communications Theory (3) Intensive analysis of selected theories and supporting research data dealing with source, message, media, receivers, or situations in process of communication. Prereq: 5140.

6200 Seminar in Communication Topics (3) Identification, presentation and analysis of special issues and problems in communication. Organization and strategy in writing research proposals. Prereq: 5100, 5120, 5140. Recommended prereq: 6100 or consent of instructor.

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

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

6320 Seminar in Historical Research Methods in Communications (3) Materials and methods in historical, descriptive, and interpretative research in communications theory and behavior. Prereq: 5100, 5120. Recommended prereq: 5140, 6100. A

Advertising

Professors: R. L. Head, Ph.D. Michigan State; S. E. Allen, Ph.D. Arizona State; E. D. Ackerman, Ph.D. Wisconsin; D. Fletcher, Ph.D. Illinois; D. G. Hileman, Ph.D. Illinois; S. K. Zeigler, Ph.D. Michigan State.

Assistant Professor: J. B. Dunlap, Ed.D. Akron.

3500 Advertising Copy and Layout (4) Ideas and their translation into persuasive words and pictures. Principles and techniques of copy and layout. Lecture and labs. Prereq: 3000 with grade of "C" or better or consent of instructor. F.

4000 Advanced Advertising Copy and Layout (4) Creative strategy and execution of advertisements for mass media. Problems in idea creation for advertising. Lectures and labs. Prereq: 3500 with grade of "C" or better or consent of instructor. F, W.

4360 Advertising Media (3) Media, markets, and audiences. Evaluation of media in relationship to communication needs of advertisers. Prereq: 3000 with grade of "C" or better or consent of economics. F.

4460 Cases and Problems (3) The case approach to the study of advertising problems. Analysis of camp
4470 Advertising Campaigns (4) Application of theory in planning and execution of campaigns. Marketing, development, and allocation of budgets. Choice of appeals and approaches; media selection; preparation of advertising materials. Prereq: 4670 and 4360 with grade of “C” or better or consent of instructor. F, W

5510 Current Issues in Advertising (3) Current socioeconomic, legal, ethical, and cultural issues in advertising and consumer communication to determine advertising’s role in and responsibility toward society. Emphasis on both marketing and behavioral science aspects of advertising. Consideration of creativity, media, management, and research. Extensive individual reading; preparation and delivery of papers.

5560 Advanced Advertising Research (3) Nature, scope, and application of research including measurement of advertising, media audiences, and evaluation of messages. Prereq: 4460 or consent of instructor.

5570 Creative Projects (3) Creative or problem solving interests related to advertising. Designed for the advanced student who wishes to apply theory and skills to specific problems. Prereq: 4500 and 4460 or consent of instructor. May be repeated.

5970 Independent Study (3) E

Broadcasting

Professors: D. W. Holt (Head), Ph.D. Northwestern; H. H. Howard, Ph.D. Ohio.

Associate Professors: I. G. Simpson, M.S. Syracuse.

Assistant Professors: F. A. Lester, M. A. Tennessee; M. C. Pounds, M.S. Syracuse; R. A. Shirley, M. A. Tennessee; M. K. Sidel, Ph.D. Northwestern.

Communications Specialist: J. H. Carr, M.S. Tennessee.

3360 Television and Radio Advertising (3) Principles of successful radio-television advertising; emphasis on media research, rate structure, programming, creativity; television commercials. W, Sp

3580 Radio-Television Writing (3) Theory and technique of writing broadcasting scripts except news and dramatic. Special events, interviews, musical scripts, radio talks, documentaries, and promotion materials. Prereq: 3360. F, W

4101 Speech for Broadcasting (3) Fundamental broadcast conditions affecting the announcer; pronunciation. Prereq: Speech 2311. F, W

4200 Radio Production (3) Study of radio production past and present. Familiarization with production and broadcasting techniques; group and individual production activities. Prereq: 2750 or consent of instructor. Cannot be taken for graduate credit by communications majors. E

4300 Television Production (3) Overview of elements of television production: cameras, sound, lighting, film, videotape recording, optics, and studio techniques. Emphasis on working with the layperson and professional broadcast student in mind. Prereq: 4200 or consent of instructor. Cannot be taken for graduate credit by communications majors. F

4400 Advanced Television Production (3) A semi-independent course in program origination, producing, directing, and performing with orientation to the professional broadcast student. Prereq: 4060 or consent of instructor. Sp

4610 Broadcast News Operation (3) Theory and practice in covering local news and public affairs events for radio and television. Gathering and production of news broadcasts, using tools of broadcast newsgathering. Prereq: 3610 and 3670 or consent of instructor. 2 hrs and 1 lab. Sp

4670 Radio-Television Management (3) Business policies and practices of networks and stations. Departmental functions, cost and income figures, sales techniques, promotion, advertising agencies, and governmental regulations. Lectures by commercial broadcasters. Prereq: 2750 or consent of instructor. F, Sp, Su

4680 Broadcast Sales Management (3) Problems and practices of television and radio sales, case studies in sales development, pricing, promotion, and other areas of sales management. Prereq: 2750 or consent of instructor. Sp

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

5510 Creative Projects (3) For students having specializations in broadcasting or those who wish extensive directed study in creative writing or production projects. May be repeated. E

5610 Public Affairs Broadcasting (3) News and public affairs function in broadcasting stations and networks, including management, economics, personnel utilization, sources of program materials, ethical and legal aspects. Public affairs program development, particularly press conferences, interviews, and news specials. Prereq: 3610 or consent of instructor. W

5620 Broadcast Law and Regulations (3) Socioeconomic, legal, and public pressures upon station policies. Emphasis on unique situation of broadcasting in terms of regulations. Prereq: Journalism 4410 or 5210 or consent of instructor. F

5630 Broadcast Documentary Writing (3) Role of documentary in radio and television. Research, writing, and production techniques. Prereq: 4470.

5650 Radio-Television Program Development (3) Planning basic program structures for broadcasting stations. Historical trends in programming and current programming practices as related to audience requirements, governmental policy, and competitive conditions. Individual studies of program development on both local station and network levels. Prereq: 2750 or consent of instructor. Su, F

5970 Independent Study (3) E

School of Journalism

Professors: J. A. Crook (Director), Ph.D. Iowa State; J. B. Hackett, Ph.D. Minnesota; B. K. Leiter, Ph.D. Southern Illinois; J. R. Lynn, Ph.D. Vanderbilt.


Assistant Professors: M. L. Kern, M.S. Florida State; J. P. McKerns, Ph.D. Minnesota.

3120 Writing Feature Articles (3) Selection of topics and practice in writing feature articles for newspapers, magazines, and company publications. Prereq: 2220 or consent of instructor. E

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

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

3720 Advanced Public Relations (3) Preparation of communications materials to gain support from various publics: public relations programs. Prereq: 3710. F, Sp

3810 Specialized Publications (3) Editorial and design management of special publications and small magazines. Prereq: 2230 and 3310 or consent of instructor. W, Sp

3910 Journalism Research Methods (3) Use of social science research methods in journalism with emphasis on survey techniques. Interpretation and communication of research findings to public: W, Sp

4130 Editorial Writing (3) Analysis of editorial policies, practices, pages. Writing of editorials and columns, with emphasis on study and use of rhetoric, style, and logic. Prereq: 3710. F

4150 Issues in Journalism (3) Topics vary. May be repeated. Maximum 6 hrs.

4310 Reporting Public Affairs (3) Reporting news of courts, politics, and government. State, county and local coverage. Prereq: 2230 and senior standing. F, Sp

4410 Mass Media and Society (3) Roles and responsibilities of mass media in society. Critique of mass media performance. Media codes and controls on the media. E

4420 Newspaper Management (3) Daily and weekly business operations. Developments in newspaper management. Sp

4560 Investigative 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: 2220. W

4710 Public Relations Cases (3) Case studies and application of public relations principles to problems in businesses and organizations and their publics. Designed for the advanced student with an interest in public relations. Prereq: 3720. F, Sp

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

4910 News and Feature Photography (3) Advanced principles and methods in black-and-white photography. Emphasis on news and feature photography, and picture stories. Prereq: 3910 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; barriers to the flow of information; comparison of world press systems. F

4970 Independent Study (3) May be repeated. Maximum 6 hrs.

5210 Government and the Press (3) Historic and current problems in the relations of executive, judicial, legislative, and regulatory segments of government and press. Prereq: 3110 or consent of instructor. W

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

5510-20-30 Writing and Editing Projects (3, 3, 3) Specialized writing or editing interests, such as agriculture, politics, labor, finance, science, technical as well as general publications. Prereq: 2220 or 2230.

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

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

5810 Magazine Editing and Production (3) Analysis of editorial and production problems of general, regional, and specialized publications. Reader interest evaluation. Individual editorial projects. Prereq: 4410 or consent of instructor.

5950 Communications and International Development (3) Seminar emphasizing mass media in na-
tional and international development. Communications and change in developing countries. Problems in international and cross-cultural communications. Prereq: 4950 or consent of instructor.

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

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

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

The Ph.D. program with a major in Education provides five options for study in the departments of Curriculum and Instruction, Educational Administration and Supervision, Educational and Counseling Psychology, Physical Education, and Vocational-Technical Education. The program requirements and the options and emphases are:

### The Program

<table>
<thead>
<tr>
<th>Research Area</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Foreign or Computer Language</td>
<td>0-9</td>
</tr>
<tr>
<td>General Core Requirements</td>
<td>6</td>
</tr>
<tr>
<td>Courses in learning theory, curriculum theory, and administrative theory</td>
<td>9</td>
</tr>
<tr>
<td>Trans-college seminar—four consecutive quarters</td>
<td>4</td>
</tr>
</tbody>
</table>

### Options and Emphases

**Option I. Administration Theory and Practice**
- The Administration of Higher Education
- Contemporary Economics and Educational Finance
- Educational Planning
- Facility Planning
- Maintenance of School Plants
- Organizational Theory
- Personnel Administration
- The Politics of Education
- The Principalship
- School Law
- The Superintendency
- Supervision

**Option II. Theories of Curriculum Development and Foundations of Education**
- Anthropological, Historical, Philosophical, and Sociological Bases for Educational Planning and Curriculum
- Principles and Models for Planning, Developing, and Evaluating Educational Programs
- Research Design for Educational Programs

**Option III. Instructional Theory and Practice**
- Principles and Models for Instructional Improvement
- Subject Areas of Instruction and Practice: i.e., English, Foreign Languages, Mathematics, Science, Social Studies, etc.
- Elementary and Early Childhood Instruction and Practice
- Learning Media Services
- Physical Education Instruction and Practice
- Adapted Physical Education
- Vocational-Technical Fields of Instruction and Practice

**Option IV. Theories and Practices of Educational and Personal Adjustment**
- Assessment (Educational, Vocational, Personality)

**Specialization:**

- Major Option—A minimum of 24 hours normally selected from one or two emphases within the major option. (May be selected from any one of the five options but not a combination of options.)
- Supporting Emphasis—A minimum of 12 hours selected from an emphasis other than those emphases selected in the major option. (May be selected from any one of the five options but not a combination of options.)
- Cognate—A minimum of nine hours selected from outside the College in addition to the designated research courses.

<table>
<thead>
<tr>
<th>Dissertation</th>
<th>Minimum</th>
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<tr>
<td>36 Hours</td>
<td>Minimum</td>
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</table>

**Masters of Science**

- Emphasis: (demonstrate proficiency)
  - Anthropological, Historical, Philosophical, and Sociological Bases for Educational Planning and Curriculum
  - Principles and Models for Planning, Developing, and Evaluating Educational Programs
  - Research Design for Educational Programs

**Specialization:**

- Major Option—A minimum of 24 hours normally selected from one or two emphases within the major option. (May be selected from any one of the five options but not a combination of options.)
- Supporting Emphasis—A minimum of 12 hours selected from an emphasis other than those emphases selected in the major option. (May be selected from any one of the five options but not a combination of options.)
- Cognate—A minimum of nine hours selected from outside the College in addition to the designated research courses.

<table>
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<tr>
<th>Dissertation</th>
<th>Minimum</th>
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<tbody>
<tr>
<td>9 Hours</td>
<td>Minimum</td>
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</table>
curriculum offerings with architectural designs, organizing regional institutes to promote innovative construction concepts, encouraging full staff utilization to secure an optimal learning environment, facilitating renovative projects within existing buildings, and conducting custodial clinics on proper maintenance techniques. Course work relating specifically to school planning is offered through the Department of Educational Administration and Supervision, while two-year graduate assistantships are under the administrative auspices of the Laboratory.

Departments of Instruction

Art and Music Education

C. H. Ball, Head

Art Education

MAJOR

DEGREE

Art Education

M.S.

H. N. Null, Ed.S. Peabody.

Assistant Professors:


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:

<table>
<thead>
<tr>
<th>Quarter hours</th>
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</thead>
<tbody>
<tr>
<td>1. Art Education 5310, 5320 and electives</td>
</tr>
<tr>
<td>2. Education Curriculum and Instruction 5710, 5720</td>
</tr>
<tr>
<td>3. Minor (selected with committee)</td>
</tr>
<tr>
<td>4. Thesis (Art Education 5000)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Quarter hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Art Education 5210, 5310, 5320, and electives</td>
</tr>
<tr>
<td>2. Education Curriculum and Instruction 5800, and electives</td>
</tr>
<tr>
<td>3. Minor (selected with committee)</td>
</tr>
<tr>
<td>4. Electives</td>
</tr>
</tbody>
</table>

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 comprehensive examination. Both the oral and written exams are conducted by the student's Master's degree committee.

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

3210 Art in the Secondary School Program (3) Program planning; materials and equipment; relation to other school experiences. Classroom observation. Prereq: 9 hrs art education. 1 hr and 2 labs. F, Sp


3930 Textiles in School Program (3) Exploration of processes of weaving, stitching, batik, and silk screens. Prereq: 2100. 1 hr and 2 labs.

4120 Designing of Teaching Aids for Art in School Program (3) Design and preparation of charts, exhibitions, slides, films, and other teaching aids for grades one through twelve. Prereq: 2100 or consent of instructor. 1 hr and 2 labs. W, Su

4130 Three-Dimensional Design in School Program (3) Exploration of wood, wire, metal, plastics, and other sculptural materials. Prereq: 2100 or consent of instructor. 1 hr and 2 labs. F, Sp

4150 Lettering, Posters, and Displays in the School Program (3) Design and layout; techniques and procedures. Prereq: 2100 or consent of instructor. 1 hr and 2 labs. W, Su

4160 Appreciation of the Arts in the School Program (3) Prereq: 2100 or consent of instructor. 1 hr and 2 labs. Summer

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

5000 Thesis (1-15) E

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

5210 Organization, Administration, and Supervision of Art in the School Program (W) W

5310 Art in Education (3) Historical background, current philosophy, theory, and trends; nature and function of aesthetic behavior in visual arts; relationships to psychology, sociology, and anthropology. F

5320 Program Development in Art Education (3) Objectives, organization, content selection, facilities, and equipment; supervision; evaluation; professional growth; leadership and community relationships; art for special student. Summer

5650-60-70 Problems in Art Education (3, 3, 3) Prereq: Consent of instructor. E

Music Education

MAJOR

DEGREE

Music Education

M.S.

C. H. Ball (Head), Ph.D. Peabody;

A. W. Humphreys (Emeritus), Ed.D. Illinois;

J. H. Jones (Emeritus), Ed.D. Columbia;

W. J. Julian, Ph.D. Northwestern.

Associate Professors:

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

J. D. Minta, Ed.D. Columbia;

A. J. Palmer, Ph.D. California (Los Angeles);

A. W. Tipp, Ph.D. Michigan.

Assistant Professor:

M. C. Moore, Ph.D. Michigan.

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 hours), the music education major (18 hours), minor areas in music (9 hours), and professional education (9 hours). Required courses: Music Education 5000, 5210, 5220, 5230; Curriculum and Instruction 5710.

Requirements for non-thesis option:

1. Minimum of 51 quarter hours of course

Behavioral Interventions

Counseling Theory, Research, and Practice

Growth and Development in Counseling

Behavioral Psychology Applications in Counseling

Societal and Cultural Influences on Counseling

Clinical Assessment in Counseling

Evaluation of Counseling Services

Prevention of Disability

Psychological Interventions in School and Community Settings

Prevention of Disabilities in Education

Psychological Foundations of School Psychology

Philosophical and Sociological Foundations of School Psychology

Psychological and Educational Factors Related to Fitness and Performance

Ethics and Professional Standards in Counseling

Theories of Counseling

School Counseling and Counseling in the General Setting

Conference and Consulting Activities in Counseling

CFR 8-12, 2100, and electives 9

CFR 2100. 1

CFR 4160 Appreciation of the Arts in the School Program (3) Prereq: 2100 or consent of instructor. 1 hr and 2 labs. Summer

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

CFR 5000 Thesis (1-15) E

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

CFR 5210 Organization, Administration, and Supervision of Art in the School Program (W) W

CFR 5310 Art in Education (3) Historical background, current philosophy, theory, and trends; nature and function of aesthetic behavior in visual arts; relationships to psychology, sociology, and anthropology. F

CFR 5320 Program Development in Art Education (3) Objectives, organization, content selection, facilities, and equipment; supervision; evaluation; professional growth; leadership and community relationships; art for special student. Summer

CFR 5650-60-70 Problems in Art Education (3, 3, 3) Prereq: Consent of instructor. E

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

CFR 6500-60-70 Problems in Art Education (3, 3, 3) Prereq: Consent of instructor. E

CFR 7500-60-70 Problems in Art Education (3, 3, 3) Prereq: Consent of instructor. E

CFR 8500-60-70 Problems in Art Education (3, 3, 3) Prereq: Consent of instructor. E

CFR 9500-60-70 Problems in Art Education (3, 3, 3) Prereq: Consent of instructor. E

SCHOOL PLANNING LABORATORY

The School Planning Laboratory (SPL), located in Claxton Education Building, assists schools and colleges in integrating
College of Education

work with a minimum of 26 hours at the 5000 level.

2. Evidence of ability to understand and interpret research through completion of:
   a. Curriculum and Instruction 5610 or equivalent.
   b. Music Education 5710.
   c. Satisfactory performance of research activities in required courses in music education listed below.

3. Curriculum:
   a. For at least 72 quarter hours in music education.
   b. A minor: at least 15 quarter hours in music.
   c. 9 quarter hours in professional education (using Curriculum and Instruction 5610 and Educational Psychology 4760 or equivalents and a 3-hour elective.

4. Specific course requirements:
   a. Music Education Foundation (15 quarter hours) including: One Seminar (3 hours), 5210, 5240, 5250, 5710.
   b. Music: Six quarter hours in applied music (piano; voice; a band or orchestra instrument; or theory and composition).
   c. Education (limited to elective of 6 quarter hours): Educational Psychology 4760 or 5050, 5320, or other appropriate course in educational psychology with 3 hours credit.
   d. Music: 12 credit hours from courses numbered 5000.
   e. Music: 9 credit hours from courses at the 5000, 4000, or 5000 levels. No courses required in the undergraduate curricula may be included.
   f. Education: 3 credit hours, elected from other departments in Education.
   g. Education in addition to routine examinations:
      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.
   h. The presentation in public performance of an original musical composition(s) accepted by the committee as music suitable for school music performing groups.
   i. Aural: In addition to required courses, the major will 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.
   j. Student's Committee: A minimum of three faculty members—the advisor from music education; one member from music; one member from education.

4441-42-43 Teaching Class Piano (1, 1, 1) For majors in music, music education, or elementary education. Prereq: Consent of instructor. F, W, SP
4460 Marching Band Techniques (3) Functions, organization, and direction of a school marching band. Prereq: Consent of instructor. Coreq: 3511: F, Sp
5000 Thesis (1-15) E
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E
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 administration and teaching of music in school relationship of music with humanities in curriculum. Sequel to 3150.
5210 Psychological Foundations of Music (3) Perception; function; aesthetics; talent measurement; implications for teaching theory and practices. A review of classic and current experimental studies. Prereq: consent of instructor.
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 management and teacher-made tests applicable to music and specialized evaluative techniques for use in classroom situations. Uses of musical aptitude and achievement tests. Statistical measures applied to learning music. Prereq: General psychology, educational psychology, and elementary statistics. Su
5250 The Role of Music in Education (3) 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: 3120 or 3130 or consent of instructor.
5270 Studies of Music for Children in the Primary Grades (3) Children's growth processes in music for Grades K-3. Prerequisite: experience or study in music education. Prereq: 3120 and 3130 or consent of instructor.
5320 Advanced Choral Literature and Conducting (3) Reading, conducting, and interpreting vocal scores suitable for school, church, and community groups; emphasis on contemporary and standard music literature. Prereq: Undergraduate degree with a major in music or music education; 4450, 4510 or equivalent.
5350-56-70 Special Problems in Music Education (3, 3, 3) Current problems in music education at all levels of instruction and in various specialized areas of music curriculum. Prereq: 5710 or equivalent and consent of instructor. E
5410 Advanced Music 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; 4430 or equivalent.
5510-20-30 The Talent Education Program of Shinichi Suzuki (2, 2, 2) Study of the psychology, procedures and literature utilized by Shinichi Suzuki in Talent Education program in Japan. Prereq: Consent of instructor. F, W, Sp
5710 Research in Music Education (3) Prereq: Consent of instructor. Su
5810 Seminar (3) Music teaching in 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 vocal and general music areas of junior high school curriculum. Survey of research, professional literature and development of bibliography. Prereq: Admission to M.S. program.
5830 Seminar (3) Music teaching in instrumental areas of the elementary, junior high, and senior high school curriculum. Survey of research, professional literature and development of bibliography. Laboratory activities. Projects. Prereq: Admission to M.S. program.
5840 Seminar (3) Music teaching in vocal, theoretical, historical, and appreciation areas of 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.
College Student Personnel M.S.

Professors:

Associate Professor:
K. C. McCollough, Ph.D. Florida State.

Assistant Professor:

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 requiring a minimum of 45 hours, and a non-thesis option requiring a minimum of 51 hours. For each option, 9 hours must be completed in the behavioral sciences.

The Master of Science degree in College Student Personnel is designed for individuals interested in entering the field of student personnel administration in colleges and universities, and in community or junior colleges. The program has both a thesis and non-thesis option. A minimum of 60 hours, which includes 9 hours of practicum experience, is required. For further information write the Department of Continuing and Higher Education.

5454-55-56 Student Leadership Workshops (1, 1, 1) Small group and individualized experiences to develop knowledge and skills in leadership roles; for resident assistants, student government leaders, student activities, other student organizations. Prereq: Consent of instructor. S/N only.
5500 Thesis (1-15) E
5602 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E
5600 Adult Education: A General Survey (3) Historical and philosophical foundations of adult education, agencies, programs, current issues, and literature of adult education. F, Sp
5610 Seminar in College Teaching (3) Effective college teaching, testing and measurement; recent research in college instruction; major problems and issues in higher education. Required of candidates for the MACT degree. S/N only. Sp
5830-70-80 Problems in Continuing and Higher Education (1-3, 1-3, 1-3) Independent study of problems and special institutes. S/N only. E

54
5410 College and University Law—The Legal Environment (3) Legal precedent affecting organization, administration and processes of public higher education. Academic freedom, faculty tenure, taxation, private support, religion, tort liability, and related federal regulations. Prereq: 5420 or consent of instructor. F

5420 College and University Law—Constitutional Rights and Responsibilities of Students (3) Legal precedent affecting student personnel services in public higher education. Student discipline, housing, drawing, organizations, activities, fees, tuition, and related federal regulations. F

5430 College and University Law—Tort Liability and Risk Management (3) Legal precedent concerning liability exposure of public institutions of higher education. Personal and institutional liability. Basic principles of risk management and liability insurance. Prereq: 5410 or equivalent. W

5440 American Higher Education (3) Purposes, functions, organizations, and programs. F, Sp

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

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

5470 The Curriculum of Undergraduate Higher Education (3) Background, content, and organization of instructional programs, trends, and evaluation procedures including accreditation activities. Prereq: 5460 or equivalent. F

5510 Governance of Colleges and Universities (3) Development, change, trends, process, and structure of collegiate government. F

5550 Fiscal Problems in Higher Education (3) Revenue sources and fiscal management in public and private colleges and universities. Sp

5560 Program Planning in Continuing and Higher Education (3) Theory and method for planning adult education programs. W

5750 Student Personnel in Higher Education (3) Philosophy and scope. W

5770 Case Studies in College Student Personnel (3) Prereq: 5750 or consent of instructor. F

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

5955-65-75 Practicum in Continuing and Higher Education (1-3, 1-3, 1-3) Supervised practice in selected areas of instruction or administration of continuing or higher education programs. S, N, or C only. E

5960-70-80 Seminar in Continuing and Higher Education (1-3, 1-3, 1-3) Problems and issues confronting professionals in fields of adult or higher education. E

5990 Practicum in College Student Personnel (3) Prereq: 5750, 5770. Educational Psychology 5560, or consent of instructor. May be repeated with consent of instructor. Maximum 9 hrs. W

6450 Advanced Seminar in Program Planning (3) Concepts and theories related to program planning in continuing and higher education. Prereq: 5660 or equivalent.

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

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 Media and Technology M.S.
Mathematics Education M.S.
Reading Education M.S.

Science Education M.S.
Social Science Education M.S.
Education Ph.D.

Professors:

Assistant Professors:

Assistant Professors:

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, the Doctor of Education degree, and the Doctor of Philosophy in Education degree.

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

THE SPECIALIST PROGRAM
The Educational Specialist degree program with a major in Curriculum and Instruction encompasses concentrations in the following areas: curriculum, educational leadership, English education, foreign language education, instructional media and technology, mathematics education, science education, social science education.

THE DOCTORAL PROGRAM
The Ed.D. program in Curriculum and Instruction may include emphasis upon the following fields: curriculum, social foundations, educational research, elementary education, English education, foreign language education, mathematics education, science education, social science education. The Doctor of Philosophy degree with a major in Education includes options and emphases as listed on page 8.

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 Educational Culture in Perspective (3) Contributions of anthropological concepts (primary concepts of culture) to understanding of education processes, problems, and thought in our society and others. (Same as Anthropology 4110.)

4111 Non-Western Education: Anthropological Approaches (3) (Same as Anthropology 4111)

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

4216 Curruculum in Elementary School Social Studies (3) Survey of current curricular approaches and trends in elementary school social studies. Prereq: Teaching experience or student teaching. Sp, Su

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

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

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 courses or background in teaching elementary school language arts.

4230 Introduction to Diagnosis and Correction of Classroom Arithmetic Difficulties (3) Classroom strategies for diagnosis and correcting arithmetic difficulties grades 1-8. Prereq: 3350 or 3751 or 4216 or equivalent.

4240 Classroom Instructional Organization (3) Developing understandings and skills relating to grouping, individualization, space utilization, organization, grading, integration, and achieving an effective social environment for elementary classroom teachers. Prereq: 3350 or 3751.

4250 Initiating the Activities Program (3) Prereq: Educational Psychology 2430. 6 hrs of methods of teaching in elementary school.

4260 Philosophy of Education (3) Truth, knowledge, and valuation in relation to work of the schools. Prereq: 3010, Educational Psychology 2430 or 3810, or equivalents. E

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

4280 Diagnosis and Correction of Classroom Reading Problems (3) Prereq: 3280 or equivalent. E

4300 Developmental Reading in Secondary School and Community College (3) Approaches and materials for teaching reading and procedural reading in secondary schools and colleges. Prereq: Course in reading.

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

4303 Language Development of Children: Birth-Preadolescence (3) In-depth view of language development from birth through preadolescence. Application of procedures for development of instructional programs for early and middle childhood.
4304 Developing Reading Skills in Content Fields (3) Approaches and techniques for teaching reading skills in content areas of school program. Emphasis on early school and secondary school programs. Prereq: Consent of instructor.

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

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

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

4352-62-72 Problems in Teaching Social Studies (3, 3, 3)

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

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

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

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

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

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

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

4400 Problems in Improvement of Instruction (1-3) Special conferences, workshops, or in-service programs designed for improvement of instruction. May be repeated. Maximum 9 hrs. SNC only.

4410 Educational Sociology (3) (Same as Sociology 4410.)

4430 Problems in Improvement of Instruction (3) May be repeated. Consent of instructor. Maximum 9 hrs. SNC only.

4440 Problems in Improvement of Instruction (1-3) Special conferences, workshops, or inservice programs designed for improvement of instruction. May be repeated. Consent of instructor. Maximum 9 hrs. SNC only.

4500 Teaching in Kindergarten: Overview (3) Relation of kindergarten to total elementary program: goals, historical settings and current developments. E

4451 Teaching in Kindergarten: Program Development (3) Curriculum planning and organization, classroom management. Prereq: Consent of instructor. E

4530 Current Educational Problems (3)

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

4750 Utilization of Instructional Media (3) Introduces the basic communications process, media, instructional media, instructional development, selection and utilization of media, and basic socio-cultural environment. (Same as Library and Information Science 4750 and Vocational-Technical Education 4750.) E

4840 Introduction to Data Processing in Education (3) Analysis of current activities in field of educational data processing. Emphasis on curricular, administrative, and research opportunities in education, using modern electronic data processing methods and machines.

4860 Programmed Learning (3) Theories of learning as related to technology of programmed instruction; techniques and applications of programming. Prereq: Psychology 3210, Educational Psychology 3730, or consent of instructor. (Same as Psychology 4860) 4 hrs. and 1 lab.

5000 Thesis (1-15)

5002 Non-Thesis Graduation Completion (2-15) Required for the non-thesis student not otherwise registered during any quarter when such a student unenrolls from academic programs and is not taking credit hours. Consent of instructor. Prereq: Psychology 3210. 4 hrs. and 1 lab.

5007 Seminar in Intercultural Education (3) Analysis of selected problems: political factors in 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.

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

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


5140 Comparative Philosophies of Education (3) Educational theory and policy proposals of the major philosophic schools of thought. Prereq: 4260 or equivalent.

5141 Pragmatism in Education (3) Effects of American pragmatist tradition on educational policy and practice. Prereq: At least one course in history or philosophy of education.

5142 The Existential Student (3) Literature of existentialism as source for harmonizing student's educational goals and curriculum.

5143 Supervised Readings in Philosophy of Education (3) Prereq: At least 9 hrs history or philosophy of education.

5150-60-70 Seminar (1-3, 1-3, 1-3) Curriculum, elementary school development, local problems, and special emphasis as they relate to goals of students' programs. Maximum 9 hrs. SNC only.

5180-90-200 Seminar Educational Specialist Research Methods in Education (3)

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

5211 Instructional Strategies in Elementary School Social Studies (3) Specific teaching methods and instructional procedures for organizing social studies learning. Prereq: Undergraduate social studies course or equivalent.

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

5230 Advanced Study and Practicum in Diagnosis and Remediation of Arithmetic Difficulties (3) Assessment and remediation experience with students having corrective and remedial arithmetic needs. Prereq: 4260 or equivalent. F, Su

5240 Creative Thinking and Expression in the Elementary School (3) Trends, issues, and research findings. Prereq: 3720, 4215, or 5282 or equivalent, or consent of instructor.

5250 Secondary School Instruction (3)

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

5280 The Teaching of Language Arts in the Elementary School (3) Trends, issues, and research in content and method for the language arts program. Prereq: 3261 or consent of instructor.

5281 Teaching Social Studies in the Elementary School (3) Recent trends, issues, and research findings. Prereq: 3261 or consent of instructor.

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

5283 Programs and Materials in Teaching Elementary Science (3) Analysis of new and innovative science program materials, instructional strategies inherent in teaching of these materials. Prereq: 5282 or equivalent, or consent of instructor.

5341 Seminar in Teaching Elementary Science (3) Analysis of current curriculum issues related to elementary science education. Emphasis on individual student presentations, projects, and investigations.

5530 Curriculum Laboratory for High Schools (3) Production of syllabi, courses of study, source units, and other materials.

5580 Curriculum Planning and Development (3)
current curricular issues. Emphasis on individual student projects and investigation. W.
5835 Teaching Mathematics in the Senior High School and Community/Junior College (3) Curriculum and teaching problems. Methods of teaching "analysis" courses such as Algebra II, trigonometry, analytic geometry and calculus. Prereq: 3751-52 or equivalent. Su.
5841 Trends and Issues in Early Childhood (3) Historical background, trends, and issues as basis for evaluating current programs; materials and techniques of teaching. F. Sp.
5842 Problems in Education: Early Childhood Education (3) May be repeated. Maximum 9 hrs. Six hrs may be taken concurrently. W.
5843 Seminar in Early Childhood Education (3) Analysis of research in early childhood education (K-3) with emphasis on application to programs and methods of instruction. Prereq: 5710 or 5800 or equivalent. W.
5844 Mathematics in Early Childhood Education (3) Behavioral characteristics of children in regard to mathematics, content materials and functional instructional setings, and teaching strategies for development of mathematical ideas. Prereq: 3350 or equivalent. Su.
5845 Social Studies and Science in Early Childhood Education (3) Integrative approaches to and substantive classification systems of content areas of social studies and science for early childhood years. Emphasis on selection of appropriate social studies and science content and approaches for the young child. Prereq: 3570 and 3720 or equivalent. F. Su.
5846 Language Arts in Early Childhood Education (3) Language development of young learner with emphasis on teaching methods, procedures, program and materials in early childhood language arts program. Prereq: 3260 and 3280-81 or equivalent. Su.
5850-60-70 Problems in Education: English (3, 3, 3)
5851-61-71 Problems in Education: Mathematics (3, 3, 3)
5852-62-72 Problems in Education: Social Studies (3, 3, 3)
5853-63-73 Problems in Education: Science (3, 3, 3)
5854-64-74 Problems in Education: Language Arts (3, 3, 3)
5855-65-75 Problems in Education: General Curriculum (3, 3, 3)
5856-66-76 Problems in Education: Instructional Materials (3, 3, 3)
5857-67-77 Problems in Education: Foreign Languages (3, 3, 3)
5859-69-79 Problems in Education: Conservation (3, 3, 3)
5899 Field Experience (1-6) Application of curricular and instructional principles, methods, and materials in schools. Program prerequisites must be met, and consent of instructor required. May be repeated. Maximum 12 hrs. SHC only.
5901 Linguistics and the Teacher of English (3) Analysis and application of linguistics in the classroom. Su.
5902 Teaching Composition in the High School (3) Techniques in teaching rhetoric. W.
5903 Teaching Fiction in the Secondary School (3) Reading, study, and analysis of literary selections. F.
5905 Teaching English in the Community/Junior College (3) Emphasis on thorough understanding of communication needs of community/junior college students and effective strategies and materials for meeting these needs. Su.
5906 Teaching Poetry in Grades 7-12 (3) Materials and strategies for teaching poetry. F.
6350 Seminar in History of Education (3) May be repeated with consent of instructor.
6282 Advanced Studies in Elementary School Science (3) Critical analysis of current research in elementary school science. Prereq: Undergraduate course and one graduate course in science, or equivalent.
6350 The Professional Education of Teachers (3) Basic theories, programs, and practices.
6400 The Dynamics of Educational Change (3) Theoretical and practical issues between educational theory and practice; factors useful in reducing this lag.
6500 Advanced Studies in Early Childhood Education (3) May be repeated. Maximum 6 hrs.
6510 Advanced Studies in Elementary School Language Arts (3) Critical research analysis of selected issues in elementary school language arts. Prereq: 5280 or equivalent and consent of instructor. Sp
6*610-20-30 Seminar in Dissertation Proposal Writing (2, 2, 2) Preparation and evaluation of dissertation proposals. Prereq: Completion of at least one research competency or consent of instructor. S
6710 Advanced Educational Statistics (3)
6720 Interpretation of Data (3) Types of data 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 elementary and secondary schools. Prereq: 5270 or 5410 or equivalent.
6731 Studies in Curriculum Theory and the Structure of Knowledge (3) Major curriculum theories, models, and designs; structures of knowledge and structures of disciplines in elementary and secondary school programs. Prereq: 5270 or 5410 or equivalent.
6740 Curriculum Workshops in Instructional Improvement (3) Observation and participation in workshops sponsored by College of Education; evaluation and analysis of workshop approaches to teacher education and instructional improvement.
6750-60-70 Problems in Curriculum and Instruction (3, 3, 3)
6830 Studies in Mathematics Education (3) Reading and study related to historical trends and issues in mathematics education in United States providing broad perspective on current curricular problems and future trends. Prereq: 5830 or consent of instructor.
6850 Principles of Educational Leadership (3) Conflicting concepts, with application to major problems of instruction, supervision, and administration.
6899 Internship (1-6) Independent experience in application of principles and practices of curriculum development and instructional improvement. Program prerequisites must be met and consent of instructor required. May be repeated. Maximum 12 hrs. S/NC only.

*May not be used toward meeting 6000 requirements.

Education
MAJOR DEGREE ED. PH.D.
6001 Trans-College Seminar (1) Minimum of four consecutive quarters of required of all Ph.D. students. Prereq: Admission to Ph.D. program. May be repeated. May not be used to meet 6000 requirement. S/NC only.

Educational Administration and Supervision
MAJOR DEGREES M.S., Ed.S.
6380 Instructional Supervision—School District (3) May be repeated. E
6358 Instructional Supervision—School District (3) May be repeated. E
6220 Programs for the Professional Preparation of Administrator Update (3) Current topics of performance of critical tasks of educational administration. Prereq: Consent of instructor. May be repeated. S/NC only. F
5870 Maintenance of School Plants (3) Skills in operation of school custodial and maintenance programs. Sp
5810 Survey Research Methods (3) Overview of descriptive studies, data collection, analysis, and interpretation of student and school survey strategies for descriptive research in education. W, Su
5850-60-70 Independent Study in Educational Administration (3, 3, 3) Prereq: Consent of instructor. E
5890 Decision Making and Decision Theory in Educational Organizations (3) Theoretical constructs undergirding executive decision making; direct application of decision theory problem-solving activities for preservice and practicing administrators. Executive decision making at several administrative levels in complex educational organization. S/NC only. A
5900 Special Topics (3) May be repeated. E
5910-20-30 Problems in Lieu of Thesis (3, 3, 3) E
5950 Elementary Administrators Seminar (3) For in-service training of elementary school administrators. Development of problems, programs, and trends of elementary schools and management skills of elementary school administrators. Prereq: Presently an elementary school administrator or consent of instructor. May be repeated. S/NC only. F
5960 Middle School Administrators Seminar (3) For in-service training of middle school administrators. Development, programs, problems, and trends of middle schools and management skills of middle school administrators. Prereq: Presently a middle school administrator or consent of instructor. May be repeated. S/NC only. F
5970 Secondary Administrators Seminar (3) For in-service training of secondary school administrators. Development, problems, programs, and trends of secondary schools and management skills of secondary school administrators. Prereq: Presently a secondary school administrator or consent of instructor. May be repeated. S/NC only. F
6000 Doctoral Research and Dissertation (3-15) E
6040 Seminar in Educational Administration and Supervision (1) Required three consecutive quarters. S/NC only. E
6100 Internship in Educational Administration (3) May be taken with consent of student's committee. Opportunity for doctoral students and advanced graduate students to gain experience in performance of administrative tasks of educational administration under supervision of practitioner and University representative. E
6110 Administrator Update (3) Current topics of concern to practicing school administrators; selected each quarter and presented by a specialist. Prereq: Presently a school supervisor or administrator, or consent of instructor. May be repeated. S/NC only. E
6190 Administration in Higher Education (3) Developing conceptual understanding of administrative theory and practice in higher education. F, Sp
6220 Programs for the Professional Preparation of Educational Administrators and Supervisors (3) E
6340 Current Trends in School Law (3) Logical arrangement of case and statutory material for public school administration; in-depth examination of problems concerning the law and public education. W, Su
6350 Instructional Supervision—School District (3) Definition and analysis of instructional supervision at the local level. Supervisory operations, including goal development; curriculum development; instructional support, help, and service for teachers; and administrators; personnel development; program evaluation. W, Su
6420 School Board-Superintendency Relationships (3) The local unit of school administration, school board and its governing body, board of education or school board. Sp
6440 School Business Management (3) Emphasizes superintendency task concept; planning, procurement and utilization of fiscal resources. F, Su
6450 Grant and Contract Proposal Preparation (3) Grants and contracts processes in education. Basic concepts applicable to other special agencies. S
6460 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, and promotion; personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. F, W, Su
6480 Special Topics in School Personnel Administration (3) Human problems in school personnel administration; staff planning, record systems, personnel policy development; collective bargaining in education; and staff evaluation. May be repeated. Maximum 12 hrs. F, W, Sp
6530 Futuristic Educational Planning Methods (3) Methods for describing alternative futures. W
6540 Contemporary Economics and Educational Finance (3) Contemporary educational finance policies and their influence on educational service and programs. Personal economic policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations and political science. One field inquiry. Prereq: Consent of instructor. May be repeated. S/NC only. F
6550 State-Federal Relations in Education (3) Purposes and functions of federal/state/local educational organizations; interorganizational control and political variables. Major education laws, rule and regulation-making process, grants and contracts as interlevel issues. S
6560 Legal Foundations of Public Education (3) Legal framework and theoretical concepts that impinge on operation of schools within present legal structure of the United States. Sp
6560 Seminar in Managing Conflict (3) Learning about and experiencing various forms of conflict. W, Su
6750-60-70 Independent Studies in Educational Administration and Supervision (3, 3, 3) Prereq: Consent of instructor. May be repeated. E
6800 Administration of Complex Educational Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational organizations. W, Sp
6870 Advanced Study in School Facility Planning (3) In-depth experiences in development of educational specifications and techniques of leadership in treatment of facility needs. S
6900 Special Topics (3) May be repeated. E
6981 Specialized Seminar: School Operation (3) E
6982 Specialized Seminar: Higher Education (3) Current policy development, organizational relationships, and administrative issues in higher education. W, Su
6983 Specialized Seminar: State School Administration (3) E
6984 Specialized Seminar: Preparation Programs (3) E
6990 Specialized Doctoral Seminar in Politics of Education (3) Political theories and practices as they affect operation of public school system. Appropriate interdisciplinary discussions based on literature and research from education, sociology, and political science. One field inquiry. Prereq: Consent of instructor. A
6991 Specialized Seminar: Theory (3) E
6992 Specialized Seminar: Finance (3) E
6994 Specialized Seminar: Business Management (3) E
6995 Specialized Seminar: Personnel (3) E
6996 Specialized Seminar: School Plant (3) Theory and practice in planning and operating educational facilities: related research in education and other disciplines; implications for further research, application of existing knowledge to known school facility settings. Prereq: Consent of instructor. A
6997 Specialized Seminar in Organization and Structure (3) Organizational theories in education including systematic review of status of organizational and leadership research in education and related disciplines; implications for further research; application of educational theory and research in known educational settings. Prereq: Consent of instructor. A
6998 Specialized Seminar: School Law (3) E
6999 Specialized Seminar: Supervision (3) Sp

Educational and Counseling Psychology

MAJORS

DEGREES

M.S.

M.S.

Educational Psychology

Educational Psychology

Ed.D.

Ph.D.

Guidance

Guidance

College of Education
4130 Mental Health (3) Studies and exploration of positive mental health. Application of mental health criteria to a study of one's self based on a battery of personality assessment instruments.

4350-60-70 Special Topics and Problems (1, 1, 1) (Same as Psychology 4510-11-12.) S/NC only.

4440 General Evaluation Procedures for Public School Personnel (3) (Same as Psychology 2430.) E

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

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

4760 Advanced Child Study (3) Prereq: 2430 or 3810 or consent of instructor. W, Su

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

4810 Psychosocial Aspects of Appalachian People (3) Exploration of psychology of people of Appalachian region through examination of history, culture, and role of education. W, Su


4830 Differential Psychology (3) Nature and sources of individual differences in behavioral characteristics, and differences between racial, ethnic, socioeconomic, sex, and other groups.

4840 Diagnostic and Corrective Teaching (3) Practical procedure for improving pupil's learning. F

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Requisite for the non-thesis track not 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. E

5040 Guidance and Personnel Services in Education (3) (Same as Vocational-Technical Education 5040.) F, Su

5050 Children and Adolescents (3) Mental, social, physical, and emotional growth, development, and learning of children and adolescents; prevention, identification, and remediation of learning problems. W, Su

5060 Group Approaches with Students (3) Knowledge and skills appropriate to functioning with group, counseling, psychological and parent education. F, W, Su

5070 Seminar in Elementary School Guidance (3) Trends, role, function, and administration of guidance in elementary school. Sp

5090 Field Work (1-6) Practical experience in departmentally approved field placement. Supervision by field and University personnel. Program prerequisites must be met. May be repeated. Maximum 6 hrs. S/NC only.

5100 Developmental Psychology (3) (Same as Psychology 5100.) F, W, Su

5101 Advanced Psychology of Adolescence (3) Theory and research on principles and problems of adolescent development: application to individual adolescents. Prereq: 3810 or equivalent.

5110 Psychology of Women (3) Past and current educational and psychological theory and practice with special attention to assumptions and practice in regard to women: sociocultural context in which various theories were developed and current theories and research focused on women and other differences. Prereq: 4130 or basic course in personality theory. E

5111-12-13 Seminar in Current Issues in School Psychology (1, 1, 1) (Same as Psychology 5111-12-13.) S/NC only.

5120 Seminar in Bias-Free Counseling (3) Feminist psychology, bias-free education, and counseling. Prereq: 4110 and 5110 or consent of instructor. May be repeated. Maximum 9 hrs.

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

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

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

5210 Interpreting Published Articles: Statistics (3) Descriptive and experimental research in educational psychology, guidance and counseling, and college student personnel. Prereq: Non-thesis option students only or consent of instructor. F, W, Su

5220 Interpreting Published Articles: Research Design (3) For students not conducting research projects; interpret and evaluate statistical tables and statistical tests as reported in journals. Prereq: 5210 or consent of instructor. W, Sp, Su

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

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

5330 Theory and Research in Human Learning (3) Contempory developments in theory and research and its influence upon school practice. F

5331 Current Developments in Human Learning (3) Sp

5340 Group Dynamics (3) Principles of group dynamics as they apply to a variety of group settings. Group counseling, leadership, and group development and leadership skills. (Same as Psychology 5340.) E

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

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

5720 Evaluation in Education (3) Techniques and instruments of evaluation and design. Evaluation, the thinking processes, social adjustment, emotional needs, personal interests, and problems. W

5760 Career Development: Theory and Research (3) E

5785 Career Development: Program Development Implementation and Evaluation (3) Career development and pre-vocational programs and projects. K-adult with emphasis on development, implementation, and evaluation. Prereq: 5780 or equivalent, or consent of instructor. Sp

5790 Career Development: Workshop (1-6) Designed for in-service training of school personnel. Development, problems, and programs and trends related to career development. May be repeated. Maximum 6 hrs. (Same as Curriculum and Instruction 5790 and Special Education 5790.)

5840 Student Appraisal (3) Gathering, interpreting, and using data for development of guidance programs and individual counseling. Prereq: Educational Psychology or Psychology 4640 or equivalent in standardized testing, (Same as Psychology 5840.)

5850-60-70 Special Topics and Problems in Educational Psychology and Guidance (1-6, 1-6, 1-6) May be repeated. May be taken for letter grade or S/NC. E

5860 Career Development: Occupational and Educational Resources (3) Gathering, interpreting, and using educational, occupational, and community information in the guidance program; sources, types of materials, and occupational filing plans. For use both in group and individual guidance programs. W, Su

5885 Career Development: Field Experience (1-3) Application of career development principles and practices in schools, community, business, and industry. May be taken concurrently or separately. 5760, 5780, 5785, 5880, and/or consent of instructor. May be repeated. Maximum 6 hrs. E

5890 Counseling Theories and Techniques (3) Presentation, demonstration, and application of counseling theories and techniques. Open to students interested in the counseling process. (Same as Psychology 5890.) F, W, Su

5897 Practicum (3) Didactic experiences and counseling simulations in learning laboratory. Coreq: 5890. E

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

5940 Counseling Practicum (3) Supervised practice in counseling in elementary or secondary school guidance and/or student personnel work. Prereq: 4640, 5060 (or 5340), 5890, 5897 or consent of instructor. May be repeated with consent of department. Maximum 6 hrs. E

5945 Group Counseling Practicum (3) Supervised practice in group counseling with children and/or adults. Prereq: 5340, 5890, 5897, and 5940 and consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

5950-60 Theory and Practice of Consultation (3, 3) (Same as Psychology 5950-60.)

5959-69 Practicum in Consultation (2, 2) (Same as Psychology 5959-69.) S/NC only.

5960 Organization and Administration of Counselor Programs (3) Basic principles, procedures, and policies. Prereq: 4130, 4640 or consent of instructor. W

6000 Doctoral Research and Dissertation (3-15) E

6040 Seminar in Educational Psychology and Guidance (1) Required in fall quarter. Maximum 3 hrs. S/NC only. F

6090 Internship (1-6) Supervised employment at departmentally-approved internship sites. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. F

6110 Application of Research Design in Educational Psychology and Guidance (3) Research design and statistical analysis unique to educational psychology, counseling, and college student personnel. Emphasis on designs "experimental" in nature. Prereq: 2 courses in statistics or consent of instructor. F, Sp

6120 Application of Experimental Research Design in Educational Psychology and Guidance (3) Experimental designs used by researchers in educational psychology, counseling, and college student personnel. Prereq: 6110 or equivalent. W, Sp

6319 Field Work in School Psychology: Level II (2) (Same as Psychology 6318.)

6550-60-70 Seminar in College Student Personnel (2, 2, 2) Issues in college student personnel, college counseling, student development, etc. Prereq: Consent of instructor, admission to the doctoral program. S/NC only.

6610-20-30 Seminar in Dissertation Proposal Writing (2, 2, 2) Preparation and evaluation of dissertation proposals. Prereq: Two consecutive statistics courses or consent of instructor. F, W

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

6699 Practicum in School Psychology III (2) (Same as Psychology 6689.) S/NC only.

6700-70 Problems in Educational Psychology and Guidance (3, 3, 3) S/NC only. E

6810 Seminar in Counseling (3) Selected counseling theory, topics, issues. Prereq: 5890 or consent of instructor. May be repeated. F, W, Sp

6840-50-60 Seminar in Professional Issues (1, 1, 1) Job selection, convention participation, publishing, writing grant proposals, consulting, etc. For final year doctoral students only. S/NC only. F, W, Sp

6910 Special Topics Seminar (3) Exploration of special research or theoretical topics with students who have necessary background. Topic will vary from quarter to quarter, depending upon instructor.
EDUCATION OF THE HEARING IMPAIRED

4000 Rehabilitation Practicum (3) Evaluation of client data; planning rehabilitation program. Prereq: 4230. F, Sp
4100 Speech Development of Hearing Impaired (3) Anatomy and physiology of speech system. Relationshi of normal to impaired. Theories and techniques of speech development and improvement; for hearing impaired children. Prereq: Audiology and Speech Pathology 4190. F, Su
4200 Practicum in Speech Development of 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.) W, Sp
4210 Language Development of Hearing Impaired I (3) Systems by which formal language is presented. (Same as Audiology and Speech Pathology 4210.) F, Su
4220 Language Development of 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.) W, Su
4230 Communication Processes for the Hearing Impaired (3) Various communicative skills required by hearing impaired person; speech and language development; auditory training, speech reading, meaning relation to other forms of communication, Observations and practice. (Student must acquire a degree of proficiency in use of manual language.) Prereq: Consent of instructor. E
4231 Communication Processes for Hearing Impaired II (3) Intermediate course in manual communications skills and techniques with emphasis on vocabulary development with receptive and expressive fluency. Prereq: 4230 or consent of instructor. A
4240 Nature of Hearing Impairments (3) Basic principles of audiology; anatomy and physiology of hearing; nature and causes of hearing loss; methods and instrumentation for assessment of hearing level; interpretation of audiograms; selection and use of hearing aids; relation of audiological services to medical and other rehabilitation disciplines. Observations and practicum. F, Sp
4250 Introduction to the Psychology and Education of the Hearing Impaired (3) For those planning to enter field of teaching deaf and hard-of-hearing. Review of history of education of deaf. Research studies relating to psychology, social adjustment, and learning difficulties of professional literature in area of deaf child and adult. (Same as Audiology and Speech Pathology 4250.) E
4280 Curriculum Development in Elementary and Secondary Schools for Hearing Impaired (3) Adaptation of curriculum development and methods in public school education to meet needs of deaf and hard-of-hearing students in residential and integrated settings. W, Su
4290 The Teaching of Reading to Hearing Impaired Children (3) Readiness activities, developmental approaches, theories, and specialized materials for curriculum in teaching reading. Survey of professional literature in area of deaf child and adult. (Same as Audiology and Speech Pathology 4290.) E
4870 Student Teaching with Hearing Impaired Children (6) Supervised practicum with preschool, day school, and residential pupils. S/NC only. F, W, Sp
4871 Practicum with Hearing Impaired Children (6) S/NC only. F, W, Sp
5220 Linguistics in the Education of the Hearing Impaired (3) Recent research and developments in linguistics related to speech development. F, Su
5240 Seminar in Language Remediation for the Hearing Impaired (3) Current and recent developments in educational methodologies and to research pertaining to teaching language to hearing impaired. Research and materials current in use of various sign language systems and adaptations. Emphasis on approaches which accommodate and assist integration of hearing impaired children in regular classrooms. W, Su
5280 Seminar on Educational Implications of Language Deficiency (3) Readings, discussion, and projects on impact of language deficiency on educational programming for children with language deficiency. Sp, Su
5310-20 Manual Communication (2, 2, 2) Basic introduction and advanced studies in finger-spelled and signed forms of communication. Emphasis on ability to express and receive the manual forms. Prereq: Consent of instructor. Must be taken in sequence. F, W, Sp, Su
5400 Educational and Vocational Guidance of the Deaf and the Hard of Hearing (3) Evaluation; test techniques for diagnosis and guidance; social and personality adjustment; occupational opportunities. F, Sp
5540 Seminar in Language Pathology (3) (Same as Audiology and Speech Pathology 5540.)
5620 Curriculum Development Applied to Programs for the Hearing Impaired (3) Current curriculum trends adapted for hearing impaired individuals. New curriculum options in education of these children. Current education theories for programs for hearing impaired children. Prereq: Curriculum and Instruction 5850 or equivalent and consent of instructor. Sp
EDUCATION OF THE MENTALLY RETARDED
4110 The Nature and Concept of Mental Retardation (3) Identification, description, and study. E
4120 Education of the Mentally Retarded Child (3) Philosophical and historical underpinnings and guiding principles of mentally retarded; methods and materials in special and regular classes. Prereq or coreq: 4110 or E
4440 High School Program for the Mentally Retarded (3) Trends, issues and research relating to core and work study programs. E
4810 Student Teaching Mental Retardation (3) Prereq: Major in education of mental retardation. S/NC only. F, W, Sp
4811 Student Teaching Mental Retardation (9) Prereq: Major in education of mental retardation. S/NC only. F, W, Sp
4922 Student Teaching of the Educable Mentally Retarded (3) Observation and supervised practicum. S/NC only. E
5111 Psychology of Mental Retardation (3) Intelectual functioning, psychological theories and learning international and curricular and educational implications emphasized. Prereq: 4410. F, Su
5112 Psychology of the Severely Mentally Retarded (3) Program and curriculum development for training education of severely retarded in public schools, institutions and privately operated schools and workshops. Sp
5113 Advanced Curriculum for the Mentally Retarded (3) Educational models, methodologies, and curriculum in education of mentally retarded children and adults. Emphasis on varied curriculum alternatives to retarded child's education. Sp, Su
MUTIPLE DISABILITIES
4130 Education of the Brain-Injured Child (3) Nature of brain-injured child; skills for indentifying educational, physical, and emotional characteristics; special educational techniques. E
4150 Education of Children with Crippling and Special Health Conditions (3) Medical and educational characteristics; appropriate educational modifications and associated services. Prereq or coreq: 3953 or consent of instructor. E
4840 Educational Problems of the Cerebral Palsied Child at Home and School (3) Physical, social, and educational needs of the cerebral palsied; evaluative techniques; related services. A
4921 Student Teaching in Crippling and Special Health Conditions (3-15) Observation and super-
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, possibilities of preventing and correcting such behavior, and the relationship of the emotional disturbance to the academic achievement of the pupil. Prereq: 4610 and 4620 or consent of instructor. A

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

4630 Practicum in Residential Settings Serving Children with Disturbing Behavior (3) Practice in residential setting with disturbed children. Interpretation of behavior problems within family and community. Prereq: 4610 and 4620 or consent of instructor. A

4640 Practicum in Public School Systems Serving Children with Learning and Behavior Problems (6) Acquiring tutoring capacity within regular classrooms. Particular emphasis and practice in individualizing instruction for learning and behavior problems in 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. A

4924 Student Teaching of the Emotionally Disturbed (3) Individual tutoring and classroom observation of teaching techniques; Curriculum and Instruction 4720 or 4820. S/NC only. A

REHABILITATION COUNSELOR EDUCATION

5100 Orientation to Rehabilitation (3) History, philosophy, and legal bases for rehabilitation movement; fundamentals of physical therapy; types of rehabilitation agencies and facilities; public/private rehabilitation facilities; analysis of appropriate industrial management models related to rehabilitation programs; simulation of work planning, decision making, and case selection. W

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

5121 Job Development and Placement in Rehabilitation (3) Techniques and procedures involved in managing case load; development of preparation programs and public/private rehabilitation facilities; analysis of appropriate industrial management models related to rehabilitation programs; simulated experience in work planning, decision making, and case selection. W

5141 Interpretation of Vocational Evaluation Data in Rehabilitation (3) Procedures, principles, and techniques used in interpretation of vocational evaluation programs. Determining and planning amount of floor space, type of equipment, type and number of staff, and rates of community integration, essential to maintenance of vocational evaluation programs. Effective supervisory, referral, recording, programming, and follow-up work. Prereq: 5141 and 5142. Su

5144 Development and Supervision of Client Evaluation Programs (3) Procedures involved in establishment and maintenance of effective vocational evaluation programs. Determining and planning amount of floor space, type of equipment, type and number of staff, and rates of community integration, essential to maintenance of vocational evaluation programs. Effective supervisory, referral, recording, programming, and follow-up work. Prereq: Consent of instructor. W; Sp; Su

5150-5159 Internship in Rehabilitation (9, 9) Systematic Human Relations Training (3) Active listening, observing verbal and nonverbal behavior, development of effective communications with handicapped individuals. F

5160 Approaches to Rehabilitation Counseling (3) Techniques and procedures used in group counseling with handicapped adults to further develop student's counseling skills. Problem-solving techniques and utilization of alternative modes of counseling procedures in rehabilitation. Prereq: 5170 or consent of instructor. W

5170-5179 Disability Evaluation Education (3, 3, 3) Supervised experience in area of rehabilitation with emphasis on application of concepts, principles, and skills acquired in previous or concurrent course work. Prereq: Consent of instructor. W; Sp; Su

5180 Systematic Human Relations Training (3) Active listening, observing verbal and nonverbal behavior, development of effective communications with handicapped individuals. F

5190-5199 Disability Evaluation Education (3, 3, 3) Supervised experience in area of rehabilitation with emphasis on application of concepts, principles, and skills acquired in previous or concurrent course work. Prereq: Consent of instructor. W; Sp; Su

5700 Evaluation and Mobilization of Community Resources (3) Issues, processes, and programs related to the rehabilitation of handicapped persons; communication with public and private rehabilitation; facility management; social and vocational guidance. E

5710 Medical Aspects of Disability I (3) Etiology, clinical signs and symptoms, diagnostic, and therapeutic procedures related to muscularkeletal, neurological, circulatory, and respiratory diseases/diseases. Effect on structure and function of human body. Restorative measures to eliminate or minimize resulting handicaps; skills necessary to communicate effectively with lay persons and medical community on evaluation of impairments and administration of appropriate rehabilitation services. W

5720 Medical Aspects of Disability II (3) Etiology, clinical signs and symptoms, diagnostic, and therapeutic procedures related to neoplastic, skin, digestive, genito-urinary, endocrine, mental, visual and hearing disorders. Effect on structure and function of the human body. Restorative measures to eliminate or minimize resulting handicaps; skills necessary to communicate effectively with lay persons and medical community on evaluation of impairments and administration of appropriate rehabilitation services. Sp

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

5740 Disability and Work in Society (3) Relationships of work, family, social, psychological, and economic development of disabled individual. Process and techniques of vocational evaluation, work adjustment, and job development. Prereq: Consent of instructor. W

5750 Principles and Procedures of Disability Evaluation (3) Individual identification and analysis of principles and problems of disability evaluation process or structures; emphasis on problems of different evaluation process or structures, and innovation exploration of alternatives, and sharing experience within group. Prereq: 5760 or consent of instructor. W

5760 Seminar: Functional Capacity Assessment (3) 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. W

5770-5779 Problems in Disability Claims Evaluation (1-3, 1-3) Current problems in process, content, or administration of disability claims evaluation; workshops in demonstration and proposal of alternative solutions. May be repeated with consent of instructor. S/NC only, A

SCHOOL SPEECH AND HEARING THERAPY

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

4040 Appraisal of Speech and Language Disorders (4) (Same as Audiology and Speech Pathology 4040.)

4100 Student Internship (3) (Same as Audiology and Speech Pathology 4100.)

4320 Introduction to Clinical Practice in Speech Pathology (3) (Same as Audiology and Speech Pathology 4320.)

4321 Introduction to Clinical Practice in Audiology (3) (Same as Audiology and Speech Pathology 4321.)

4330 Clinical Practice in Speech Pathology (1-6) (Same as Audiology and Speech Pathology 4330.)

4340 Clinical Practice in Speech Pathology (1-6) (Same as Audiology and Speech Pathology 4340.)

4341 Clinical Practice in Communication Disorders in Schools (3) Prereq: 4300, 4320-30-40 and consent of instructor. S/NC only. F, W, Sp

4342 Seminar in Communication Disorders in Schools (3) Prereq: 4300, 4320-30-40 and consent of instructor. F, W, Sp

4400 Voice Disorders (4) (Same as Audiology and Speech Pathology 4400.)

4720 Audiology II (4) (Same as Audiology and Speech Pathology 4720.)

4730 Aural Rehabilitation: Speechreading and Auditory Training (3) (Same as Audiology and Speech Pathology 4730.)

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

5380 Cerebral Palay (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.)

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. A

4650 Eye Problems Encountered by the Teacher (3) Eye anatomy and hygiene; common diseases and defects; testing and treatment; educational adjustment for specific eye conditions; related service resources. A

4823 Student Teaching of the Partially Seeing (3) Observation and supervised practicum in special and regular classes. S/NC only. A

GENERAL COURSES

3333 Education of the Exceptional Child (3) Principles, characteristics, and special needs; local and state programs for diagnosis and care; educational provision in regular or special classes; home teaching; social and vocational guidance. E

3520 Language-Speech Handicapped Child in the
follow-up procedures, evaluation, and curriculum


5290 Continuing Education in Vocational-Technical Education (3) Importance, objectives, historical development, psychological and sociological formulations, methods and techniques, research, and evaluation.

5270 Placement, Follow-up and Evaluation Procedures in Occupational Education (3) 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) 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) Supervision of program planning, coordination, and instruction. Roles and functions of supervisors.

5810 Principles and Objectives of Vocational-Technical Education (3) Fundamental principles and objectives for vocational-technical education.

5850-50-70 Problems in Vocational-Technical Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation (3-15) E

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

6210 Curriculum Planning in Vocational-Technical Education (3) Prereq: Curriculum and Instruction 5410 or equivalent.

6220 Program Planning and Development in Vocational-Technical Education (3) Planning vocational-technical and work force state, local, and institutional programs; research in planning, advisory committees, planned change, administrative structures, and evaluation procedures.

6230 Evaluation of Vocational-Technical Education Programs (3)

6310 Administration of Vocational-Technical Education (3) Administrative principles and relationship to vocational and technical training.

6411-12-13 Internship in Vocational and Technical Education (3) Field experiences in selected areas of vocational and technical education. S/NC only.

Agricultural Education

4510-20-30 Problems in Agriculture (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

4710-20-30 Seminar in Agricultural Education (1, 1, 1) Prereq: 4350 or consent of department head.

5000 Thesis (1-15) E

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

5011 Problems in Lieu of Thesis (3)

5110 Graduate Seminar in Current Problems (3)

5111-12-13 Graduate Seminar: Current Problems in Business Education (1, 1, 1)

5120 Graduate Seminar in Tests and Measurement (3)

5130 Graduate Seminar in Guidance (3)

5140 Organization and Operation of Area Vocational-Technical Schools (3) (Same as Industrial Education 5140)

5410-20-30 Practicum in Business Education (2, 2, 2)

5510 Evaluation of Research in Business Education (3) Prereq: Curriculum and Instruction 5610 or equivalent.

5511-21 Problems in Business Education: Typing (3, 3)

5622-32-32 Problems in Business Education: Bookkeeping and Accounting (3, 3)

5623-33 Problems in Business Education: Bookkeeping and Accounting (3, 3)

5641 Methods and Materials for Vocational Office Education (3) Methods and materials for vocational office education programs. Development of instructional aids, related instructional activities (clubs), enrollee, instructor and advisory committees.

5624 Problems in Business Education: Clerical Practice (3)

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

5618 Organization and Management of Vocational Office Education Program (3) Developing office occupations, guidelines in cooperatives, laboratory, and model office programs. Physical facilities, instructional aids, related instructional activities (clubs), enrollee, instructor and advisory committees.

5620 Problems in Business Education: Administration (3)

5610-20-30 Current Issues in Business Education (3, 3, 3)

5620-30 Advanced Studies in Business Education (3, 3, 3)

5610 Higher Education for Business (3)

Distributive Education

4130 Areas of Distribution (3) Marketing, production or service technology, social skills, basic skills, and distribution as these areas affect the distributive education curriculum in secondary and postsecondary programs.

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

4510 Organization and Development of Distributive Education Programs (3) Background and development needs, federal and state legislation; curriculum implications; establishing, evaluating, reporting, and improving the programs.

4520 Methods and Materials in Distributive Education (3) Prereq: 4310 or consent of instructor.

4530 Coordination Techniques in Distributive Education (3) Selecting training agencies; job analysis; selecting and briefing training supervisors; committees; adult and other community services. Prereq: 4310, 4320.

4510-20-30 Problems in Distributive Education (1, 3, 3) Research, teaching, and coordinating distributive education programs. May be repeated. Maximum 18 hrs.

5000 Thesis (1-15) E

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

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

5120 Organizing and Teaching Adult Distributive Education (3) Planning, organizing, promoting, teaching, and evaluating distributive education programs in distributive education; utilizing trade associations, employment agencies, business groups, and advisory committees.

5210-20-30 Special Problems in Distributive Education (3, 3, 3) Individual research, conferences, and/or workshops in teaching and supervising high school, postsecondary, and adult programs.

5616-26-36 Problems in Distributive Education: Retailing (3, 3, 3)

Home Economics Education

5000 Thesis (1-15) E

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

5100 Advanced Methods of Teaching Homemaking Classes for Adults (3)

5130 Furthering Good Human Relationships in the Classroom (3) Relationship between human problems in human relations, basic needs of individuals, techniques of interpersonal relations and social values in developing more effective teacher education programs.

5220 Evaluation in Home Economics Education (3) Purpose of evaluation in development of home economics programs; techniques used in evaluation. Techniques for determining progress of students; individual problems of evaluation.

5310 The Problem Method of Teaching Home Economics (3) Underlying philosophy; skills and techniques of interpersonal relations and social values in developing more effective teacher education programs.

5410 Curriculum Development and Implementation in Family Relationships Instruction (3) Content for teaching family relationships. Selected materials and methods, approaches to career planning, curricular 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) Recent advances in home economics education. Development of teaching material in relation to total homemaking program in secondary schools, adults, home experience, and Future Homemakers of America.
School of Health, Physical Education, and Recreation

Madge M. Phillips, Director

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

THE MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: Physical Education, Recreation, Safety Education and Service, and School Health Education. Forty-five quarter hours are required for the M.S. Approximately 23 quarters 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 3 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, health planning/administration, and occupational/environmental health and safety. Fifty-four quarter hours are required for the M.P.H. degree. One full quarter of field practice is required. During field practice, no student shall hold a full-time job except by special permission of the division chairperson. Students may be placed in all parts of this country.

DOCTORAL PROGRAM

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. Concentrations are available in exercise physiology, motor behavior, adapted physical education, and philosophical and sociological foundations. 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.

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 practical for success in the major area of study.

The Doctor of Philosophy degree with a major in Education includes options and emphases as listed on page 8.

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 doctoral 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 and recreation classes. the Department and recreation 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 doctoral 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 and recreation classes, leading recreational activities, supervising recreation field work students, and/or directing or helping to manage extracurricular programs. Students interested in these opportunities should file their applications before February 1.

Letters shall 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 degrees. These are provided by the University of Tennessee, Knoxville, Tennessee 37916.
Departments of Instruction
Division of Health and Safety

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

DEGREES
Ed.D. (Public Health)
M.P.H.
M.S., Ed.S.
M.S.

Professors:
R. H. Kirk (Chairperson), H.S.D., Indiana; A. Pickett, M.S., Tennessee; A. F. Thompson, Ph.D., M.S., Michigan State.

Associate Professors:
M. A. Smith, M.S., California; G. Gorski, D. P. New York; A. A. Thompson, Ph.D., Michigan State.

Assistant Professors:

Lecturer:
M. Dufly, M.D., Pennsylvania.

The Health and Safety Division offers the following degree programs:

Master of Public Health degree with a major in Health Education: Option in community health education is accredited by the American Public Health Association. Options with specialization in health planning/administration or occupational/environmental health and safety are also available.

Master of Science degree with a major in School Health Education or Safety Education and Service (thesis and non-thesis options). Non-thesis option requires 45 quarter hours of course work.

Educational Specialist degree in Safety Education and Service.

Doctor of Education degree in Health Education.

Doctor of Philosophy degree in Health Education.

Public Health

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


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

4730 Workshop in Public Health Education (3-5) For teachers, nurses, case workers, sanitarians, and other voluntary and public health agency personnel; emphasizes the problem-solving approach through small group interaction, case method, and critical incident technique. May be repeated. Su.


5002 Non-Thesis Graduation Completion (3-5) 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 completion. May not be used toward degree requirement. May be repeated. S/NC only. E

5010-20-30 Workshop in Public Health (3-4, 3-5, 3-5) Designed to deal with specific public health problems in short or extended period of time. Su.

5070-80-90 Field Practice and Seminar in Public Health (3-5, 3-5, 3-5) Internship or field experience under professional supervision in public health. S/NC only. E

5110 Environmental Health (3-5) Varied environmental factors within general framework of air, food, water, shelter, transportation as they affect human's survival, prevention of disease, performance and enjoyment. Lecture, demonstrations, laboratory, and field practice. Prereq: Consent of instructor. Su.

5200 Occupational Health and Safety (5, 5) Occupational health and safety theory and practice related to overall improvement of community health and safety. Laboratory and field practice. Prereq: Consent of instructor. W

5510 Industrial Toxicology (3) Elements of industrial toxicology as they relate to the improvement of occupational safety and health. Prereq: Consent of instructor. Sp.

5220 Health and Sickness (3) Formulation of models of positive health within life cycle and within community: types of sickness afflicting individuals and groups. Su.


5420 Administration of Public Health (3) Administration, organization, and function of public health agencies including governmental aspects, legal bases, organizational principles, personnel factors, fiscal management, and related studies. F, W, Sp.


5440 Methods and Materials in Public Health Education (4) Theory and practice in use of communication techniques and materials in community health education. 3 hrs and 2 labs. W.

5540 Factors in Problem Solving for Community Health (5) Tests skills in communication and group process on route to problem identification, objective setting, problem solving and planning for health education. 4 hrs and 2 labs. W.

5550 The Public Health Educator in Community Organization and Development (4) Overview of health organizations and agencies in the community; factors affecting conflict and divergence of practice between health education service and health education program for community learning levels. 1 2-hr lecture-seminar session per week. F.

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


5730 Seminar in Health Education (3-5) F.

5735 Emergency Medical Services (3-5) Sp.

5745 Family Health Unit (3-5)

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

5755 Health Facilities Administration (3-5) W.

5760 Health Services Administration (3-5) F.

5785 Occupational Health Unit (3-5) Sp.

5790 Self-Care Unit (3-5) Sp.

5795 The Training of Paramedical Personnel (3-5)


6000 Doctoral Research and Dissertation (3-5) E.

6030 Critical Analysis of Writing and Research in Health Education (3) (Same as School Health Education 6030.) F.

6050-60 Seminar in Health Education (3, 3) (Same as School Health Education 6050-60.) W, Sp.

6210 Health Aspects of Gerontology (3) Su.

6220 Seminar on the Nation's Health (3) F.

6230 International Health (3) W.

Safety

3520 Principles of General Safety (3) Deals with principles, practices, and procedures in general safety. Covers safety problems in school, traffic, recreation, industry, home, and other public areas. E.

4010-20-30 Problems in Safety (1-3, 1-3, 1-3) Individual identification and study of current problems in safety. E.
Prereq: 3510 or Public Health 1110 or Nutrition 1230.

E 3620 The Teaching of Sex Education (3) Trends, content, methods, and materials in sex education. F, W, Sp

E 3850 Methods in Secondary Health Instruction (3) Preparation and presentation of health topics. Teaching method emphasized and student participation stressed. E

4710 Workshop in School Health Education (3-6) For advanced students, teachers, school administrators, nurses and other paramedical school personnel. Lectures, demonstrations, films, field trips, and supervised research in special health problems. May be repeated. Su

4810-20-30 Problems in School Health Education (1, 1, 1) Individual identification and study of current problems in school health education. Extensive reading of literature. E

5000 Thesis (1-15) E

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

5320 Behavioral Problems in Safety Education and Accident Prevention (3) Problems of behavior, causes of accidents, and application of principles of psychology in development of safe behavior in all segments of our environment. F

5330 Problems and Research in Accident Prevention (3) Analysis of safety problems found in wide variety of accidents that occur in community; findings of current research in behavioral sciences as related to variation incidence of accidents. P

5340 Organization, Administration, and Supervision of Safety Programs (3) National, state, and local level programs including administrative, instructional, and supervisory aspects. Basic emphasis on implementation of relevant programs. W

5350 Civil and Defense Education (3) Civil and defense problems: tornadoes, floods, fires, mass civil disorders, and nuclear and personnel attack by alien countries. P

5790-30-40 Graduate Workshop in Safety (3-6, 3-6, 3-6) Deals with specific safety problems. Special safety problems in a concentrated period of time. Su


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

6010-20-30 Internship and Research in Safety (3, 3, 3) Designed to give students the opportunity to gain field experience so that a significant problem in that field will be identified, researched, and reported on in acceptable form. E

School Health

3210 First Aid and Emergency Care (4) (Same as Public Health 3210.) E

3410 School Health Instruction (3) Selection of health topics, planning and presentation of health instruction, evaluation of achievement, teaching skill and supervision. Prereq: Consent of instructor. F

3420 School Health Services (3) Development, maintenance, and protection of health of students including examination, screening, special services, community health, health instruction, emergency care, and school health records. F, W, Sp

3510 The School in Community Health (3) Role of teacher in community health education; school's responsibilities through use of simulation, multimedia, and other systems of instruction to improve health awareness and the place of existing media and agencies in program. Not open to health and physical education majors. E

3810 Methods in Elementary Health Instruction (3) Preparation and presentation of health topics. Teaching method emphasized and student participation stressed. Required for elementary teachers.

Division of Physical Education

MAJOR

Physical Education

DEGREES

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

Professors: J. E. Ackerman, M.D. Tennessee; G. F. Brady (Emeritus); Ph.D. Iowa; E. K. Capen (Emeritus); Ph.D. Iowa; B. D. Franks (Consulting Professor); A. J. Kozel, Ph.D. Michigan; W. P. Limmohn, Ph.D. Iowa; M. M. Phillips, Ph.D. Iowa; B. A. Polstonick (Emeritus); Ed.D. Boston; H. B. Watson (Emeritus); Ph.D. Michigan; H. G. Welch, Ph. D. Florida.


The Physical Education Division offers the following degree programs:

Master of Science degree in Physical Education (thesis and non-thesis programs). Ph.D. Doctorate of Education degree in Physical Education with concentrations in exercise physiology, motor behavior, adapted physical education, and philosophical and sociological foundations.

The Doctor of Philosophy degree with a major in Education includes options and emphases as listed on page 6.

3050 Rhythmic Analysis (2) Emphasis on analysis of organic movement. Prereq: Consent of instructor. A

3090 History of Dance and the Related Arts I (2) Dance history and the arts related to it from beginnings in primitive societies through the nineteenth century. F

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

3430 Adaptive Physical Education Laboratory (1) Practical work, including student teaching, supplementing 4110. E

4010 Advanced Modern Technique (2) Development, integration, and synthesis of previous dance vocabulary, based upon advanced practice and principles. Prereq: 3030. May be repeated. Maximum 6 hrs. Available to dance majors and minors or with consent of instructor. F, W

4020 Practicum in Dance Production (3) Prereq: Consent of instructor. W

4060 Advanced Composition (4) Application of compositional, production and administrative skills culminating in presentation of two complete choreographic works. Prereq: 3062. 4020. A

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

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. E

4140 Measurement and Evaluation in Physical Education (3) Relationship of measurement and evaluation in physical education. Administration and critique of the use of the measures of physical fitness, sports skills and knowledge. W, Sp, Su

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

4880 Motor Behavior: A Theoretical Perspective (4)
logical findings to practical problems related to human function. Prereq: 1 yr general chemistry, or consent of instructor.

5610 Advanced Exercise Physiology (4) Principles of energy transfer in humans, with special emphasis on integration of organ systems in adapting to requirements of muscular exercise. Prereq: Zoology 4540 or equivalent. Recommended: 1 yr chemistry, physics, and mathematics. 3 hrs and 1 lab. W

5620 Experimental Techniques in Applied Physiology (3) Laboratory course in experimental methodology and instrumentation. Respiratory and blood gas analysis, human calorimetry, blood chemistry, and pulmonary function tests. May be repeated with consent of instructor. S/NC only.

5650 Social-Psychological Dimensions of Physical Activity (3) Examination of social-psychological factors which influence performance in physical activity with emphasis on research. Prereq: Psychology 3120 or equivalent.

5810-20-30 Seminar in Physical Education (1, 1, 1) Current issues and problems in physical education with emphasis on outstanding studies and research in field. E

5810-20-30 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. E

6000 Doctoral Research and Dissertation (3-15) E

6140 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: S510, 5500 and Physics 2210 or equivalent. May be repeated with consent of instructor. S/NC only. E

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

6330 Advanced Motor Behavior (3) Theoretical issues of contemporary significance in human motor behavior. Prereq: S540 or consent of instructor. Sp

6410 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: S510, 5500 and Physics 2210 or equivalent. May be repeated with consent of instructor. S/NC only. E

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

6610 Seminar in Applied Physiology (2) Prereq: S5610. May be repeated with consent of instructor. S/NC only. F, Sp

8640 Research Participation in Applied Physiology (1-4) Advanced level of individual, under supervision of faculty member whose research area coincides with interests of student. Prereq: Consent of instructor. May be repeated with consent of instructor. S/NC only. F

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

**Division of Recreation**

**MAJOR**

**RECREATION**

**DEGREE**

**M.S.**

**Professor:** M. L. Peters (Chairperson), Ph.D. Illinois.

**Assistant Professors:** M. J. Carter, Re.D. Indiana; K. L. Krick, Re.D. Indiana.

The Recreation Division offers the following degree program:

- Master of Science degree in Recreation (thesis and non-thesis programs) with concentrations in general recreation, recreation administration, and therapeutic recreation.

- 4130 Recreation Administration (3) Introduction to recreation administration, including planning, personnel, areas and facilities, program services, finances, and public relations. Prereq: 3140, 3200, 3880, or consent of instructor. F, W

- 4200 Survey of Recreation for Special Populations (3) Physical, curricular, and professional aspects of special interest groups whose leisure opportunities and needs may require special servicing. Prereq: 3140, 3200, 3880, or consent of instructor. F, Sp

- 4310 Camp Administration (3) Program planning and organization, campsite development and maintenance, camp operation for administrators and supervisors.

- 4500 Specialized Study in a Selected Area (1-6) Comprehensive study in a selected specialized area within the broad field of recreation. For recreation students only. Prereq: Consent of instructor. May be repeated with consent of division. Maximum 6 hrs.

- 5000 Thesis (1-15) E

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

- 5120 Problems of the Curriculum in Physical Education (3) Comprehensive review of literature in physical education for educators and supervisors.

- 5140 Advanced Philosophy of Sport (3) Critical examination of the epistemological, and axiological status of sport. Prereq: Senior or graduate standing or consent of instructor. F

- 5200 Supervisory Problems in Physical Education (3) For students interested in supervision of physical education programs.

- 5300 Analysis of Basic Motor Skills (3) Mechanical analysis of basic motor skills, emphasizing application of these skills to physical education and athletic fields.

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

- 5330 Psychology of Sport (3) Human behavior in sport context. Prereq: General psychology course and consent of instructor. W

- 5340 Motor Behavior and Skill Acquisition (3) Application of research on human movement behavior to sport and physical education. Prereq: 4860 or consent of instructor.

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

- 5500 Advanced Kinesiology (3) Action of muscles involved in fundamental movements, calisthenics, sports, and gymnastics. Prereq: 5300 or equivalent. Sp

- 5510 Selected Topics in Anatomy (3) Intensive study of various systems of human body. Prereq: 5500 or equivalent. May be repeated with consent of instructor. S/NC only. Su

- 5550 Physical Rehabilitation (3) Physical disabilities and rehabilitation techniques. Prereq: 5500 or equivalent. F

- 5600 Physical Activity and Health (5) Relationship of physical exercise to longevity, weight control, cardiovascular diseases, low back pain and other diseases, mental health, growth, and aging. Applications for maintenance of health. Prereq: Course in physiology of exercise or consent of instructor. S lecture per week. (Same as Public Health 5550.) Su

- 5660 Applied Physiology (6) Principles of physiology with special emphasis on application of physiological findings to practical problems related to
Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science degree, the Master of Engineering degree, and the Doctor of Philosophy degree. For a listing, consult majors and degrees available on page 8.

OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEOTAPE-ELECTROWRITER

Since 1966, the College of Engineering has made use of electronic communication techniques to reach students beyond the confines of Knoxville classrooms. These remotely-taught classes make the specialized talents of engineering college faculty available to students at off-campus centers and industrial sites. This effort makes use of videotapes prepared from a regular on-campus class in specially-equipped classrooms. The tapes contain a visual and audible record of a professor’s lecture and discussions with the on-campus classes and are played back at remote locations. Telephone/Electrowriter contact is established periodically between the professor and the off-campus class to allow full discussion and questions. Occasional visits by the professor are made to each remote class and students visit the Knoxville campus at selected times.

Graduate courses have been offered to students at other campuses and established centers of the UT System (Chattanooga, Kingsport, Martin, Nashville, and Tullahoma). 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 and Columbia State Community Colleges.

The remotely-taught courses offered by UTK carry full graduate credit toward the Master’s degree under authorization of the regional accrediting agency, the Southern Association of Colleges and Schools.

YEAR-IN-JAPAN M.S. PROGRAM

This is a unique program allowing American engineering students to develop some understanding, both scientific and cultural, of Japan. It allows an M.S. candidate to obtain a degree from UTK while carrying out research work at a Japanese university. The program requires approximately two years, one year being spent in Japan and the remaining period being spent at UTK to fulfill the course requirements and to write the thesis or project report, as appropriate to the particular department. The program is administered in the framework of each department’s regular graduate program except that the research is done in Japan. Although the language of communication in Japan would be English, cultural understanding is one of the important objectives of the program and as such a participant would be asked to begin Japanese language study. At the option of the department, up to 6 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

W. K. Stair, Associate Director

The Station is organized to conduct investigations in fundamental engineering science and to aid in the development of the state’s resources and industries as far as funds available will permit.

The Station may also make special arrangements with any person or company to study any technical question within the capacity of its resources, and to report the results exclusively to the company requesting the study. In such case, the whole expense will be carried by the parties requesting the investigation.

Engineering Administration

MAJOR

Engineering Administration

DEGREE

M.S.

Committee:


A program of study leading to the degree of Master of Science with a major in Engineering Administration is offered. This program is aimed at providing education for graduate engineers in the organization and direction of work in engineering functions, at a level which requires understanding of such areas as marketing, finance, and industrial relations. It should be emphasized that this is an engineering program, aimed at preparing individuals for line management positions in construction, design, development, and manufacturing where both technical and nontechnical 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.

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 should have graduated from an A.B.E.T. accredited 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
Pennsylvania State; J. J. Perona, Ph.D.
Northwestern; J. W. Prados, Ph.D.
Tennessee; J. E. Spruell, Ph.D.
Tennessee; Ph.D. Cincinnati; C. O. Thomas, Ph.D. Tennessee;
R. A. Vanderwalt, Ph.D. Institute of Technology; J. S. Watson, Ph.D. Tennessee;
J. L. White,1 Ph.D. Delaware; M. A. Wright,*
Ph.D. Wales.

Associate Professors: W. T. Becker, Ph.D. Illinois; D. D. Burns,
Ph.D. Houston; P. J. Meschiter, Ph.D. Pennsylvania.

Lecturers: L. Dresser, Ph.D. Princeton; H. W. Hoffman,
D. Eng. John Hopkins; McEvey, Ph.D. Tennessee;
T. D. Parish, Ph.D. Rice; W. H. Seaton, Ph.D. Ohio State; E. von Halle,
Ph.D. Tennessee; M. E. Whately, Ph.D. Iowa State.

Graduate programs lead to the degrees of
Master of Science and Doctor of Philosophy
in Chemical Engineering with concentrations
in chemical engineering, chemical engineering.
biotechnology, advanced control systems,
and polymer science and engineering, in
Metallurgical Engineering, and in Polymer, Engineering.

THE MASTER'S PROGRAM

Minimum departmental requirements include the satisfactory completion of:
1. A major consisting of 18 to 27 quarter hours of graduate courses in chemical engineering, metallurgical engineering, or polymer engineering. The polymer engineering major must include Polymer Engineering 5110, 5230, 5310, 5410, and 5120.
2. One or two minors or collateral work, 9 to 18 hours total in engineering, chemistry, mathematics, physics, or other related fields.
4. Active participation in graduate seminars in the department. Resident students must register for the appropriate 5101 every quarter offered.
5. Final examination covering thesis, related fields, and graduate course work.

THE DOCTORAL PROGRAM

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

Department requirements consist essentially of the satisfactory completion of:
1. Graduate courses in chemical engineering, metallurgical engineering, or polymer engineering amounting to approximately 36 quarter hours, at least 12 of which must be in 6000 series courses. The polymer engineering major must include Polymer Engineering 5110, 5210, 5230, 5310, 5410, 5120, and Chemistry 5140.
2. Supporting courses in related scientific and engineering fields amounting to approximately 36 quarter hours, subject to approval by the student's faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.
3. The comprehensive examination, usually given in two parts, and covering such materials as chemical, metallurgical, and polymer engineering operations and processes, thermodynamics, technology, mathematics, physics, chemistry, and other related fields.
4. Active participation in graduate seminars conducted by the department. Resident students must register for the appropriate 5010 every quarter offered.
5. Reading knowledge of a foreign language relevant to the candidate's research program, selection of language to be made in consultation with the faculty committee.

Appropriate languages are French, German, Italian, Japanese, and Russian.

UTK-JAPAN COOPERATIVE PROGRAM IN POLYMER ENGINEERING

The UTK-Japan Program provides a means for Japanese research professors to spend part-time in the graduate program, and provides a joint Japanese-UTK program for the admission of Japanese students into the polymer engineering graduate program. A committee of faculty from Japanese universities makes recommendations for students and a UTK committee acts on them.

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 the department requires, for the M.S. degree, a thesis in the field, completion of Polymer Engineering 4910, 5110, 5310, 5410, 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 Polymer Engineering 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

3410 Flow of Fluids (4) Differential and overall momentum and energy balances; flow in pipes, flow in ducts, and packing beds; unit operations, pumps. Prereq: Chemical and Metallurgical Engineering 2200, Mathematics 2850, 3 hrs and 1 lab.

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

3440 Stagewise Operations (3) Analytical and graphical methods applied to stagewise separatory operations.

3450 Diffusional Operations (3) Diffusion, simultaneous heat and mass transfer, applications including humidification, gas absorption, extraction. Prereq: 3420. Chemical Engineering 3040.

3620 Chemical Process Control (3) Basic control theory applied to chemical processes; cascade control systems, cascade control, feed-forward control, stability analysis, frequency response. Survey of control techniques used in typical industrial unit operations. Prereq: 3610.

4110 Chemical Engineering Data Analysis (3) Analytical and experimental identification of system extremals; statistical properties of samples and source systems; empirical modeling of processes; statistical process control. Prereq: 3420 and Mathematics 3159.

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

4130 Introduction to Optimization (3) Principles and applications of optimization techniques to chemical process design; unconstrained optimization, equalities and inequalities constrained optimization, and dynamic programming. Prereq: Mathematics 2840.


4410 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.

4420 Process Design and Economic Analysis (3) Special problems in design and economics (3) Design and economic analysis of projects participation in the American Institute of Chemical Engineering 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: 3440.

4470 Sulfur Removal from Coal and Associated Processes (3) Sulfur removal from coal and associated processes: beneficiation by both physical and chemical methods; fluidized bed gasification; slurry gasification with both natural and synthetic SOx sorbents; stock gas SOx scrubbing. Prereq: Consent of instructor.

4480 Coal Processing to Liquid Fuels (3) Characterization of coal; modeling of conversion processes and estimation of maximum yields; water and oxygen requirements; pyrolysis; catalytic hydrogenation; reactor design considerations; review and critique of selected articles from the current literature and patents. Prereq: Consent of instructor.

4530 Chemical Engineering Reaction Kinetics (3) Chemical reaction rates in closed and flow systems; interpretation of laboratory and pilot plant data; reactor design. Prereq: Chemistry 5450.


4550 Process Modeling, Simulation, and Control of Chemical Processes (3) Development of process models, experimental process identification, process computer simulation, and conventional and non-conventional feedback control, advanced control concepts. Prereq: 3620 or equivalent background in basic control theory. Prereq: Consent of instructor.

4730 Mass and Energy Flow in Biological Systems (3) Basic physiochemical and organizational principles applicable to biological systems. Derivations of general equations of biomass and energy transfer. Thermodynamics of transport and equilibrium in biological systems. Discussion of Volta’s equation and biological clocks. 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 of transport through cell-free organs. Prereq: 3440, 3450 or consent of instructor.

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

4760 Principles of Biochemical Separation (3) 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 Chemical Bioengineering (3, 3, 3) Problems of interest in chemical bioengineering. Prereq: Consent of instructor.

4810-20-30 Special Problems in Chemical Engineering (3, 3, 3) Problems of current interest to chemical engineering students. Prereq: Consent of instructor.

5000 Thesis (1-15) E

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

5050 Production Metallurgy (3) Thermodynamic equilibrium of heterogeneous systems. Prereq: 5050.

5120 Heat Convection (3) Analysis of heat convection in fluids under viscous and turbulent flow conditions, emphasizing analytical approaches; simultaneous diffusion of momentum and heat. Prereq: 5050.

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: 4130.


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

5310 Thermodynamics of Heterogeneous Equilibria (3) Phase rule; equilibrium between phases; composition relationship between phases; ideal and nonideal solutions. Prereq: 3040.

5320 Statistical Thermodynamics (3) Basic concepts of physical phenomena and application to evaluation of thermophysical properties. Prereq: 5310.

5510 Chemical Reactor Design (3) Nonideal flow patterns in chemical reactors; diffusion and reaction in two phase systems; introduction to heterogeneous catalysis and reactor stability. Prereq: 4550.

5610 Stagewise Mass Transfer Operations (3) Equilibrium stage, concepts applied to mass transfer operations; heat and mass transport in nonisothermal and multicomponent systems. Prereq: 3450.

5620 Differential Mass Transfer Operations (3) Differential mass transfer operations; falling film, packed tower and bubble contacting devices; nonisothermal and multicomponent systems; current theories of mass transfer; mass heat and momentum transfer analogues. Prereq: Mathematics 2840.

5810 Mechanics of Viscous Flow (3) (Same as Engineering Science and Mechanics 5220)

5900 Special Topics in Chemical Engineering (3) Special topics of current interest to chemical engineers. May be repeated. Maximum 8 hrs.

6000 Doctoral Research and Dissertation (3-15) E

6130 Process Optimization (3) Optimization of chemical processes with emphasis on modern optimization techniques; static and dynamic systems. Prereq: 5130.

6210 Advanced Diffusional Operations (3) Fixed flows, stabilized bed operations, stagewise and differential mass transfer bed concepts. Prereq: Consent of instructor.

6250 Venture Analysis in the Process Industries (3) Interactions among line functions of typical chemical company in application of modern decision theory and mathematical models to achieve optimum product investment decision in face of external competition. Prereq: 5250.

6310 Thermodynamics of Irreversible Processes (3) Thermodynamic treatment of irreversible chemical processes, transport processes, coupling phenomena, with special emphasis on topics and methods of interest to engineering and bioengineering graduates. Prereq: 5130.


6510 Applied Chemical Reaction Kinetics (3) Chemical reactions in gas and liquid phases, heterogeneous catalysis, catalyst effectiveness and role of transport in kinetics. Emphasis on development of phenomenological description although mechanistic models are discussed. Prereq: 5510.

6520 Catalytic Reactor Design (3) Kinetics, heat and mass transfer applied to design and analysis of heterogeneous catalytic reactors. Prereq: 5510.

6710 Process Dynamics (3) Development of dynamic models of process equipment from conservation and rate laws, testing of models by frequency, step, and pulse response methods. Prereq: Consent of instructor.

6900 Advanced Topics of Chemical Engineering (3) Advanced topics of current interest to chemical engineers. May be repeated. Maximum 9 hrs.

7059 Production Metallurgy (3) Thermodynamic aspects of metallurgical processes. Prereq: Consent of instructor.

7060 Metallurgical Kinetics (3) Application of principles of chemical reaction kinetics, fluid flow, and heat and mass transfer, to pyro-, hydro-, and electro-metallurgical processes. Reaction order and reaction rate laws, laws of mass and heat transfer, laws of adsorption and catalysis. Roasting of sulfides and oxides, smelting, refining, electrolysis, and leaching. Prereq: 3500; Chemical Engineering 3410 and 3420 or equivalent. 3 hrs or 2 hrs and 1 lab.

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

3120 Engineering Materials II (3) Extension of 2110 or 3110 with emphasis on control of mechanical properties of materials by specification of composition, thermal, and mechanical treatment; correlation of resultant properties with service performance. Suggested for mechanical, civil, and industrial engineering students.

3130 Engineering Materials III (3) Extension of 2110 or 3110 with emphasis on control of electrical and magnetic properties of materials by specification of composition, thermal, magnetic, and electrical treatment; correlation of resultant properties with service performance. Suggested for electrical engineering students.

3140 Engineering Materials IV (3) Extension of 2110 or 3110 with emphasis on materials processing, specification and evaluation. Suggested for mechanical and industrial engineering students.

3150 Engineering Materials V (3) Extension of 3110 with emphasis on the mechanisms and control of reactions of engineering materials with aqueous, moist, or gaseous environment. Prereq: 3110 or equivalent.

3160 Engineering Materials VI (3) Extension of 2110 or 3110 with emphasis on materials of significance in nuclear engineering. Reactor nuclear fuels, materials, and interactions of radiation with solids to produce changes in energy and reaction processes. Suggested for nuclear and mechanical engineers.


3220 Diffusion and Annealing (3) Introduction to solid state kinetics; point defects, solid solutions, diffusion equations and mechanisms, annealing of cold-worked steels. Prereq: 3210; Mathematics 2840 or equivalent.

3230 Phase Transformations (4) Thermodynamic and structural factors governing binary equilibrium. Phase diagrams for noble gas-univalent element, covalent compound, intermetallic, and ceramic systems. Prereq: Chemistry 1110-20 or equivalent.

3250 Materials Behavior and Chemical Process Equipment Design (3) Mechanical, metallurgical and chemical behavior of materials in chemical processing equipment. Prereq: Chemical and Metallurgical Engineering 3020 or equivalent; 3150; and Chemical Engineering 3420. (Same as Engineering Science and Mechanics 3520.)

3710 Metallurgical Applications in Manufacturing Technology (3) Fabrication methods and principles of microstructural behavior of metals and ceramics; methods of fabrication of components; control of defects; applications of protective coatings and surface treatments. Prereq: Mathematics 1110-20 or equivalent.

3720 Metallurgical Applications in Manufacturing Technology (3) Fabrication methods and principles of microstructural behavior of metals and ceramics; methods of fabrication of components; control of defects; applications of protective coatings and surface treatments. Prereq: Mathematics 1110-20 or equivalent.

4340 Engineering Materials Design (3) Property control through composition, heat treatment and transformation in ferrous alloys. Plain carbon steels, alloy steels, and tool steel processing for property selection and service requirements. Prereq: 3230 or consent of instructor.

4510-20 X-Ray Diffraction and Crystallography (3, 3) Principles of X-ray 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 Science and Mechanics 3520.) Analysis of stress, strain, and elastic-plastic properties of materials; relationship of mechanical behavior to structure and properties. 3 hrs or 2 hrs and 1 lab.

4730 Mechanical Metallurgy I (3) Elastic behavior. Description of stress, strain, and elastic-plastic constitutive relations of composition, microstructure, and loading on mechanical behavior. Failure by yielding. Prereq: 2110 or 3110 or Chemical and Metallurgical Engineering 3030. Suggested for mechanical engineering, engineering mechanics, and chemical engineering students. 3 hrs or 2 hrs and 1 lab.

4740 Mechanical Metallurgy II (3) Ductile and brittle fracture, creep and stress rupture, fatigue, and residual stresses. Effects of state of stress, loading rate, time, temperature, and metallurgical structure. Prereq: 3120 or 3530 and 4730 or Mechanical Engineering 3650 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 I-III (1-15) E

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

5050 Engineering Analysis (3) (Same as Chemical Engineering 5050.)

5110 Point Defects and Dislocations (3) Theoretical and experimental analysis of point, line, and planar imperfections in solids. Prereq: 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 temperature and alloying on short-term loading. Prereq: 5110.

5130 Plastic Deformation II (3) Plastic deformation of polycrystalline materials; theoretical and experimental analysis of dislocations and dislocation rearrangement from deformation and annealing. Prereq: 5120.

5140 Diffusion and Annealing in Solids (3) Analysis of models and experimental observations relating to phenomena associated with 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.


5210-30 Welding Metallurgy (3, 3, 3) Welding processes; physical metallurgy of fusion 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.

5301 Solidification and Crystal Growth I (3) Solute redistribution, thermodynamic considerations, kinetic, convection and fluid flow effects on the solid to liquid transition. Prereq: Mathematics 4500.

5410-20 Advanced X-Ray Diffraction (3, 3) Review of crystallography, Laue diffraction, theoretical interpretation of X-ray diffraction, analysis of scattered intensity in reciprocal space; relationship of scattered intensity to thermal motion, order-disorder, particle size and lattice faults. Introduction to x-ray structure analysis and group theory, and crystal structure problems; some laboratory work. Prereq: Mathematics 4610.


5540-50 Electron Microscopy I and II (3, 3) Kinematical and dynamical electron diffraction developed and their application to electron diffraction patterns and contrast effect in transmission electron microscopy are discussed. Special attention is given to metallurgical applications such as plastic deformation, fracture, precipitation, and phase transformations. Prereq: 4510-20.

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. Effect of radiation on solid state reactions. Phenomena associated with use of engineering materials in radiation environments. Prereqs 4540, Physics 5730 or consent of instructor.


5810-20 Special Topics in Metallurgy (3, 3, 3) Lectures and recitation on more recent advances in metalurgy and materials science. Prereqs: Chemical Engineering 3650 and 4740.

5840-50 Metallurgy of Deformation and Fracture (3, 3) Theoretical and engineering analysis of fracture. Stress state, strain rate, environment, temperature, and metallurgical state in ductile and brittle behavior in service, testing, and fabrication.

5910-20 Metallurgical Thermodynamics (3, 3, 3) Application of thermodynamic and physicochemical methods to metals and metallurgical reactions. Relation of theory and experiment to structure of liquid and solid solutions, and to alloy systems.

6000 Doctoral Research and Dissertation I-III (1-15) E

6110-20 Theoretical Metallurgy (3, 3, 3) Phases of iron, steel, and their physical behavior applicable to metallurgy; elas
ticity, introductory quantum theory, specific heats, electron theory, electrical and thermal conductivity, magnetic properties, theory of alloy formation. Prereq: 4610 or Physics 3720. Mathematics 4550 and consent of instructor.

6210-20 Rate Process in Metallurgy (3, 3, 3) Theoretical and practical considerations of rate process in solids such as diffusion, recrystallization and grain growth, and phase transformations.

6230-30 Solidification and Crystal Growth II and III (3, 3) Fluid flow, magnetohydrodynamic effects in incompressible liquid conductors, morphology, stability of steady state coupled heat and mass transfer processes in liquid to solid transition, multiphase solidification, composites, nonsteady state dendritic phenomena, some nucleation phe
nomena. Prereq: 5510.

6410-20 Thermodynamics of Solids (3, 3) Classical and statistical thermodynamic analysis of stability of solid solutions, compounds and ordered phases. Prereq: 5910-20 or consent of instructor.

6810 Mechanical and Physical Properties of Crystals (3, 3) Anisotropic behavior of crystalline materials treated by matrix and tensor techniques. Property classification according to transformation behavior. Prereqs: Core curriculum in Metallurgical Engineering and Mathematics 4050 or 4710 or consent of instructor.

6820 Mechanical and Physical Properties of Crystals (2, 2) Continuation of Metallurgical Engineering 6810 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. Prereq: 6810 or 6820, or consent of instructor. May be repeated.
Polymer Engineering

4910 Applied Polymer Science (3) First course in the field of polymers. Polymer structure, crystalline and glass transitions, physical properties of amorphous and crystalline polymers, solutions, and rheology are discussed. Not for credit for Polymer Engineering majors.

4920 Polymer Processing (3) Rheological properties of polymer melts and glassy and crystalline polymer solids. Properties of flow, viscous behavior occurring macromolecules. Prereq: Undergraduate physics or chemistry.

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

5050 Engineering Analysis (3) (Same as Chemical Engineering 3050)

5110 Structural Characterization of Polymers with Electromagnetic Radiation (3) Theory of scattering and diffraction of electromagnetic waves by matter, special emphasis on experimental techniques applied to polymers. Prereq: Undergraduate Physics 3010.


5230 Mechanical Behavior of Solid Polymers (3) Application of linear viscoelasticity and large deformation elasticity to solid polymer melts and photoelastic stress analysis. Prereq: Undergraduate physics or chemistry.

5310 Polymer Solution Properties and Characterization (3) Molecular weight determination, chromatography, solution thermodynamics, phase separation; application to synthetic and naturally occurring macromolecules. Prereq: Undergraduate physics or chemistry.

5410 Rheology and Polymer Processing (3) Methods for determining the rheological properties of polymer melts, solutions and suspensions; linear viscoelasticity, simple nonlinear constitutive relationships, viscous heat generation; application to processing particularly extrusion, injection molding, and blow molding production.

5450 Principles of Injection and Blow Molding Operations (3) Technology, theoretical analysis of injection mold filling, structure of molded parts; principles of mold design, mold and molding; principles of shell theory, application to blow molding, structure and properties of blow molded containers. Prereq: 5410 or equivalent.

5511 Laboratory Methods in Polymer Engineering I (1) Basic experimental procedures for polymer characterization, x-ray diffraction and optical methods. Coreq: 5110 or consent of instructor. 2 labs.

5512 Laboratory Methods in Polymer Engineering II (1) Basic experimental procedures for polymer characterization, polymer melt processing, mechanical behavior of polymers. Prereq: 5410 or consent of instructor. 2 labs.

5513 Laboratory Methods in Polymer Engineering III (1) Basic experimental procedures for polymer characterization, polymer melt processing, mechanical behavior of polymers. Prereq: 5410 or consent of instructor. 2 labs.

5710 Phase Transformations in Polymer Systems (3) Analysis of nucleation and growth of phases in polymer systems, spinodal decomposition, application from the melt, precipitation from solution.

5810 Physical Properties of Polymer Structures (3) Molecular weight and composition distributions in complex fluids, molecular orientation, phase behavior of polymers and polymer mixtures as related to glassy and crystalline phases, transition incompatibility, thermal-mechanical properties of high polymers. Prereq: Undergraduate physics or chemistry.

5910-20-30 Selected Topics in Polymer Science (3, 3, 3) Advanced problems in modern polymer research of current interest to students. Prereq: 4910, 4920 or equivalent.

6000 Doctoral Research and Dissertation (3-15) E

6230 Advanced Mechanical Behavior of Polymers and Mechanics of Deformation (3) Curvilinear coordinate systems formation to analysis of polymer processing operations. Prereq: 5210.

6250 Large Deformation Elasticity (3) Curvilinear coordinate systems formation to analysis of polymer processing operations. Prereq: 5210.

6610 Advanced Industrial Polymer Chemistry (3) Special application to experimental techniques of crystal structure determination; Patterson and Fourier functions; helical nets and Bessel function techniques; levels of order, thermal motions, defects, order-disorder transitions and para-crystallinity. Precision and Weisenberg photographs, single crystal and powder diffractometry 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 para-crystallinity. Precision and Weisenberg photographs, single crystal and powder diffractometry studies of synthetic and biological macromolecules.

6210 Nonlinear Viscoelasticity (3) Tensor formulation of constitutive equations for viscoelastic material subjected to large deformations. Integral, differential, and acceleration tension formulations. Application to stress, strain and flow problems. Prereq: 5210 or equivalent. (Same as Engineering Science and Mechanics 6800)

6220 Advanced Methods of Polymer Processing (3) Application of theories of rheological properties and structure to analysis of polymer processing operations. Prereq: 5210.

6230 Advanced Mechanical Behavior of Polymers (3) Stress analysis with emphasis on developing constitutive equations for yielding behavior of solid polymers, failure analysis and general deformation mechanics of solid polymers. Relation of microporosity to molecular structure.

6250 Large Deformation Elasticity (3) Curvilinear tensor analysis, theory of finite strains, Mooney-Rivlin formulation of isotropic non-linear elasticity, solution of large homogeneous and heterogeneous deformation problems, application to vulcanized rubber, reinforcement with inextensible cords. Prereq: 5230 or equivalent.

6450 Liquid Crystals: Structure, Characterization, Technology (3) Structure of low molecular weight and macromolecular liquid crystals. Identification, microscopies, electronic, optical, photomechanical, single crystal and powder diffractions, infrared stretching strength fibers. Prereq: 5120, 5410 or equivalent.

6610 Industrial Primary Polymer Chemistry (3) Chemistry and properties of new polymer engineering materials, highly integrated engineering and chemical approach. Prereq: Consent of Instructor.

6910-20-30 Recent Advances in Polymer Science and Engineering (3, 3, 3) Treatment of latest developments in polymer science and engineering. May include topics in morphology, structure, characterization. Prereq: Consent of Instructor.

Civil Engineering

MAJORS

DEGREES

Civil Engineering (M.E., M.S., Ph.D.)

Emeritus Professors:

E. G. Shelton, MCE Brooklyn Polytechnic, P.E.; C. R. Walker, S.M.

Massachusetts Institute of Technology, P.E.

Professors:

W. L. Greco (Head), Ph.D. Michigan State, P.E.;

O. S. Beard, J. D. American University, P.E.

E. G. Burdette, Ph.D. Illinois, P.E.; J. W. Thirty, Ph.D.

Courtaoise, d'Universite de Toulouse (France);

J. B. Humphreys, Ph.D. Texas A&M, P.E.;

R. A. Minear, Ph.D. Washington; B. A. Tschantz,

D. W. Goodpasture, Ph.D. Illinois, P.E.;

D. W. Heathington, Ph.D. Northwestern, P.E.;

J. W. Jaffe, Ph.D. Pennsylvania State, P.E.;

J. W. Thaddeus, North Carolina State, Church,

D. W. Johns Hopkins; W. T. Davis, Ph.D.

Tennessee; B. J. Frederick, B.C. Clarkson

Ph.D. Missouri; D. C. Jameson, Jr., M.S.

Tennessee; P. G. D. Kressin, J. D. Engineering,

R. A. Moore, B. S.; Tennessee; P. E.

R. F. Tiry, B.S. Marquette, P.E.;

D. W. Wetter, Ph.D. Purdue, P.E.

Assistant Professors:

A. L. Briggs; Ph.D. Pennsylvania State;

S. L. Hana; Ph.D. Pennsylvania State;

J. W. Fortey, Ph.D. Virginia Polytechnic Institute;

R. B. Jackson, Ph.D. Illinois.

Lecturers:

J. M. Corum, Ph.D. Illinois, C. Franks, B.S.

Tennessee; D. L. Garrett, B. S. Purdue;

G. J. Hyfantis, Ph.D. Vanderbilt;

R. J. Johey, Ph.D. Tennessee; T. L. Miller,

Ph.D. Tennessee.

The Department of Civil Engineering offers degrees leading to the Master of Science, Master of Engineering, and Doctor of Philosophy with a major in Civil Engineering, concentrating in structural engineering, structural engineering, soils engineering, materials and transportation engineering; and to the Master of Science and Master of Engineering in Environmental Engineering with concentrations in water quality, water resources, and air quality.

MASTER OF SCIENCE PROGRAM

The Master of Science programs in Civil Engineering and in Environmental Engineering 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 degree 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 9 hours of thesis, is required.

Option II: A minimum of 48 quarter hours,
including a 3 quarter-hour special problems is required. The special problem will culminate in a written report which must be approved by the student's major professor.

ENVIRONMENTAL ENGINEERING

For a major in Environmental Engineering the Bachelor's degree may be in fields other than civil engineering. In some cases, pre-existing 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 9 quarter hours of thesis and 18 quarter hours credit of approved environmental engineering course work. A minor may be selected but is not necessarily required.

Option II: the student must present a minimum of 48 quarter hours of approved graduate courses. The major shall include a minimum of 27 quarter hours of approved environmental engineering course work. A minor may be selected but is not necessarily required.

Option I or II must be approved by the department.

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

MASTER 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 A.B.E.T. 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 available under these programs.

THE DOCTORAL PROGRAM

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

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

1. A minimum of 108 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 36 quarter hours credit in Doctoral Research and Dissertation will be required.

2. A minimum of 36 quarter hours of graduate courses in the Civil Engineering Department, exclusive of thesis or dissertation credit, at least 9 hours of which must be 6000-level courses.

3. Supporting courses in related scientific and engineering fields, amounting to approximately 6 quarter hours of graduate courses, subject to approval by the student's faculty committee. These related fields will normally include such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 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 comprehensive examination.

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

Civil Engineering

4120 Concrete Design (3) Reinforced concrete continuous beams and floor slabs; footing, and retaining walls. Prereq: 4110 and 4410. Sp

4220 Foundations and Substructures (3) Foundations and 4110 in 4520. W; design of dry and subaqueous foundations. Prereq: 3310, Sp, Su

4230 Legal and Ethical Aspects of Engineering (3) Legal principles underlying engineering work; laws of contracts, torts, and crimes; problems of professional registration and ethics. F

4240 Structural Design (3) Plastic theory, eccentric connections, industrial building design, timber design. Prereq: 3230 and 4410. 2 hr-periods. F, Sp

4260 Photogrammetry (3) Methods of plotting maps from aerial photographs; stereoscopic plotting instruments; applications. Prereq: 2360 or Forestry Summaries.

4420 Analysis of Framed Structures (3) Maximum stresses due to moving loads; use of influence lines; lateral forces due to earthquake and wind; analysis of portals, building frames and space frames. Coreq: 4410 W

4430 Construction Methods and Equipment (3) Fundamental operations in construction and selection of equipment; production rates, balancing of equipment, and cost estimates. F, W

4510-20 Advanced Structural Design (3, 3) Plastic design in steel in 4510; design of typical short span highway bridges in 4520. Prereq: 3230 for 4510; and 5230 and 4410. W, Sp

4530 Cost Comparison in Design and Construction (3) Cost of engineering and construction. Cost comparison of alternate designs with emphasis on applications to civil engineering problems. Prereq or coreq: 3230, 4410.

4540 Computer Utilization (3) Computer use, economic justification, and extent of use by industry. Utilization of computers in design and construction of civil engineering projects. Prereq or coreq: 3230, F, W

4550 Engineering Behavior of Soils (3) Plastic and elastic behavior of soils, determination and use of engineering properties of in-situ soils. Prereq: 4220 or consent of instructor. 2 hrs and 1 lab. F

4560 Stabilization of Soils (3) Chemical stabilization of soils by compaction, drainage, and blending; chemical stabilization of soils with admixtures; waterproofing and modifying soils with additives. Prereq: 3310. 2 hrs and 1 lab. W

4620 Airport Planning and Design I (3) Emphasis on airport master planning. Included for consideration on the air side are runway configuration, capacity, geometric and lighting; on the land side are included terminal layout and design and ground access systems and parking, Prereq: 3600 and 3610. Sp

4640 Traffic Engineering (3) Characteristics of driver, vehicle and roadway and their interrelationship; traffic studies; basic considerations of traffic control and circuit; elements of urban transportation planning and design. Prereq: 3310 and 3320. 2 hrs and 1 lab. W

4660 Airport Planning and Design II (3) Integration and application of principles of airport master planning for purpose of site selection and design of an airport facility through a comprehensive team project, includes environmental evaluation of design. Prereq: 4620. 1 hr and 2 labs. Su

4710 Portland Cement Concrete Mix Design (3) Properties and tests of portland cement concrete, methods of concrete mix design, nondestructive concrete evaluation, use of concrete admixtures. Prereq: 3710. 2 hrs and 1 lab. F

4720 Asphalt and Bituminous Concrete (3) Properties and tests of asphalt and asphalts mixes, mix design of bituminous mixtures, use of asphalt in transportation construction projects. Prereq: 3710. 2 hrs and 1 lab. W

4731-32 Earthquake Resistant Structures I, II (4, 4) (Same as Architecture 4731-32). Su

4800 Introduction to Civil Engineering Systems (3) Methods of modeling civil engineering systems and their specific application to problems of transportation, environment, water resources and materials. Prereq: Senior standing or consent of instructor. Sp, Su

4850 Elementary Structural Matrix Methods (4) (Same as Engineering Science and Mechanics 4850 and Architecture 4850) Su

5000 Thesis (1-15) E

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

5110-20 Statically Indeterminate Structures (3, 3) Deflection and beam bending analysis; analysis of trusses, analysis of slope deflection in 5110; analysis by moment distribution and other displacement methods in 5120. F, W

5140 Statically Indeterminate Structures (3) Analysis of complex planar and space frames. Prereq: 5110 and 5120. Sp

5150 Matrix Formulation of Structural Problems (3) Review of matrix and vector algebra; considerations; stiffness and flexibility analysis of plane trusses, general members and structures composed of general members. Prereq: 4540 or consent of instructor. F

5160 Analysis and Design of Plate Structures (3) Bending and buckling of plates; analysis and design of bridge and building floors and structural plate components. Prereq: 5110. F

5170 Introduction to Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structural systems; application of finite element methods to structural analysis; stability considerations; stiffness and flexibility analysis of plane trusses, general members and structures composed of general members. Prereq: 4540 or consent of instructor. F

5180 Finite Element Structural Analysis (3) Application of finite element method to structural analysis; plane stress, plane strain, axisymmetric, and three-dimensional elements; use of typical computer programs. Prereq: 5150, and Engineering Science and Mechanics 5580. (Same as Engineering Science and Mechanics 5180) Sp, A

5220 Pavement Design (3) Pavement loads; pavement design; design practices; construction and maintenance. Prereq: 3310. Sp

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: 3310. Sp

5350 Advanced Properties of Materials: Bituminous Substances and Mixes (3) Serviceability concepts; pavement failures and remedies; bituminous pavement maintenance techniques; other uses of asphalt products. Prereq: 4720. Sp

5270 Planning and Transportation (3) Preparation of transportation and elements of comprehensive development plans. Analysis of transportation planning and design, including decision-making between various transportation modes and between transportation and other community features. (Same as Planning 5270). W

5310 Engineering Practice (3) Valuation and feasibility studies: depreciation and useful life; engineering economics. F
effect of mass transportation; channelization; mar-
tion, intersections, utility considerations, parking,
tion of streets; design features, including cross sec-
growth and development; classification and func-
5850 Functional Design of City Streets and Urban
5800 Urban Systems : Engineering and Manage-
5500 Soil Mechanics—Plastic Equilibrium (3) Fail-
ure theories; earth pressure analysis, bearing capac-
ysis, and slope stability analysis. Prereq: 3310 or consi-
5560 Soil Mechanics—Elastic Behavior (3) Stress-
deformation characteristics, consolidation, settle-
ment analysis. Prereq: 3310 or consent of instructor. W
5570 Soil Mechanics—Seepage (3) Saturated flow
through embankments, filter design criteria, seep-
age forces and velocities, subdrains, and embank-
mold behavior. Prereq: 3310 or consent of instructor. Sp
5610 Behavior of Steel Structures (3) Behavior of
structural steel members due to static and fatigue
loading; relation between research results and cur-
rent specialization for design. Prereq: 3230. W
5730 Prestressed Concrete (3) Properties of pre-
stressing materials and anchorages systems;
method of analyzing prestressed concrete beams and-posi-
analysis and design of members and continuous struc-
tures. F
5740 Behavior of Reinforced Concrete Members (3)
Ultimate strength and behavior of reinforced con-
crete members, relation between research re-
sults and current specifications for design. Prereq: 4120. W
5800 Urban Systems: Engineering and Manage-
ment I (3) Management of various urban systems
usually under city manager and/or city engineer.
Organizational structure, internal and external com-
petition, budgeting, financial management and pub-
lic relations. Prereq: Consent of instructor; Coreq:
Civil or Environmental Engineering or consent of
instructor. W
5805 Urban Systems: Engineering and Manage-
ment II (3) Continuation of 5800. Management
and engineering of urban streets, including lighting,
cleaning and snow removal, water supply and waste-
water for drainage, solid waste, air pollution and
regulations. Prereq: 5800. Sp, A
5810 Traffic Engineering—Characteristics (3) 
Driver-vehicle-roadway system; level-of-service
concept of capacity. Coreq. Statistics 3450. 2 hrs
and 1-2 hr lab. F
5820 Traffic Engineering—Operations (3) Fixed-
time and volume-density controllers; progressive
systems; one-way operations; reversible flows; sys-
tem operation, including computerized networks;
legal aspects of operational controls. Prereq: 5610. 2 hrs
and 1-2 lab. F
5840 Geometric Design (3) Advanced theory and
practice in the geometric design of highways. Pre-
req: 4600. Sp
5850 Functional Design of City Streets and Urban
Freeways (3) Design of the various systems upon
which urban growth and development; classification and func-
tion of streets; design features, including cross sec-
tion, intersections, utility considerations, parking,
effect of mass transportation; channelization; mar-
kening; lighting; freeway, frontage road, surface street
strategies, and regional urban and metropolitan plan-
5860 Urban Transportation Planning (3) Prediction
of traffic demands and vehicular flows; land use
planning; parking needs. Prereq: 5510. F
5870 Public Transit Planning (3) Person movement
distribution model. Nature of public trans-
5890 Traffic Accident Reconstruction (3) Traffic
accidents; statistical analysis, basis of design-
ing accident prevention or control pro-
grams. Many contributing factors to an accident;
predicting accidents; second accident causes as
they relate to roadway improvements. Prereq: 4640 or
graduate standing, W, A
5900 Special Problems in Civil Engineering (1-9) To
fulfill the special problem requirement in the non-
therapy program. Enrollment limited to civil engineer-
ning students in non-thesis program. Prereq: Con-
sent of instructor. May be repeated. Maximum 9 hrs.
S/NC only. E
5510-20-30 Special Topics (1-6, 1-6, 1-6) Topics re-
lated to current developments in civil engineering
not included in other courses. May be repeated.
6000 Doctoral Research and Dissertation (3-18) E
6110 Behavior of Steel Bridges and Buildings (3) 
Behavior of reinforced concrete elements; analysis of
columns and composite members subjected to static
and dynamic loading. Prereq: 5170 and 5610. Sp, A
6740 Behavior of Reinforced Concrete Beams and
Frames (3) Behavior of reinforced concrete mem-
bers, importance of elasticity and behavior of in-
stantly indeterminate reinforced concrete struc-
tures; applicability of elastic analysis to framed
structures; limit analysis. Prereq: 5120 and 5740. Sp,
A
6750 Behavior of Reinforced Concrete Slabs (3)
Behavior, analysis and design of reinforced con-
crete slabs, behavior under various bending mo-
tions AC Code methods; yield-line theory. Prereq:
5740, 5810 or Engineering Science and Mechanics 6310. Sp, A
6830 Traffic Flow Theory (3) Queuing theory, Mar-
kov processes, Monte Carlo methods, simulations of
various conditions and/or designs. Prereq: 4540 or
Mathematics 3150; 5850.
6860 Statewide Passenger Transportation Planning
(3) Comprehensive multimodal transportation plan,
intercity traffic models, functional classification,
programming and scheduling. Emphasis on
transportation system planning and effective use of
air and highway investments. Prereq: 5860. W, A
6870 Future Transit Technology and Research (3)
New transit systems and new technology; identifica-
tion of public need and development of alternative
technologies and planning process and possible research designs. Prereq:
5870. Sp, A
6880 Planning Models for Transportation System I
(3) Analytical analysis of trip generation employing
mathematical, statistical, and computer science
75
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.

**DOCTORAL PROGRAM**

The Ph.D. degree with a major in Electrical Engineering may be pursued in the areas of circuit theory, computers, electro-optics, 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 Master of Science or Master of Engineering degree.
2. A minimum of 12 quarter hours of course work beyond the B.S. degree excluding thesis, research, and dissertation credit.
3. A minimum of 36 quarter hours credit in doctoral dissertation.
4. A minimum of 36 quarter hours of course work beyond the B.S. degree excluding thesis, research, and dissertation credit.
5. A final oral examination covering the student's research efforts.
6. A final oral examination covering the student's research efforts.
7. A minimum of 27 hours of graduate course work beyond the B.S. degree excluding dissertation.
8. Participation in departmental seminars.
9. A minimum of 18 quarter hours of course work beyond the B.S. degree excluding dissertation.
10. A minimum of 36 quarter hours of course work beyond the B.S. degree including dissertation.
11. A minimum of 18 quarter hours of course work beyond the B.S. degree excluding dissertation.
12. A minimum of 36 quarter hours of course work beyond the B.S. degree including dissertation.
13. A minimum of 18 quarter hours of course work beyond the B.S. degree including dissertation.
14. A minimum of 36 quarter hours of course work beyond the B.S. degree including dissertation.

**MASTER OF ENGINEERING PROGRAM**

A graduate program leading to the Master of Engineering degree is available to qualified graduates of A.B.E.T.-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 4000-5000 level mathematics courses approved by the student's Master's committee must be substituted for any of the above course material covered in undergraduate work.
3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in one area of electrical engineering and 9 quarter hours of 5000-level work in another area approved by the student's Master's committee.
4. A minimum of 18 quarter hours of 5000-level work in Electrical Engineering must be divided equally between two different electrical engineering areas.
5. A master's thesis, totaling 9 quarter hours or more.
6. 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 A.B.E.T.-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 substituted for any of the above course material covered in undergraduate work.
3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in one area of electrical engineering and 9 quarter hours of 5000-level work in another area approved by the student's Master's committee.
4. A minimum of 18 quarter hours of 5000-level work in electrical engineering must be divided equally between two different electrical engineering areas.
5. A master's thesis, totaling 9 quarter hours or more.
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**Departmental requirements**

1. Electrical Engineering 5070-80 and 5710.
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4. A minimum of 18 quarter hours of 5000-level work in electrical engineering must be divided equally between two different electrical engineering areas.
5. A master's thesis, totaling 9 quarter hours or more.
6. A final oral examination covering the thesis and related course work.
4080 Microwave Circuits and Electronics (3) Circuit amplifiers and applications in basic feedback configuration. Basic digital switching circuits. Prereq: 3820. 3 hrs including project laboratory.

4090 Propagation II (3) Metal tube, dielectric rod, and stripline waveguides. Waveguide resonators and coupled resonator filters. (Design of structures utilized for microwave power transmission and for microwave integrated circuits. Prereq: 3060. 4 labs.)


4200 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.

4140 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.

4210 Power Systems Analysis (3) System studies including load flow, faults, and stability. Prereq: 3090.

4300 Transmission, Distribution, and Protection (3) Studies in underground and d.c. transmission; consideration of overloads and insulation requirements; system protection against faults. Prereq: 3090.

4400 Lasers and Masers (3) Introduction of principles of laser and maser operation based on classical concepts and electrical engineering analogies. Consideration of practical devices and applications.


4480 Plasma III (3) Macroscopic plasma equations, particle orbits, interactions, oscillations and waves. Prereq: 3190.

4490 Electro-optics (3) Fourier optics, Diffraction, lenses, and filters. Incoherent imaging, Engineering applications; holography.

5000 Electro-optics Detection and Instrumentation (3) Propagation of monochromatic and spatially uniform monochromatic and coherent waves by various means. Prereq: Computer Science 1510. (Same as Computer Science 4820.)


5170 Bioengineering Systems III Instrumentation and Microprocessor System Design (3) Bioengineering systems with biological systems as stimuli and responses. Systems proper-
ties of resistance, impedance, and storage are investigated. Analog and digital simulation of biological systems. Prereq.: 5110 or consent of instructor.

5190 Bioengineering Systems I Models, Systems Analysis and Simulation (3) Modeling techniques applied to physiological systems. Systems properties and response to disturbances are investigated. Analog and digital simulation of biological systems. Prereq.: 4370 or consent of instructor.

5175 Introduction to Logic Design (3) Combinational and sequential network design. Digital modules and memory devices. Asynchronous and synchronous networks. Sequential machines as finite state machines: identification experiments on sequential machines. Biweekly lab. Coreq.: Elemen-
tary linear algebra and calculus of several variables. (Same as Computer Science 5175.)

5180 Bioengineering Systems II Bioelectric Phenomena (3) Electrical phenomena associated with biological systems as stimuli and responses. Topics dealing with the design of functions, devices, photographs, and temporal detectors (e.g. photodi-
dodes) will be given. The last third of the course will be devoted to selected electro-optical instrumentation systems (e.g. laser light scattering, optical data processing, interferometers, etc.). Prereq: 4370 or consent of instructor.

5190 Bioengineering Systems III Instrumentation and Microprocessor System Design (3) Bioengineering systems with biological systems as stimuli and responses. Systems properties of resistance, impedance, and storage are investigated. Analog and digital simulation of biological systems under test and process by which this information is gathered and transmitted from biological system to computer system for further analysis and design, including digital data transmission and telemetry. Coreq.: 4660 or consent of instructor.
maximize yield of meaningful information about original biological system. Prereq: 4660 or consent of instructor.

5210-20 Advanced Electrical Machinery (3, 3) Fundamentals of electric machinery, power conversion, application in conventional devices. Differential equations for rotating machinery, Park's transformation and two-axis model, transient behavior of isolated and interconnected rotating machines. Prereq: 4780 or equivalent.

5320 Advanced Electrical Machinery Applications (3) Analysis of transient and other speed control techniques; variable frequency operation. Prereq: 5210.

5240-50-60 Control Systems Design I, II, III (3, 3, 3) Analysis; system response analysis; design of estimator and observer; system compensation. Emphasis on engineering aspects of control systems. Coreq: 5070 or equivalent.

5271 Modern Systems Theory I (3) Introduction to linear systems theory, State-space model, linear dynamical system, state transition map, matrix exponential, controllability, observability, realization theory, pole placement, observers, stability theory for linear systems. Prereq: Consent of instructor.

5281 Modern Systems Theory II (3) Optimal estimation, state estimation, Kalman filtering, optimal stochastic processes, uncertain dynamical systems, estimation and filtering theory, Wiener filtering, the Kalman filter and its extensions. Prereq: 5271 or consent of instructor.


5310 Basic Requirements for Plasma Fusion (3) Historical study of fusion systems in nature, Lawson criterion, inertial fusion systems—hydrogen bomb, laser fusion, and electron-beam fusion. Magnetically-confined plasma systems, tokamak, mirror system, and exotic systems. Confinement, stability, and heating. Possibility of fusion-fission hybrids. Prereq: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.

5320 Diagnostics for Fusion (3) Hot plasma. Simple plasma—transport, resistivity, and diamagnetism. Microwave methods. Charge-exchange techniques. X-ray and neutron techniques and future possibilities. Prereq: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.


5340 Introduction to Quantum Electronics (3) Infrared absorption, spectroscopy, band structure of solids, optical properties of laser and crystal, semiconductors, and solid state phenomena. Prereq: 5340 and Mathematics 4710 or equivalent.


5370 Advanced Direct Electrical Energy Conversion I (3) Theory, latest devices, and applications for production of electrical energy by gaseous means of thermionic, magneto-dynamic, and electro-dynamic effects. Prereq: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5380 Advanced Direct Electrical Energy Conversion II (3) Theory, latest devices, and applications for production of electrical energy by gaseous means of thermionic, magneto-dynamic, and electro-dynamic effects. Prereq: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5390 Advanced Direct Electrical Energy Conversion III (3) Prereq: 5370 and 5380, or equivalent.

5410 Power System Networks (3) Sequence impedances for transmission lines, machines, and transformers. Formation of system network characterization such as Zbus, Yuus, and others, such as ring networks. Methods. Prereq: Graduate standing or consent of instructor.


5440 Distribution System (3) Electric power distribution with particular reference to utility systems. System growth and planning, interconnected system operation and control. Prereq: 4410, 4420, 4430 or equivalent.

5460 Selected Topics in Power Systems (3) To meet special needs of students. Possible topics: power system reliability, interconnected system operation and control. Prereq: Consent of instructor. May be repeated with consent of department.

5510-20-30 Advanced Analog Electronics (3, 3, 3) Physical operation of modern electronic devices with emphasis on semiconductor devices, diodes, bipolar, transistors, J-FETs, and MOSFETs. Small-signal equivalent circuits and noise models of active devices and passive linear and non-linear circuits, band low-noise feedback amplifiers and radio-frequency amplifiers using discrete, monolithic and hybrid devices, applications including switching regulators. Use of specialized electronic systems in analog signal processors. Advanced topics of current interest. Coreq: Mathematics 4710 or equivalent. Prereq: 4410, 4600, 4680, 4740 or consent of instructor. Coreq: Math 4510 or 4710. Project laboratory included.

5540 Thick-Film Hybrid Microcircuits (3) Processing and basic design techniques for prototype production of hybrid-thick-film integrated circuits; from circuit design through packaging, testing, and troubleshooting. Coreq: Mathematics 4710 or equivalent.

5550 Properties of Quantum Devices (3) Optical resonant cavity theory and design; steady-state and Q-switched operation of lasers. Unipolar and bipolar transistor devices. Measurement and characterization techniques. Laser output power spectral line shape and noise considerations. Limitations of photodetectors, detectors, and detectors, including photomultiplier tubes, photodiodes, and solar cells. Prereq: 5340 and Mathematics 4710 or equivalent.

5560 Application of Quantum Electronic Devices (3) Properties of laser radiation and...
Engineering Science and Mechanics

MAJOR DEGREES

Engineer Science M.S., Ph.D.

Professors
- W. T. Snyder (Head), Ph.D. Northwestern;
- J. E. Akin, Ph.D. Virginia Polytechnic Institute;
- T. G. Carley, Ph.D. Illinois;
- P. E.; B. R. Dewey, Ph.D.
- Illinois;
- P. E.; A. H. Errssen, Ph.D. North Carolina State;
- R. J. Forrestier, Ph.D.
- Iowa State;
- P. E.; D. W. Lee, Ph.D. Illinois Institute of Technology;
- W. A. Miller, Ph.D. Georgia Institute of Technology;
- P. E.; H. Ph.
- Illinois Institute of Technology;
- C. J. Remenyik, Ph.D.
- Johns Hopkins;
- C. D. Scott, Ph.D.
- D. H. Tennant;
- L. R. Shobe, M.S.
- Kansas State (Emeritus);
- P. E.; J. E. Stoneking, Ph.D.
- Illinois;
- P. E.; J. Thomas, Ph.D.
- Ohio State;
- P. E.

Associate Professors
- R. J. Hendrickson, Ph.D. Virginia; P.E.
- K. C. Kim, Ph.D. North Carolina State;
- A. Mathews, Ph.D. Illinois;
- P. E.; T. F. Moriarty, Ph.D.
- Illinois;
- P. E.; W. Scott, Ph.D.
- Johns Hopkins;
- J. W. Wasserman, Ph.D.
- University of Cincinnati;
- P. E.

Graduate programs leading to the degree of Master of Science and Doctor of Philosophy with a major in Engineering Science are available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. Program options include solid mechanics, fluid mechanics and biomedical engineering. 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 prerequisites 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. A departmental application is required in addition to the Graduate School application. The names and addresses of four references must be included with the departmental application.

The flexibility and interdisciplinary aspect 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) are at one of the interfaces between science and engineering, or can best be met by interdisciplinary study in engineering. The department's course offerings and research activities are also intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mechanics, or in related interdisciplinary studies such as biomechanics.

THE MASTER'S PROGRAM

Two M.S. plans are offered: Plan I requires a thesis, while Plan II does not. The second plan is offered to meet the needs of engineers 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 her advisory committee, can benefit from additional coursework more than from work on a thesis.

In Plan I a minimum of 45 quarter hours, including the thesis, is required. In Plan II a minimum of 48 hours is required. These include the following:

Plan I Plan II

 Mathematics

Engineering courses 18 27*

(Major 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 A final examination is required under both plans, covering graduate coursework and the thesis (if the doctoral program).

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 graduate engineering courses, exclusive of thesis and dissertation credit. These courses

*Engineering courses under Plan II may include advanced laboratory work or special problem work, for example Engineering Science and Mechanics 5910 or analogous courses in other departments.
will normally be number 5000 and above, with at least 12 quarter hours of 6000-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.

3. A minimum of 18 quarter hours in mathematics or computer science in courses numbered 4000 and above, exclusive of a first course in ordinary differential equations.

4. A minimum of 9 quarter hours of courses numbered 5000 and above, offered in departments other than mathematics, computer science, and the student's major department and which are not included in the areas of concentration under item 2.

5. Active participation in graduate seminars and colloquia.

6. A written examination consisting of a written qualifying examination and an advanced examination. The qualifying examination covers areas of engineering science and mathematics, for the most part at a level equivalent to that 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 comprehensive portion of the examination.

8. Submission of a dissertation which meets the requirements of the Graduate School, the department, and the student's advisory committee.

3311 Mechanics of Materials (4) Concepts of stress and strain; stress-strain relations and Mohr's circle; static analysis of members; area moment of inertia; stress and displacement analysis of axially-loaded members; torsion; bending. Not for departmental graduate credit. Prereq: Basic Engineering 1310. Coreq: Mathematics 2640 or consent of instructor.

3410 Introduction to Biomedical Engineering (4) Designed to introduce the facets and opportunities of biomedical engineering, and to provide basic terminology and background in knowledge for courses in the field. Subjects include anatomy, physiology, biomaterials, mathematical models of body systems. Coreq: Mathematics 2640 or consent of instructor.

3420 Introduction to Clinical Engineering (3) Designed to train students in life sciences, health professions, and engineering in use and applications of medical instruments. Body systems are introduced, and instruments used in care of those systems are explained and demonstrated. Prereq: 3410 or consent of instructor.

3520 Materials Behavior and Chemical Process Design (3) (Same as Metallurgical Engineering 3520.)

3700 Dynamics (4) Kinematics of rigid bodies; mass moments of inertia; coulomb friction; kinetics of rigid bodies using force, mass, acceleration; work-energy; impulse-momentum. Not for departmental graduate credit. Prereq: 2705 or Basic Engineering 1320, Mathematics 2840.

3710 Intermediate Dynamics (3) Three-dimensional dynamics of particles and rigid bodies; dynamics of bodies with varying mass; central force motion; LaGrange's equations. Prereq: 3700, Mathematics 2840.

4240 Engineering Aspects of Infection Control (3) Biomedical engineer's role in infection control will be related to hospital and clinical activities. Fluid flow phenomenon, pressure measurement methods, and basic bacteriological and mycological tests will be demonstrated. Course identifies new and critical role for biomedical engineering in health care systems, including analysis of hospital facilities and monitoring systems. Prereq: 3410 or consent of instructor.

4430 Orthopedic Biomechanics (3) Introduction to engineering applications of fundamental concepts in orthopedics and rehabilitation. Topics include statics, Newton's laws of motion, stresses in simple sections, strain, and biological material properties. Prereq: Consent of instructor.

4500 Applied Mechanics for Life Scientists (4) Concise and broad coverage of basic principles and concepts of mechanics of solids and fluids; statics, vibrations, continuum mechanics and properties of materials. Applications in engineering and medicine. Prereq: Mathematics 1860 or consent of instructor.

4520 Biomechanical Fluid Mechanics (3) Discuss objectives, review foundations and present developments in biomechanical and fluid mechanics. Properties of human blood and blood vessels, determinants of cardiac performance, analysis and measurement of flow and pressure in arteries, non-invasive study of circulatory system, mechanics of microcirculation. Applications to areas of hemodynamics, thrombosis, and fluid dynamics of hemorrhage of assistant injuries. Prereq: a course in fluid mechanics or consent of instructor.

4529 Biomechanical Fluid Mechanics Laboratory (2) Measurement and recording of flow characteristics in biological systems. Project and/or term paper required. Coreq: 4520.

4530 Biomechanics (3) Discuss objectives, review foundations and present developments in areas of mechanical properties 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 review of mechanical properties of materials that are indicative of fracture resistance, including transition temperature, R-curves, stress intensity factors, and J-integrals; the use of these properties in design. Prereq: 3310 and Metallurgical Engineering 2110. (Same as Metallurgical Engineering 4540.) 3 hrs or 2 hrs and 1 lab.

4580 Principles of Nondestructive Testing (3) (Same as Physics 4580.)

4610 Experimental Stress Analysis (3) Basic concepts; theory, techniques, and instrumentation of resistance strain gage; theory and techniques of brittle coating of materials. Prereq: 3700 or consent of instructor. Prereq: 3310, Electrical Engineering 2020 or 3110. 2 hrs and a 3-hr lab.

4620 Dynamic Data Acquisition (4) Instrumentation of measuring instruments and responses; signal conditioning; oscillographs, oscilloscopes, and magnetic tape recording; telemetry and data transmission; data processing. Prereq: 3311, 2700, Electrical Engineering 3120, 3 hrs and a 3-hr lab.

4630 Introductory Photomechanics (3) Introduction to photoelasticity, photoelastic coating method. Moire method, interferometry, and holography. Prereq: 3711, Physics 2320. 2 hrs and a 3-hr lab.

4710 Fundamentals of Vibrations (3) Free and forced vibrations of damped and undamped lumped parameter systems; energy methods. Prereq: 2720, Mathematics 2840.


4810-20 Engineering Analysis (4, 3) Integration of fundamental physics laws and mathematical methods of analysis on emphasis on application to realistic engineering problems. Prereq: 3110, 3311, and Mathematics 3150.

4850 Elementary Structural Matrix Methods (Same as Civil Engineering 4850 and Architecture 4850.)
applied dynamic loads; approximate methods of solution. Prereq: 5410 and Mathematics 4550.

5750 Orbital Mechanics (3) Planetary, satellite, and astronomical orbits and trajectories; orbital perturbations; applications of minimum principles. Prereq: 3710 and 4710.

5800 Introduction to Continuum Mechanics (3) Fundamentals of mechanics of solids and fluids; Cauchy's stress tensor; stress, strain, and flow in the continuous medium; constitutive equations; applications to solids and fluids. Prereq: 3130 and 3311 or equivalent and consent of instructor.


5860 Introductory Finite Element Methods (3) General finite element procedure; convergence requirements; programming concepts. Stress analysis, heat transfer, fluid flow, and solution of differential equations. Prereq: 5800 or 5310, or Mechanics of Materials II and consent of instructor.

5910 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments. Prereq: Consent of instructor. May be repeated with consent of department.

6000 Doctoral Research and Dissertation (3-15) E 6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) Survey of literature on advanced convective momentum, heat, and mass transfer; boundary layers and free convective flow. Prereq: Navier-Stokes equations; boundary layer stability analysis; phenomenological theories of turbulence; turbulent boundary layers; high-speed flow of phenomena in nonreacting and reacting systems. Prereq: 5110-20 or equivalent; Mathematics 4610-20 or equivalent (Same as Environmental Engineering 6110-20).

6140 Advanced Finite Element Methods in Fluid Dynamics (3) Computational fluid dynamics using finite elements; special problems in formulation for two- and three-dimensional, multispecies compressible flows, second-order turbulence closure; parabolic Navier-Stokes equations. Multidimensional, turbulent, and reacting flows. Prereq: 5130 and 5140.

6230-40-50 Theory of Turbulence (3, 3, 3) Mathematical description of turbulence; isotropic turbulence; Reynolds averaged Navier-Stokes equations; large and small eddy structure by turbulent flows; turbulent diffusion by continuous movement; applications to turbulent jets, wakes, pipe flow, and boundary layers. Prereq: 5110-20 and coreq: Mathematics 4610-20-30.

6310 Theory of Plates (3) Classical theory of bending of beams and plates; thick plates; effects of variable thickness; buckling and large deflection problems. Prereq: 5310-20-30.

6320 Analysis and Design of Thin Shell Structures (3) Geometry of surfaces, derivation of thin shell theory, and applications of theory for structural engineer. Prereq: 6310 or Civil Engineering 5160.


6340 Theory of Plasticity (3) Yield conditions; strain hardening; general constitutive equations; plastic potential; uniqueness theorems; extremum and variational principles; problems in perfectly plastic solids; finite plastic deformations; piecewise linear plasticity. Prereq: 5410 and Mathematics 4550.

6610 Energy Methods (3) Virtual work, minimum potential energy, and complementary energy; Castigliano's theorem; Hamilton's principle, and Lagrange's equations of motion; variational methods; examples from theory of structures, plates and shells, buckling, vibrations, and advanced dynamics. Prereq: 5710-20 and Mathematics 5610-20-30.

6910 Special Topics in Engineering Mechanics (3) Advanced problems of interest in mechanics, worked either as group or individually. Prereq: Consent of instructor. May be repeated with consent of department.

NOTE: Not all of the above courses will be offered in any one year.

Industrial Engineering

MAJOR

Industrial Engineering

DEGREES

M.S., M.E.

Professors:

J. N. Snider (Head), Ph.D. Ohio State, P.E.; D. C. Dougal, Ph.D. North Carolina; H. P. Emerson (Emeritus), S.B. Massachusetts Institute of Technology, Ph.D. R.M. LaForge, (Emeritus), M.S. Carolina; L. Loveless, M.S. North Carolina; J. L. Milliken, Ph.D. Georgia; D. P. Jones, Ph.D. Georgia Institute of Technology, P.E.

Associate Professors:


Assistant Professors:


THE MASTER'S PROGRAM

A graduate program leading to the degree of Master of Science is open to graduates of recognized undergraduate curricula in industrial engineering or to graduates of other engineering curricula who take up to 15 quarter hours of prerequisite course work. A non-thesis option with 45 hours of course work plus dissertation is available. Graduate work in Industrial Engineering provides for concentrations in operations research, industrial administration, manufacturing and production systems, human factors engineering, and systems engineering. 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 culminating year in a five-year baccalaureate-master program which emphasizes engineering design and professional practice. Admission requirements include those presented above plus the requirement of a Bachelor's degree from an A.B.E.T.-accredited engineering program. This 45-quarter hour program requires 18 hours of course work in an industrial engineering core, 9 hours of technical methods electives, 9 hours of industrial engineering design electives and 9-hour thesis or design project. Any 4000-level course required in the Bachelor of Science curriculum. Engineering program at The University of Tennessee may not be used for graduate credit in the M.S. or M.E. graduate program in Industrial Engineering.


4060 Material Requirements System Design (3) Survey of applications of forecasting, production planning, inventory analysis, planning and control, and systems design and implementation. Design of the material requirements process as an integrated system. Prereq: 3510-20. Not available for graduate credit for industrial engineering students.

4070 Production Systems Design (3) Production planning, scheduling, and control design and implementation of production systems; design of production facilities as integrated system. Prereq: 4060.

4080 Forecasting Methods in Industrial Engineering (3) Application of statistical forecasting techniques to industrial engineering problems. Includes moving averages and exponential smoothing, autoregressive and trend model regression, and seasonal components. No credit for M.S. or M.E. programs.

4150 Project Control with CPM and PERT (3) A study of project planning and control based primarily on critical path techniques, including resource allocation, trade-off techniques, cost timing schedules, and computer programs. Prereq: 3430.

4160 Materials Handling (3) Analysis and planning for the overall problem of moving, packaging, and storing of materials; equipment comparison and selection; cost analysis. Prereq: 4520 and Engineering Science and Mechanics 3310. Not available for graduate credit for industrial engineering students.

4170 Automatic Process Control (3) Characteristics of automatic processes and controllers; elementary open and closed loop analysis, and applications to industrial control system. Prereq: Mathematics 2600 and Engineering Science and Mechanics 2720.

4200 Production Facilities Design (4) Materials handling, plant layout, service areas, inventory control applications, and operating procedures design. Prereq: 3630, 3510-20, 4060, 4520.

4230 Scheduling Systems (3) Performance measures for job shop and flow shop scheduling, including both static and dynamic conditions, as well as techniques for generating production schedules. Deterministic and probabilistic dispatching conditions. Prereq: 3520.

4250 Work Measurement Applications (3) Application of learning curves, queuing theory, standard data and incentive systems to the design of industrial work situations.

4260 Engineering Economy (3) Methods and problems involved in economic evaluation of engineering decisions among engineering alternatives, involving capital recovery, economic life of equipment, and rate of return on investment. Not available for graduate credit for industrial engineering students.

530 Case Studies in Engineering Economy (3) Extension of basic engineering economy principles to actual problems faced by competitive firms and regulated industries. Case studies taken from literature form basis of 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 decisions, and techniques for generating production schedules. Prereq: 3520.

4520 Industrial Development (3) Factors other than mechanical or chemical which enter into successful establishment and implementation of new enterprises. Cost and location studies and market analysis to determine the commercial feasibility of new plants or projects.

4500 Simulation (3) Generation of outcome of complex random process by computer. Models of complex systems using available simulation languages. Simulation as design tool for training enterprise. Cost and location studies and market analysis to determine the commercial feasibility of new plants or projects.

530 Case Studies in Engineering Economy (3) Extension of basic engineering economy principles to actual problems faced by competitive firms and regulated industries. Case studies taken from literature form basis of classroom discussion. Out-of-class assignment is made which involves working with local companies to evaluate make or buy options, leasing versus cash purchases, equipment replacement studies, energy source economies. Prereq: 4520.

4540 Industrial Development (3) Factors other than mechanical or chemical which enter into successful establishment and implementation of new enterprises. Cost and location studies and market analysis to determine the commercial feasibility of new plants or projects.
4800 Predetermined Time Systems (3) Work design and measurement using predetermined time system; methods; time measurement, basic motion time-study, or work factor. Theory and application. Prerequisites: 3600, 3630.

4610 Human Factors in Work Design II (3) Human capabilities and limitations affecting work place layouts, working environments, design of tools and equipment, and interactions and performance in human-machine systems. Prerequisites: 3600, 3630, or consent of instructor.

4830 Health Systems Engineering (3) Hospital management systems and means by which they may be improved through application of modern industrial engineering principles and techniques.

4860 Industrial Systems Analysis (3) Matrices and linear vector spaces for industrial systems models. Laplace and Z-transform techniques and applications. General system description and modeling. Applications to Industrial productivity and systems. Prerequisites: 3510, 3520 and Mathematics 2660. Not available for graduate credit for industrial engineering majors.

4870 Mini-Computer Applications in Industrial Engineering (3) Introduction to computer hardware and human-computer interfaces; emphasis on small computers as element of larger system; applications and limitations of small computers in solving industrial engineering problems. Prerequisites: Senior standing.

4910-50-30 Special Industrial Engineering Topics (3, 2, 1) Prerequisite: 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 (1-15) E.

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

5110 Work Design (3) Advanced methods analysis of design and improvement of work systems, human factors, workers' response and management participation. Prerequisites: Motion and time study or work methods and design.

5210 Advanced Work Measurement (3) Characteristics of predetermined time systems, application to formula construction, and practice in application. Prerequisites: 5200, 5240.

5240 Facilities Planning and Design (3) Modern materials handling techniques, computer-aided layout techniques, applications of operations research models for the design and modification of facilities. Prerequisite: Production facilities planning or consent of instructor.

5250 Advanced Scheduling (3) Scheduling problems with mathematical closed form solutions. Application, analysis, and development of heuristic procedures for scheduling. Emphasis on objectives and costs of scheduling. Prerequisite: 4230.

5260 Information Systems Design (3) Systems engineering approach to information systems design. System model, analysis, and evaluation of information system, information objectives and design criteria. Optimization and simulation in system design.

5280 Production and Inventory Systems (3) Applied mathematical methods of production and inventory systems. Closed form solutions, search techniques, and use of available computer codes. Prerequisite: 5200, Consent of Instructor.

5340 Applied Decision Theory (3) Application of theory of decision making to problems in industrial engineering. Decision making under conditions of incomplete information; Bayesian and Neyman-Pearson statistical decision models, utility functions, value of information, linear and quadratic loss analysis and improvement of sequential decision processes. Prerequisite: Statistics 3450.


5420 Reliability Engineering (3) Reliability concepts, failure distribution, equipment reliabilities, time dependent system and component reliability, Maintenance data analysis and replacement problem. Prerequisite: Statistics 3450.


5600 Human Factors Engineering (3) Human characteristics which influence design of tools, equipment, environment, and products. Modeling of human as process or system controller. Prerequisite: Consent of instructor.

5610 Human Factors Engineering II (3) Human operator, performance characteristics, and environmental requirements. Formal description of human operator characteristics through quasilinear models and models describing operator as information processor. Prerequisite: 5600.

5700 Optimization Methods in Industrial Engineering (3) Operations research. Analytical techniques required in 5710, 5720, and 5730. Classical optimization theory, n-dimensional geometry and calculus of variations, selected areas of operations research. Prerequisite: Computer Science 3150 and matrix algebra.

5701 Operations Research Applications (3) Survey of operations research techniques with emphasis on application to industrial engineering problems. Prerequisite: Mathematics 2860 (or equivalent), Statistics 3450, computer programming. Available for credit only to students without a B.S degree in industrial engineering.

5710 Linear, Quadratic and Separable Programming (3) Mathematical programming; linear programming, quadratic programming, and separable programming. Computer solutions to programming problems. Prerequisite: Computer Science 3150 and matrix algebra.

5720 Queuing Models and Simulation (3) Theory and application of waiting line models and simulation methods employed to evaluate complex queueing systems. Data analysis and hypothesis testing related to pertinent waiting line probability density functions. Prerequisites: 5700, 5730.

5730 Game Theory and Random Processes (3) Operations research including game theory with applications to multistage decision process, dynamic systems, and sequential decision and random processes with applications to queuing, inventory models and decision making. Prerequisite: 5360.


5830 Health Systems Engineering II (3) Health systems for analysis, control and improvement of function and total health system. Prerequisite: 4830.

5840 Air Traffic Control Systems (3) Current systems of air traffic control. Stochastic systems and air traffic flow with emphasis on applicable mathematical models. Prerequisites: Statistics 3450, Computer Science 3150.

5850 Dynamic System Simulation (3) Development and use of models for computer simulation of dynamic systems. Simulation techniques in systems design. Prerequisite: 4590 and Computer Science 3150.

5900 Design Project (1-8) Industrial engineering topic to fulfill the non-thesis requirement in non-thesis program. Enrollment limited to industrial engineering students in non-thesis program. May be repeated. Maximum 8 units.

5910-20-30 Special Topics in Industrial Engineering (3, 3, 3) Special problems for students qualified to handle individual or group research projects. Prerequisite: Consent of instructor. May be repeated. Maximum 9 hours.


6520 Operations Research Models in Engineering Economy Decisions (3) Traditional capital planning and budgeting techniques; operations research approaches to capital budgeting problems. Mathematical programming and computer simulation. Interrelated projects, uncertain cash flows, and choice of appropriate evaluation criteria. Prerequisites: 5520, 5710.

6700 Nonlinear Programming (3) Optimization techniques for static and dynamic nonlinear systems subject to various constraints. Applying optimization theory to solve nonlinear optimization problems. Variable metric methods, search methods, constrained nonlinear programming, and penalty function methods. Prerequisite: 5700.

6730 Dynamic Programming (3) Solving multi-stage optimization problems as sequence of single-stage optimization problems. Computational and theoretical aspects of dynamic programming. Decision making under certainty and risk. Prerequisite: 5700.

6740 Advanced Topics in Optimization of Dynamic Systems (3) Advanced topics in optimization of dynamic systems; state, increment dynamic programming, adaptive optimization, and other selected topics. Prerequisite: 6730.

6910 Advanced Topics in Industrial Engineering (3) Will cover topics not covered in other graduate courses. A forum for advanced graduate students to study industrially oriented topics as a group. Prerequisite: Graduate standing and consent of instructor. May be repeated with consent of department.

Mechanical and Aerospace Engineering

MAJORS

DEGREES

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

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


Assistant Professors: R. D. Smith, Ph.D. California Polytechnic Institute; J. M. Issler, Ph.D. Tennessee, M. Parang, Ph.D. Oklahoma, R. G. Parsons, Ph.D. California Institute of Technology

1. Alumni Distinguished Service Professor
2. Space Institute, Tullahoma.
GRADUATE STUDY PROGRAMS
Graduate programs in Mechanical Engineering or Aerospace Engineering are available which lead to the degrees of Master of Engineering, Master of Science, and Doctor of Philosophy with concentrations in solar energy, energy resources and utilization, power generation, machine design and dynamics, aerodynamics, acoustics, stress analysis, propulsion, heat transfer and fluid mechanics, and thermodynamics. 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.

MASTER OF ENGINEERING PROGRAMS
Entrance into the Master of Engineering program is restricted to qualified graduates of A.B.E.T.-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.

MASTER OF SCIENCE PROGRAMS
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.

MASTER'S PROGRAM OPTIONS
Three program options are available:
A. 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 which includes at least 18 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally 9 quarter hours of course work (4000-level or above) in mathematics.
2. A minimum of 9 quarter hours of credit in the thesis.
3. Participation in the departmental seminar program.
4. Submission and defense of a written thesis which demonstrates the ability to conduct and report on an independent investigation.
5. Passing a final examination on all work submitted for the degree.
B. 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 vision for 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 9 quarter hours of course work (4000-level or above) in mathematics. No more than 3 quarter hours of engineering course work may be below the 5000 level.
2. Participation in the departmental seminar program.
3. Passing a comprehensive written final examination on all course work submitted for the degree. The student's committee will be of sufficient size to include all the study areas reflected in the course program.
C. 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 9 quarter hours of course work (4000-level or above) in mathematics.
2. A minimum of 9 quarter hours credit in Selected Engineering Problems (5900). A written report must be presented for each problem investigated.
3. Participation in the departmental seminar program.
4. Passing a comprehensive written final examination of all course work submitted for the degree and an oral examination of all work (including problems) submitted for the degree.

THE DOCTORAL PROGRAM
Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds. The student must satisfactorily complete an approved program of study which normally includes:
1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or problems.
2. A minimum of 36 quarter hours of credit in doctoral dissertation.
3. A minimum of 18 quarter hours in mathematics in courses numbered 4000 or above.
4. A minimum of 36 quarter hours in mechanical and/or aerospace engineering courses numbered 5000 and above, with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis, problems or dissertation credit.
5. Participation in the departmental seminar program.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Mechanical Engineering
3600 Energy—An Overview (4) Introduction to available energy resources, conservation and utilization, power generation techniques including conservation schemes; emphasis on the resource- environment-human 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.
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 of mechanical and aerospace engineering methods.
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) Applications of Newton's laws, work, energy, and impact to machinery. Force analysis of mechanisms, balancing, gyroscopic effects, flywheels. Prereq: 3610.
3650 Introduction to Machine Design (3) Ductile-brittle behavior of materials under static and cyclic loading. Stress concentration, design factors and theories of failure. Changes in material behavior in processing and fabrication. 2 hrs and 1-2 hr lab.
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 or analysis, design, performance evaluation.
4180 Energy Production and Utilization (3) Thermodynamics constraints on energy production; comparison of power generation methods; evaluation of new energy systems and concepts; energy conservation schemes.
4220 Environmental Noise (3) Basic principles of acoustics—measurement and control of noise in industrial and community environments.
4240 Heat Transfer (3) Heat transfer by free and forced convection, heat transfer in phase change, heat transfer in high speed flow, heat exchanger applications.
4560 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,
Selected Topics In Mechanical Engineering (3, 3) Problems related to developments and practice in mechanical engineering.

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered in the program. Prerequisites: university status and consent of instructor. May be repeated. S/NC only.

5110 Conduction Heat Transfer (3) Analysis of steady state and transient heat conduction by analytical and numerical techniques. Prerequisites: 3910, 4420 and Mathematics 3440.

5120 Convection Heat Transfer (3) Equations of viscous fluid flow, energy equation, convection analysis of internal and external flows including effects of variable heat flux, surface temperature, and fluid properties. Prerequisite: 5310 or equivalent.


5140 Phase Change Heat Transfer (3) Fundamental mechanisms, modeling and prediction of nucleate, transition and film boiling; critical heat flux, forced convection boiling and post-dry-out heat transfer; two-phase flow and pressure drop; condensation heat transfer. Prerequisite: 5120 or consent of instructor.

5210 Classical Thermodynamics (3) Macroscopic thermodynamics, statistical thermodynamics, and statistical mechanics. Prerequisites: 3910 and 3920; and Laws, equilibrium criteria, and thermodynamics of phase relationships. Prerequisite: 3330.

5220 Microscopic Thermodynamics (3) Thermodynamic properties, kinetic theory and statistical mechanics. Prerequisite: 5210.

5230 Special Topics in Thermodynamics (3) Prerequisite: Consent of instructor.

5310 Intermediate Fluid Mechanics (3) Vector descriptions of fluid mechanics, derivation of basic equations; two-dimensional potential flows; viscous flows with emphasis on boundary-layer theory. Prerequisite: 3920.


5410-20-30 Research in Mechanical Engineering (3, 3, 3) Research in mechanical engineering. Prerequisites: 5310; 3650 and 3910.

5510-20-30 Mechanical Engineering Design (3, 3, 3) Design of mechanical engineering units and systems.

5540-50-60 Advanced Strength of Materials (3, 3, 3) Elementary theory of elasticity; energy methods. Prerequisites: 3650 and 3910.

5610-20-30 Experimental Stress Analysis (3, 3, 3) Theory of elasticity; experimental methods; photoelasticity, strain gages, tachometer coatings.

5640-50-60 Advanced Machine Design (3, 3, 3) Design of bearings, gears, shafting; lubrication.

5760-70 Dynamics of Machinery (3, 3) Kinematics and kinetics; fixed, moving, and rotating coordinate systems; linear and angular momentum; energy methods; variables; rigid body dynamics; Lagrangian methods. Prerequisites: 3620, 3910.

5800 Vibrations of Mechanical Systems (3) Free and forced vibrations of simple and multiple degree of freedom systems; linear and nonlinear. Prerequisite: 3630.

5900 Statics of Rigid Bodies (3) Kinematics and kinetics; fixed, moving, and rotating coordinate systems; linear and angular momentum; energy methods; variables; rigid body dynamics; Lagrangian methods. Prerequisites: 3620, 3910.

6000 Doctoral Research and Dissertation (3-15) E

6110-20 Advanced Topics in Fluid Mechanics and Heat Transfer (3-3) Advanced theory and applications of fluid mechanics and heat transfer; natural convection, two-phase flows, high-speed reacting and non-reacting flows, advanced boundary layer theories. Prerequisite: Consent of instructor.

6130-40 Advanced Radiation Heat Transfer (3, 3) Radiation heat transfer in absorbing, emitting and scattering media; interaction of thermal radiation with participating flows; radiative heat transfer in hypersonic flow; radiative characteristics of luminous flames and nonuniform gases; scattering by polluted atmosphere. Prerequisite: 5110-20-30; Mathematics 4550.

6420 Selected Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium of pudendum in meta-stable states. Prerequisite: Consent of instructor.

6430 Selected Topics in Thermodynamics (3)

6610 Engineering Vibrations (3) Mechanical transients. Linear and nonlinear single degree of freedom systems. Prerequisite: Consent of instructor.

Aerospace Engineering

6150 Dynamics (3) Newton's law: work-energy, impulse-momentum, Lagrange equations, central force, gyroscopic effects. Applications to aerospace systems.

6200 Mechanical Vibrations (3) Free and forced vibrations of single and multiple degree vibrating systems; balancing of rotating machinery.

6360-40 Structural Analysis of Aerospace Vehicles (3, 3) Fundamentals of structural analysis as applied to configurations of aerospace interest. Introduction to aerelasticity phenomena. Must be taken in sequence.

6410 Aerodynamic Fundamentals (3) Atmosphere, dynamics and thermodynamics of perfect gases, fluid flow types, airflow theory, wing theory, drag. For non-aerospace engineering majors only.

6410 Aircraft Propulsion and Performance (3) Propellers, propulsion systems for aircraft, static performance and special performance problems, maneuvering, control surfaces, stability and control. For non-aerospace engineering majors only.

6420 Compressible Flow (3) One-dimensional internal flow; shock and expansion waves; friction and non-dimensional analysis.

6430 Low Speed Aerodynamics (3) Potential flow application.
theory; kinematics and dynamics of perfect fluids; analysis and design of aerospace bodies.  
4230 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow; compressibility effects; numerical solution methods.  
4240 Astronautics (3) Propulsion, trajectories, guidance, control, and atmospheric reentry of space vehicle systems.  
4250 Propulsion (3) Principles of propulsion devices: turbojet, ram-jet, and rocket engines.  
4260 System Design (3) Synthesis of aerospace system. Design report on the system.  
4471-91 Experimental Aerospace Engineering (3, 3) Experimental methods and measurements of force, length, time, temperature, pressure, transport rates and physical properties. Planning, conducting, analyzing, and reporting experimental tests run according to test standards and other specifications.  
4510 Airplane Performance (3) Introduction to airflow over bodies; drag, lift, control; static and dynamic stability; maneuvering; design of control surfaces.  
4910 Selected Topics in Aerospace Science (3) Problems and topics of special interest and significance to aerospace science and engineering required for an understanding of the several areas of aerospace science.  
5000 Thesis (1-5)  
5002 Non-Thesis Graduation Completion (3-15) Requirements: Registration; special examination; thesis; completion. May be repeated. S/NC only.  
5110 Fundamentals of Aerodynamics (3) Kinematics and dynamics of perfect fluids; potential flow about simple bodies; boundary layer theory; compressibility; effects; numerical solution methods. May be repeated. S/NC only.  
5170 Introduction to Fluid Mechanics (3) Physical laws of fluid mechanics; similarity and dimensional analysis; internal and external flows; similarity parameters, boundary layer theory; methods; applications.  
5200 Aircraft Performance (3) Analysis of aircraft performance. Required for aeronautical engineering students. May be repeated. S/NC only.  
5210-20 Aerodynamics of Compressible Fluids (3, 3) One-dimensional; flows; nonequilibrium analysis. Required for aeronautical engineering students. May be repeated. S/NC only.  
5260 Dynamics of Viscous Fluids (3) Equations of viscous fluid motion; laminar and turbulent flow; transition; separation; boundary layer theory; exact and approximate solutions. Prereq: Mechanical Engineering 5310 or equivalent.  
5290 Introduction to Hypersonic Flow (3) Special emphasis on nonequilibrium effects; blunt body theory; hypersonic flow; viscous interactions; rarefied gas flow. Prereq: 5240.  
5360 Selected Topics in Aerodynamics (3) Transonic, supersonic, and hypersonic flow theories. May be repeated. Maximum 9 hrs.  
5370-90 Aerospace Ground Test Facilities (3, 3, 3) Atmospheric models and similarity considerations. Aerodynamic test facilities including wind tunnels, shock tubes, hotshots and ballistic ranges; propulsion test facilities for air breathing and rocket engines. Theoretical and practical considerations of space environment test facilities. Prereq: 5240, Mechanical Engineering 5310 or equivalent.  
5310 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics, thermodynamic and thermophysical properties of gas plasmas; governing equations and applications. Prereq: 4220 and Mathematics 4710.  
5340-50 Atmospheric Entry (3, 3) Motion and heating along ballistic and lifting trajectories; dynamic stability; heat shield design systems. Recommended: 5240.  
5510-20-30 Aerospace Mechanics (3, 3, 3) Principles of mechanics applicable to space vehicle including equations of motion, multi-body problems, and trajectory analysis. Prereq: Mathematics 4710.  
5550 Vertical or Short Take-Off and Landing Aircraft (3) Analysis of performance and inherent stability characteristics of airplanes designed for vertical take-off, landing, short take-off. Prereq: 5210.  
5570 Aerosol Impaction (3) Aerodynamic phenomena. Phenomena associated with small particles, aerodynamic forces, and dynamic characteristics of typical modern systems. Application to systems. Prereq: 5550.  
5610-40 Aircraft Stability and Control (3, 3) Aircraft stability and control. Static and dynamic Eigenvalues of simplified structures. Prereq: 5210 and 5240 or equivalent.  
5640-50 Aerospace Vehicle Stability and Control (3, 3) Aircraft stability and control. Static and dynamic Eigenvalues of simplified structures. Prereq: 5210 and 5240 or equivalent.  
5690 Aircraft Performance (3) Analysis of aircraft performance. Required for aeronautical engineering students. May be repeated. S/NC only.  
5770 Aircraft Impaction (3) Aerodynamic phenomena. Phenomena associated with small particles, aerodynamic forces, and dynamic characteristics of typical modern systems. Application to systems. Prereq: 5550.  
5820 Air Vehicles (3) Current capabilities and future development of air transportation. For non-aerospace and non-mechanical engineering majors only. Prereq: 5220 and 5240 or equivalent.  
5830 Advanced Aerodynamics (3) Special topics and recent research results in the field of aerodynamics. Turbo-machinery noise, jet noise, and general theoretical developments, empirical equations. Prereq: 5610.  
5860 Aerodynamics of Compressible Fluids (3, 3) One-dimensional; flows; nonequilibrium analysis. Required for aeronautical engineering students. May be repeated. S/NC only.  
5900 Special Topics in Aerospace Engineering Credit to be arranged; 3 hrs maximum each quarter.  
6000 Doctoral Research and Dissertation (3-15) E  
6310 Magnetochemistry I (3) Electromagnetic field equations, magnetic field; statistical description of plasma, Boltzmann equation, conduction and diffusion in ionized gases. Prereq: 4220.  
6330 Magnetochemistry III (3) Engineering applications of magnetohydrodynamics, propulsion and power generation. Prereq: 6320, Mathematics 5630.  
6410 Physical Gasdynamics (3) High-speed, high temperature flow of gas from molecular point of view; molecular concepts and simple kinetic theory; mechanical properties of gases and gas mixtures from steady-state kinetic theory chemical thermodynamics, and statistical mechanics. Prereq: 5650.  
6420 Physical Gasdynamics (3) Continuation of 6410; flows of gas mixtures in local thermodynamic and chemical equilibrium; physical and chemical basis of the equation of state with vibration and chemical nonequilibrium. Prereq: 6410.  
6610 Advanced Boundary Layer Theory (3) Derivation and critical review of governing equations. Asymptotic solutions; similarity methods; boundary layer transformations. Approximate integral methods to include compressibility and heat transfer. Attached and separated flows; shock-wave boundary layer interaction. Prereq: 5220, Mechanical Engineering 5120, and Physics 5630.  
6690 Advanced Topics in Gasdynamics (3) Selection of topics based on students' interests. Prereq: nonequilibrium transport phenomena, radiative gasdynamics, nonequilibrium gasdynamics flows, combustion kinetics, and numerical perturbation techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.  

**Nuclear Engineering**  
**MAJOR**  
Nuclear Engineering  
M.S., Ph.D.  

**DEGREES**  

**Professors:**  
P. F. Pasqua (Head), Ph.D. Northwestern, P.E.;  
J. B. Fussell, Ph.D. Georgia Institute of Technology;  
T. W. Kerlin, Ph.D. Tennessee;  
J. E. Mott, Ph.D. University of California.  

**Assistant Professors:**  
H. E. Kaatz, Ph.D. Tennessee;  
L. Miller, Ph.D. Texas A & M P.E.;  
B. Ulahyehya, Ph.D. University of California.  

The Department of Nuclear Engineering offers degrees leading to the Master of Science, Master of Engineering, and Doctor of Philosophy with concentrations in nuclear energy, nuclear reaction and risk, radiation transport, thermal hydraulics, and core analysis.
MASTER OF SCIENCE PROGRAM

A graduate program leading to a degree of Master of Science is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary prerequisite courses before he/she enters the program. The Master of Science degree requires 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, statistics, or computer science.
4. Final examination covering the thesis and graduate course work.

An alternate program is available for the Master of Science degree which involves engineering practice rather than a thesis. The student must complete a program of study which includes the following:
1. Thirty-six quarter hours of course work similar to the requirements for the regular Master of Science program (see above).
2. Twenty-four quarter hours of Nuclear Engineering 5980. A student usually registers for 6 hours of Nuclear Engineering 5980 each quarter and is released from problem assignments 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 A.B.E.T. basic level criteria. In addition to Graduate School requirements the following degree requirements must be met:
1. Thirty-six quarter hours of course work, 18 of which must be in graduate nuclear engineering.
2. A minimum of 9 hours of design project, thesis, or 24 hours of Nuclear Engineering Practice (5980). Documentary proof of significant engineering experience may be submitted in lieu of the design project, thesis, or Nuclear Engineering Practice, but in this case 45 hours of course work are required.
3. Nine hours of course work submitted must be from outside 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. In addition, pass a final oral examination on all work presented for the degree.

THE DOCTORAL PROGRAM

Students in the field of nuclear engineering desiring to study for the degree of Doctor of Philosophy must have a Bachelor of Science in Nuclear Engineering or a Master of Science degree from a recognized university, with a major in engineering or physics, and present at least a B average. All candidates will be required to demonstrate this general competence in a comprehensive 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 research.
3. A minimum of 45 quarter hours in nuclear engineering courses numbered 5000 and above (or the equivalent), with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.
4. A minimum of 18 quarter hours in mathematics, computer science, or statistics in courses beyond nuclear engineering undergraduate requirements. Must be numbered 4000 or above.
5. A minimum of 9 quarter hours in courses numbered 5000 or above from a department other than nuclear engineering. The choice depends on the student’s overall program, and should expand his/her knowledge in a given field.
6. A reading knowledge of one foreign language will be determined by the student’s doctoral committee.

5110-20-30 Introduction to Nuclear Reactor Theory (3, 3, 3) Nuclear structure; radioactive decay laws; neutron interaction; fission process, chain-reacting systems; diffusion equation including multigroup diffusion theory, neutron moderation; reactivity coefficients; perturbation theory. Prereq: Physics 3730 or consent of instructor. W, F; Sp

4140 Thermionic Systems (3) Fusion reactions; properties of plasmas; plasma containment; plasma diagnostics; thermonuclear devices. Prereq: Physics 3730, Mathematics 4550. F

4210-20-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation, counting statistics, half-life and decay schemes, gamma spectrometry, cross-section measurements, analog computation, diffusion properties of neutrons, critical loading experiments, control rod calibration, statistical weight, shielding, xenon poisoning, prompt critical reactor behavior, fission density and adjoint flux. Prereq or coreq: 4110 or equivalent. F, W, Sp


4710 Energy Transport (4) Development of differential and integral energy conservation equations; conduction, convection, and radiation heat transfer; applications to nuclear reactor fuel elements and heat exchangers. Prereq: 3730, F

4720 Reactor Thermal Design (4) Hydrodynamics and heat transfer in boiling systems; boiling crises; fuel element thermal design, steam generator design. Prereq: 4710. F

4730 Nuclear Reactor Design (3) First order reactor design, integration with non-nuclear heat transfer and power conversion system, economic evaluation; optimization techniques, description of typical systems. Coreq: 4130. Sp

4810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation, shielding design. Prereq: Physics 3730, Mathematics 4550. Sp

4820 Reactor Kinetics and Controls (3) Derivation of kinetic equations; basic kinetic parameters; transient response with feedback, control, and protective systems. Prereq: 4110. W

4840 Nuclear Reactor Safety (3) Presentation of nuclear reactor concepts; credit accident incidence; fission product release and transport; containment systems; accident analysis; engineered safety features. Prereq: 4110. F

4930 Nuclear Fuel Management (3) Discussion of problems associated with processing of nuclear materials; fuel cycle analysis; burnup calculation. Prereq: 4110. Sp

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities for course work or research. May be repeated. S/NC only. E

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. Mathematics 4710, 4550. F; W, Sp

5210 System Dynamics (3) Transient analysis, Laplace transforms, frequent response, stability (linear and non-linear), and sensitivity analysis by state variable methods. Dynamic analysis of distributed systems. Prereq: Consent of instructor. F

5220 Reactor System Dynamics (3) Application of methods of general system dynamics to reactor systems. Modeling of delayed and non-delayed nuclear processes. Dynamics, stability, and control of zero power reactors and reactor systems. Prereq: 5210, 4130 or equivalent. W


5240 Reactor Instrumentation (3) Instrument components and systems for 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. A


5510-20-30 Nuclear Systems (3, 3, 3) Various reactor types; flow diagrams, thermodynamic analysis, control methods, effects of various reactor types and nuclear power economics. 4610-20-30 or equivalent or consent of instructor. F

5710-20-30 Nuclear Design (3, 3, 3) Analytical techniques for neutronistic aspect of nuclear reactor core design. Multigroup discrete ordinate theory, multigroup FN theory, integral transport theory, perturbation theory, and others. Generation of required multigroup constants formulated with available point data and Northem treatment in slowing down region and gas kernel in thermal region. Prereq: 4130 or equivalent. F; W, Sp

5740 Reactor Shielding (3) Application of analytic solutions of Boltzmann transport equation to shield design problems. Spherical harmonics, moments methods, numerical solutions, adjoint calculations, and invarient imaging cases studied. Prereq: 4610. F

5790 Monte Carlo Shield Design (3) Analysis of radiation transport problems in shielding by Monte Carlo Analysis methods; random sampling, evaluation of integrals, analog particle transport, techniques of variance reduction. Prereq: 4810. W

5840-50 Fast Breeder Reactors (3, 3) Special characteristics of fast breeder reactors; emphasis on LLBMFR. Need for breeders; neutron physics and thermal characteristics of reactor core; development status of experimental and full-scale fuel cycle cost analysis; safety; coolants other than sodium; world status of development.

5970 Special Topics in Nuclear Engineering (3) Lectures and recitation on recent advances in nu-
clear engineering. Prereq: Consent of instructor. May be repeated with consent of department.

5980 Nuclear Engineering Practice (3-12) Experiences in solving and reporting on engineering problems. Prereq: Approval of Nuclear Engineering Department. May be repeated. Only Alternate Plan students may take this course. S/NC only. E

6000 Doctoral Research and Dissertation (3-15) E

6110-20-30 Selected Topics in Reactor Theory (3, 3, 3) Transport theory, control rod theory, and perturbation theory. Selected topics from literature. Prereq: Consent of instructor. F, W, Sp

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. Selected neutron, gamma, and space-radiation shielding problems. Prereq: Consent of instructor. Sp

6150 Reactor Dynamics (3) Special topics in reactor dynamics and control. Prereq: Mathematics 5630. Su

6410 Selected Topics in Nuclear Systems Reliability Engineering (3) Advanced state-of-the-art topics in nuclear systems reliability engineering and risk assessment. Prereq: 5330 or consent of instructor.

6510 Nuclear Reactor Noise Analysis (3) Modern system theoretical methods for evaluating reactor performance descriptors from operating data. Prereq: 4610 and Electrical Engineering 5740 or equivalent.

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. Su
College of Home Economics

Nancy Belck, Dean
Jay Stauss, Assistant Dean, Graduate Studies
Fran Andrews, Assistant Dean,
Undergraduate Studies
Helen Grove, Assistant to the Dean

Graduate work in Home Economics prepares the student for teaching, research and public service in colleges and universities and for managerial positions in government and industry. Graduate study leads to the degrees of Master of Science in: Child and Family Studies; Consumer Studies and Housing: Public Policy; Interior Design and Housing; Food Science; Food Systems Administration; Vocational-Technical Education (concentration in home economics education); Nutrition; and Textiles and Clothing; and the degree of Doctor of Philosophy in Home Economics with three options: interdisciplinary, food science, and nutrition.

GENERAL REQUIREMENTS FOR GRADUATE STUDENTS

General requirements for graduate study are prescribed by the Graduate School and by the student's department. Each student's application is reviewed by faculty, and students lacking adequate preparation may be required to take additional courses at the undergraduate level as prerequisites to graduate study. A student deficient in English may be required to take courses as necessary to remove the deficiency.

APPLICATION FOR ADMISSION AND FINANCIAL AID

Requirements for admission to the Graduate School are on page 12 of this catalog. A College of Home Economics application and three letters of recommendation are required. These may be obtained at the Dean's Office, Jessie Harris Building, or write or call:

Jay Stauss, Assistant Dean
for Graduate Studies
College of Home Economics
The University of Tennessee
Knoxville, Tennessee 37916
Phone: (615) 974-5221

Graduate Record Examination scores for the aptitude test including the quantitative, verbal, and analytical sections are required for application to the Ph.D. interdisciplinary program, to the Master's program in Child and Family Studies, and Consumer Studies and Housing: Public Policy.

ACADEMIC COMMON MARKET

The doctoral program in Home Economics is listed in the Academic Common Market of the Southern Regional Education Board. Residents of Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, South Carolina, or West Virginia are eligible to enroll at UTK on an in-state tuition basis. The Master's program in Food Systems Administration is also listed for residents of Arkansas, Kentucky, or West Virginia; as is the Master of Science program in Nutrition for residents of Alabama and Virginia.

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*
  - Interior Design and Housing

  *Requirements include Interior Design and Housing 5615 or Child and Family Studies 5170; Child and Family Studies 5200 or Planning 5100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5660. Three-hour course in research methods or statistics. Twenty-four hours in consumer studies or housing to include 9 hours of Child and Family Studies 5000 or Interior Design and Housing 5000.

- Consumer studies courses to be selected from Child and Family Studies 5140, 5170, 5180, 5700, 5800, 5900; Interior Design and Housing 5120; Food Science 4040; Textiles and Clothing 5180; Agricultural Economics 4710; Economics 5050-60; Political Science 5641, 5670-80, 5710; Library and Information Science 5580.

- Housing courses to be selected from Agricultural Mechanization 5110, 5650; Interior Design and Housing 4330; 5615, 5616-20-30; Planning 5360-80, 5455; Geography 5520.

- Twelve hours in an area of home economics other than the area (consumer studies or housing) chosen above.

- Minimum 27 hours in and 8 hours outside College of Home Economics. Minimum of 27 hours 5000-6000 level courses and total minimum of 45 hours. Courses may be used to meet more than one requirement but all minimum requirements will need to be met.

Food Science

- Food Systems Administration
- Nutrition
- Textiles and Clothing

  Major (includes minimum of 9 hours of 5000 courses) ............. 18 hrs
  Thesis ......................... 9 hrs

Collateral area(s) of study (includes minimum of 8 hours of 5000 courses) ............. 18 hrs

  (Minimum of 18 hours of 5000-level exclusive of thesis.)

In some instances two related collateral areas may be selected with 9 hours in each area and a minimum of 3 hours of a 5000 course in each.

Collateral area(s) of study may be chosen in an area other than in home economics with the approval of the appropriate professors.

An oral examination is required.

Note: Nine hours is the maximum credit allowed for special problems work and 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 in 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* will consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000-level. A minimum of 27 hours of 5000 and 6000 level courses is required in the program. Some majors may require 9 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.

**Requirements include those listed under the thesis option for the major in Consumer Studies and Housing: Public Policy except that 21 hours are needed in consumer studies or housing to include Home Economics 5060 (6 hours), or Child and Family Studies 5060 or Interior Design and Housing 5060.
The interdisciplinary option is available in all socioeconomic needs of consumers. Other behavior; community programs to meet quality of the environment.

Economic change; technological other 90-hour seminar.

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 5310 and hours from Food Science 5510-20-30-40, 6110, Food Systems Administration 6110; and Zoology 5350 or equivalent.

2. Twenty-four hours in 5000- and 6000-level courses in food science or in food systems administration.

3. Nine hours in a collateral area. Upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area may be substituted for 5000 and 6000 courses in food science or in food systems administration.

4. Minimum of 4 hours of credit in doctoral seminar.

Nutrition option:

1. Thirty hours of 5500 or 6500 courses in nutrition exclusive of research and Zoology 5350 or equivalent.

2. Nine hours in a collateral area. Upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area beyond the 9 hours may be substituted for 5000 and 6000 courses in nutrition.

3. Minimum of 4 hours of credit in doctoral seminar.

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 major in Consumer Studies and Housing: Public Policy is particularly suitable for students interested in home economics extension, although Master's programs may be planned in any subject matter area of home economics with agricultural extension education as a collateral area. Additionally, four-week courses are offered in February each year for students particularly interested in home economics extension.

Graduate programs in Home Economics provide three options for study: interdisciplinary, food science, and nutrition. The interdisciplinary option is available in all departments in the College. The interdisciplinary program requires:

1. A minimum of 96 quarter hours in courses beyond the Bachelor's degree exclusive of credit hours for the Master's thesis to include a minimum of 12 quarter hours of 6000-level courses.

2. Selection of an option and fulfillment of the requirements as supervised by the faculty committee.

3. The faculty committee for each doctoral student shall determine whether a reading knowledge of a foreign language is required.

4. Written comprehensive examination.

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.

Other Requirements:

Interdisciplinary option:

1. Home Economics 6110-20, 6210.

2. Twenty-four to 36 hours from at least two departments in the College of Home Economics representing one of the following concentrations:

Individual and Family Behavior related to development and change throughout the human life cycle. Emphasis may be on: normal developmental processes in individuals and families; socialization through childhood, adolescence, and adulthood; behavior in diverse environmental and cultural settings; interaction processes within families; community services and planning diagnostic or remedial needs of individuals and families.

Physiological Development and Well-being in humans 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 in design, space planning, housing, food service systems, clothing, and textiles 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 microeconomics and political development on consumption patterns and other behavior; community programs to meet the socioeconomic needs of consumers.

15. Fifteen to 24 hours in cognitive or research methods needed for dissertation research.

4. Doctoral research and dissertation will be based on a problem within the interdisciplinary concentration.
5610-20 Advanced Food Science (3, 3) Biochemical and biophysical interactions in food. Prereq: 4010; Nutrition 3320 or equivalent, or consent of instructor. W; Sp.

5630 Carbohydrates and Fats in Relation to Food Science (3) Physical and chemical characteristics of sugars, starches, and fats with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5640 Proteins in Relation to Food Science (3) Physical and chemical characteristics of the proteins of milk, egg, flour, and meat with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5700 Current Programs and Trends in Food Science (1-3) Recent advances in food science, impact on curricular considerations, and implications for teachers, extension workers, and dietitians. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Science (1-3) Advanced study from 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 food-related industry or agency under supervision of faculty member. Prereq: Consent of instructor.

5900 Seminar (1-3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. S/NC only.

6000 Doctoral Research and Dissertation (3-15) E

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 Diarrheas (3) Physical characteristics of solutions, colloidal dispersions, and suspensions in relation to treatment and prevention of diarrhea. Prereq: 5520.

6310-20 Structure of Food Plants and Animal Tissues (3, 3) Histological structure of food plants and animal tissues related to physical characteristics and chemical properties of components. Prereq: 5630-40.

6510-20 Food and Sociocultural Change (3, 3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5550 or 5560; or consent of instructor. F; W

6900 Seminar (1-3) May be repeated. S/NC only.

E Nutrition

3310 Organic Chemistry (4) Emphasis on subjects leading to 3320-30. Textiles and Clothing 4220. Prereq: General Chemistry. 3 hrs and 1 lab. Not for graduate credit. S/NC only. F; W

3320 Food Analysis (4) Elementary quantitative analysis; typical food analyses. Prereq: 3310 or equivalent. 3 hrs and 1 lab. Not for graduate credit to departmental majors. F; Sp.

3330 Physiological Chemistry (3) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Not for graduate credit to departmental majors. Sp; Su.

3339 Physiological Chemistry Laboratory (1) Prereq: 3320; Coreq: 3330. 3 lab. Not for graduate credit to departmental majors. Sp; Su.

4010 Reproductive and Developmental Nutrition (3) Nutritional requirements for infantile growth, maternal health, infant, and preschool children. Prereq: 3020, 3050, or 3410. 2 hrs and 1 lab. F

4020 Nutrition for Children, Adolescents and Adults. Application of basic principles and research findings to good nutrition for children, adolescents, and adults. Prereq: 3020, 3050, or 3410. 2 hrs and 1 lab. S

4030 Community Nutrition (3) Nutrition problems and services in the community; supervised field experiences are integral part of the course. Prereq: 3020, 3050, or 3410. 3 hrs and 1 lab. F

4110 Introduction to Nutrition Research (3) Discussion of principles and laboratory experiences. Prereq: 3410 or equivalent. 2 hrs and 1 lab. Sp

4230 Nutrition in Disease (4) Nutrition problems in diseases influenced by diet. Prereq: 3410. W; Su

4231 Clinical Experiences in Dietetics (1) Planned clinical experiences applying principles of nutrition in disease. Coreq: 4230. Su

4240 Nutrition in Disease (1) (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. F

4430 Diet and Drug Therapy (3) Effect of drug therapy on absorption and utilization of nutrients, and effect of drug therapy on metabolism and toxicity of drugs. Prereq: 3410 or consent of instructor. W

5000 Thesis (1-15) E

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

5110 Advanced Physiological Chemistry (4) Bioenergetics and related metabolism of nutrients. Prereq: 5110. F; W

5120 Advanced Physiological Chemistry (3) Nutritional factors in relation to body fluids, gas transport, and endocrine function. Prereq: 3330. W

5140 Foods and Nutrition: Physicochemical Principles (3) Introduction to physicochemical properties of many of the foods used in dietetics; chemical interactions of proteins and other substances in foods and their utilization and toxicity of drugs. Prereq: Nutrition 3330 and Mathematics 1540 or equivalent. Sp, A


5220 Experimental Methods in Nutrition (3) Use of small animals in experimental nutrition. Prereq: 3320-30, 3410. 2 hrs and 1 lab. S

5240-50 Research Techniques (3, 3) Analytical methods for assay of food and biological materials. Human metabolic balance experiments. Prereq: 5300, 3 labs. F

5310 Community Nutrition (3) Nutrition problems and practices in community; supervised field work. Prereq: 3410 and consent of instructor. 3 labs. F

5320 Community Nutrition (3) Observations and participation in nutrition programs of local and state agencies. Prereq: 5310 and consent of instructor. 3 labs. W

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. Su

5340 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of study to be selected in consultation with instructor. Prereq: 5300 and consent of instructor. S/NC only. Sp

5520 Problems in Nutrition (1-3) Advanced study selected from field of nutrition. Prereq: Consent of department head and professor in charge of investigations. May be repeated. Maximum 9 hrs.

5900 Seminar (1-3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. S/NC only.

6000 Doctoral Research and Dissertation (3-15) E

6110 Proteins and Amino Acids (3) Lectures, reports, and discussions. Prereq: 5140. F

6120 Mineral Metabolism (3) Lectures, reports, and discussions. Prereq: 5140. W; Su

6140 Vitamin Metabolism (3) Lectures, reports, and discussions. Prereq: 5140. F

5210 Advanced Topics in Nutrition (1-3) Recent advances, concepts, research techniques, and current problems. Prereq: 5410-20 or consent of instructor. May be repeated. Maximum 9 hrs.

6900 Seminar (1-3) May be repeated. Maximum 9 hrs. S/NC only. E

Food Systems Administration

4130 Food Systems Administration (3) Functions of management applied to food service systems. Prereq: 3110. F

4140 Food Systems Personnel Development (3) Development of training programs for food systems personnel. Prereq: 4130. F

4150 Design and Layout of Food Service Systems (3) Design of physical facilities and selection and purchasing of equipment for food service systems. Prereq: 3110 or consent of instructor. Sp

4260 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, Accounting 2130. W

4260 Food and Lodging Physical Plant, Planning and Maintenance (4) Feasibility, planning, development, construction, and maintenance of food service and lodging physical plant and maintenance. Electrical, mechanical, heating, plumbing, air conditioning, ventilation and illumination systems. Types of building materials and construction. Prereq: 4130, 4150 or consent of instructor. 3 hrs and 1 lab. W

4270 Tourism, Food and Lodging Information Systems (3) Qualitative and quantitative analysis of information systems for decision making in food and lodging operations or other operations related to the tourist industry. Prereq: 4130, 4250, Computer Science 1410. F

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise
MAJOR: Home Economics

DEGREE: Ph.D.

5060 Practicum (1-12) Field experience in selected organizations that focus on interdisciplinary solutions to multilevel problems of society. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

5100 International Studies (1-15) Student- or staff-initiated course for study in foreign country of topic pertinent to field. Topic to be determined by student and instructor with department and college approval. May be repeated. Maximum 15 hrs.

5210 History and Philosophy of Home Economics (3) Historical development of home economics; survey of concepts and philosophy of component disciplines and analysis of current programs; emphasis on projection of future developments.

5220 Development of Community Services Programs (3) Evaluation of Community Services Programs (3) Purposes of evaluation, clarification of objectives and procedures for determining progress.

5600 Home Economics in the Community (3) Role of home economists in community and how interactions among professionals of all community resources affect the solving of problems of individuals, families, and communities related to quality of life. Prereq: Agricultural Economics 4320 or Economics 5340 or Planning 4100 or Child and Family Studies 5700 or consent of instructor.


5900 Seminar in Human Resource Development (1-3) May be repeated. S/NC only.


6110-20 Theoretical Issues in Human Resource Development (3-3) Interdisciplinary approach to development and use of human resources in solution of family and consumer problems. Prereq: 12 hrs of 5000-level courses representing 2 areas of home economics. F, W

6210 Professional Issues in Human Resource Development (3) Role and philosophy of administration and procedures for human resource development. Prereq: 12 hrs of 5000-level courses representing 2 areas of home economics. Sp

6310 Advanced Topics (3) Comprehensive individual study and group discussion of current problems in human resource development. Prereq: Consent of instructor.

6320 Seminar (1-3) Topics in home economics. May be repeated. S/NC only.

6500 Methodological Issues in Human Economics (3) Advanced methodology in home economics. Prereq: 1 graduate-level course in research methodology or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

Home Economics Education

Graduate study in home economics education provides for an M.S. in Vocational-Technical Education (concentration in home economics education) and opportunity for participation in Ed.D. program in Vocational-Technical Education in the College of Education. (See page 64 for staff and course offerings.)

Textiles, Merchandising, and Design

MAJORS: Textiles and Clothing, Interior Design and Housing

DEGREES: M.S., Ph.D.

MAJOR: Consumer Studies and Housing: Public Policy

Ph.D.

Professors: R. G. Blakemore Ph.D. (Florida State); B.C. Goswami, Ph.D. (Manchester (England)); J. V. Orihno (Head), Ph.D. (Iowa State).

College of Home Economics

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Associate Professor: M. F. Drake, Ph.D. (Pennsylvania State); J. M. Ford, Ph.D. (Pennsylvania State); I. A. Thompson, Ph.D. (Missouri).

Faculty Associate: T. L. Vigo, Ph.D. (Lane). Assistant Professors: C. E. Cox Jr., Ph.D. (Tennessee); L. A. Kocher, Ph.D. (California-Davis); G. K. McCurry, M.S. California State.

Interior Design and Housing

A student's course of study includes intensive training in 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.

The 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 interior design or the design aspects of housing.

ACQUISITIONS AND EXHIBITIONS

For interior design majors, the department reserves the right of acquisition and exhibition of work completed in its studios under the guidance of the faculty.

Prospective graduate students should submit a portfolio of their work to the department. This portfolio may include slides or original work.

4130 Contemporary Design (3) Furnishings and interiors: economic, technological and sociological influences on the design process; selection and neighborhood development; furnishing; significant designers and their work.

4155 Interior Space Planning I (6) Analysis, planning and design of office environment; includes contract specifications. Prereq: 3256 or equivalent.

4156 Interior Space Planning II (6) Studio problems involving large scale nonresidential interior spaces such as restaurants, transportation facilities, stores, institutions. Prereq: 4155 or consent of instructor.

4320 Family Housing Problems (3) Housing requirements of families. Reading and judging house plans; effective use of space; maintenance problems; housing regulations and restrictions; site selection and neighborhood problems; financing procedures. Prereq: 6 hrs from Economics 2110-20. Sp

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: 2430. 1 hr and 2 abs.

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. Prereq: 5006 or consent of instructor. May be used toward degree requirements. Maximum 9 hrs.

5040 Seminar in Design (3) Intensive reading, discussion and critical evaluation of twentieth-century design concepts and the design, building, and creative components leading to visual innovation.

5050 Advanced Design Studio (4) Strength, structural variability, and form potentials of design materials; search for aesthetic potential in depth.

5060 Practicum (1-12) Field experience in selected agencies and organizations that focus on solutions to problems in housing.

5120 Historic Interior Design (3) Research studies of historic design developments. Variable course content, emphasis on interior design, furniture and/or accessories for England, Scandinavia, Mediterran-
various concepts, theories and methodologies of individual study and group discussion of various arranged. Prereq: Consent of instructor.

5410 Advanced Problems (3) Individual development of techniques and appreciation. Prereq: 9 hrs related art or equivalent.

5510 Environmental Factors in Interior Design (3) Human factors and associated research techniques related to design of architectural environments—derivation of design implications from anatomy, physiology, anthropology, and behavioral sciences. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5520 Environmental Factors in Interior Design (3) Systematic design methodology as applied to design of microenvironments using human factors information. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5530 Environmental Factors in Interior Design (3) Human factors and systematic design methodology applied to analysis, synthesis, and evaluation of research-oriented interior design projects. Project groups; preplanned; supervised. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5610 Furniture Design (3) Analysis of human factors data in design of body support, task support, and storage of furnishings and systems; production of construction drawings and scale models. Prereq: Consent of instructor. Sp

5613 Housing Management (3) Role and functions of housing management specialist in problems of private and assisted housing management. Prereq: 4320 or consent of instructor.

5614 Housing Regulations and Controls (3) Function of regulations and other control practices and mechanisms as determinants of nature, availability of housing in local communities by various user groups. Prereq: 4320 or consent of instructor.

5615 Housing Programs and Policies (3) Analysis of private and public programs and policies to promote realization of suitable homes and living environments for families. Economic and social problems related to national housing objectives. Prereq: 4320 or consent of instructor.

5620 Experimental Methods in Household Equipment (3) Refresher course; new developments in textiles. 5260-Emphasis on fabric dyeing, and finishing. 5250 must be taken first, 5260 or equivalent. Prereq: 6 hrs or equivalent from each of follow-

5630 Environmental Requirements for Family Work Centers (3) Trend in planning work center areas such as kitchens and laundries; adequacy, convenience, surface treatment, facilities and costs; problems of installation and remodeling.

5810 Environmental Design Research (1-3) Evaluation and application of research methodologies to interior design problems. Hours and credit arr- rangement. Prereq: 5510-20-30 or equivalent and consent of department head and instructor 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. E

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. E

5910-20-50 Seminar (1-4, 1-4, 1-4) Hours and credit arranged. Prereq: Consent of instructor.

610 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) Various concepts, theories and methodologies of social sciences in housing research. Prereq: Consent of instructor.

6210 Environmental Design Analysis (3) Advanced methodology in psychology of environmental design, multidisciplinary research data and methods. Prereq: 5160 or consent of instructor. May be repeated. Maximum 9 hrs.

6220 Perspectives in Interior Design (3) Historical influences related to contemporary concepts in interior design. Prereq: 5040, 6 hrs of graduate level art history, or consent of instructor.

6230 Textiles and Clothing (3) Elementary Textile Microscopy (3) Microscopic techniques as applied to the study of textile fibers and fabrics. Prereq: 4010. 1 hr and 2 labs. W, A

6240 Design Analysis II (3) Interpretation of dress design terminating in finished garments developed through the media of draping.

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Variable flow of research-oriented project subject to 3- member teams. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5110 Textiles Testing and Methods of Research in Textiles (3) Physical and chemical testing. Research methods. 3 labs. Sp

5120 Advanced Problems in Textiles and Clothing (3) Refresher course; new developments in textiles. Selecting fabrics, agencies aiding consumer, and individual problems in textile field. 2 hrs and 1 lab. F

5130 Advanced Tailoring (3) Comparison of hand tailoring and trade methods used in making suits, coats, or costumes. 3 labs.

5150 Principles of Design Analysis (3) Application of flat pattern theory to garment design incorporating relationships of fabric geometry, texture hand, and surface ornamentation to design. Prereq: Consent of instructor. 1 hr and 2 labs. W

5160 Review of Literature (3) Intensive survey and evaluation of recent literature; implications for further research. F

5170 Social, Psychological and Economic Aspects of Clothing (3) Clothing as it relates to human behavior. Prereq: 6 hrs or equivalent from each of following areas: sociology, psychology, economics. W

5180 Advanced Textile Economics (3) Economic problems or problem areas of current importance in textile and apparel industries—production, consumption, and governmental policy. Prereq: 3420, 6 hrs economics or consent of instructor. W

5210 Evaluation of Instructional Materials in the Field of Textiles and Clothing (3) Evaluating instructional materials in communicating information in various areas of textiles and clothing. 1 hr and 2 labs.

5220 Historic Textiles (3) Development of textile industry in world; fibers used, design, and color. F

5240 Practicum (1-9) Off-campus experience with business, industry, governmental agencies and civic groups; preplanned; supervised. Prereq: Consent of major advisor and department head. May be repeated. Maximum 9 hrs. S/NC only.

5250-56-70 Problems in Textile Chemistry (4, 4, 4) Theoretical and experimental study of chemistry of textile fibers including polymerization, reactions, dyeing, and finishing. 5250 must be taken first, 5260 and 5270 need not be taken in sequence. 5250—Emphasis on structure; property relationships and reactions of fibers. 5260—Emphasis on fabric finishes. 5270—Emphasis on dyes and dyeing. Prereq: 3420 or equivalent; 1 qtr organic chemistry. 2 hrs and 2 labs.

5310 Fashion Analysis (3) Fashion as social and economic force; evolutionary theories of fashion operation. Prereq: 6 hrs each of sociology and economics.

5320 Problems in Historic Costume (3) Variable flow of styles in relation to cultural determinants. Prereq: 3480 or consent of instructor. May be repeated. 6 hrs.

5700 Current Programs and Trends in Textiles and Clothing (1-3) Pertinent developments and trends in textiles and/or clothing and implications for new types of programs, techniques and/or curricula approaches. Content and emphasis vary according to changes in fields and needs of groups serviced. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5800 Problems in Textiles and Clothing (1-3) Advanced study selected from field of textiles and clothing. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5900 Seminar in Textiles and Clothing (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E


6110 Selected Issues in Textiles and Clothing (3) 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 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 textiles and apparel. Prereq: Child and Family Studies 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6160 Textile Flammability (3) Factors affecting textile flammability as consumer issue. Standards, regulations, test methods, economic impact. Prereq: 5120, 5180, 5250, or consent of instructor.

6170 Physical Performance Behavior of Textile Structures (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.
Aviation Systems

MAJOR
Aviation Systems

DEGREE
M.S.

Lead Professor:
M. A. Wright, Ph.D. Wales.

Professors:
W. Frost, Ph.D. Washington; W. F. Jacobs, Ph.D. Goettingen (Germany); A. A. Mason, Ph.D. Tennessee; J. M. Wu, Ph.D. California Institute of Technology; R. L. Young, Ph.D. Northwestern.

Associate Professors:
F. G. Collins, Ph.D. California (Berkeley); R. D. Kimbertin, M.S. Tennessee; J. R. Maus, Ph.D. North Carolina State.

Assistant Professors:
W. B. Baker, Jr., Ph.D. Tennessee; V. K. Smith, III, Ph.D. Georgia Institute of Technology.

The University of Tennessee Space Institute offers a program leading to the Master of Science with a major in Aviation Systems. The Aviation Systems program is designed for those who possess a Bachelor's degree in engineering or science and who wish to study under a "systems philosophy" toward careers in research and development of aircraft propulsion and performance as represented by Aerospace Engineering 4110 and 4120 or equivalent, a background in accounting as represented by Accounting 5010 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. The thesis program involves satisfactory completion of the following minimum requirements:

1. 18 hours in the major field of aviation systems.
2. For the research and development area, 6 quarter hours in Industrial Engineering 5700 and 5710; for the administration area, 6 quarter hours in Economics 5030 and Accounting 5810, for a total of 12 quarter hours.
3. 6 hours of electives selected from the major field, engineering and/or the areas in item 2.
4. 9 hours in Aviation Systems 5000, Thesis, hence demonstrating the ability to conduct and report on an independent investigation.

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

1. 18 hours in the major field of aviation systems.
2. For the research and development area, 9 quarter hours in Industrial Engineering 5700, 5710, and 5720; for the administration area, 9 quarter hours in Economics 5030, Accounting 5810 and Finance 5010-20, for a total of 18 quarter hours.
3. 6 hours of electives in one of the areas in item 2.
4. 6 hours of electives in the major field, engineering and/or the areas of item 2.
5. Satisfactory completion of 3 quarter hours in Aviation Systems 5100, Project in Aviation Systems.

Satisfactory completion of a comprehensive final written examination on all course work submitted for the degree and defense of the project course paper.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.

Courses suitable for credit in the major field include:
- Aerospace Engineering 5810 and 5820, Industrial Engineering 5840; Aviation Systems 5070, 5080, 5090, 5210, 5220, and 5970.

Electives typical of those suitable for credit in the area of aviation systems, research and development include:
- Aerospace Engineering 5150-60-70; Computer Science 3510-20, 4550 and 5655-65-75; Industrial Engineering 4060, 4150, 4230, 5720, 5730, 6700, 6730; Mathematics 4225-35-45, 4510-20-30; Metallurgical Engineering 5810-20-30; and Statistics 3450.

Electives typical of those suitable for credit in the area of aviation systems, administration include:
- Accounting 5020; Business Law 5010; Economics 5020; Management 5130; Marketing 5010-20; Transportation 5050, 5130, 5210-20, and 5910.

5000 Thesis (1-15) E

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: Aerospace Engineering 5610.

5580 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 modes, present and future; requirements analysis, and model analysis of the system. Prereq: Aerospace Engineering 5810.

5590 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure and administrative and enforcement procedures. Prereq: Aerospace Engineering 5810.

5100 Project in Aviation Systems (3) In-depth study and formal report on aviation systems topic, normally performed during last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.

5210-20 Experimental Flight Mechanics (3, 3) Flight mechanics, experimental techniques. Speciality-
Comparative and Experimental Medicine

MAJOR And EXPERIMENTAL MEDICINE

DEGREES

M.S., Ph.D.

Joint Coordinating Committee

H. Kitchen (Chairperson); C. C. Congdon; J. E. Fuhr; J. M. Holland; R. L. Michel; J. M. Woodward.

The Comparative and Experimental Medicine degree program (M.S. and Ph.D.) is a jointly administered graduate program intended to prepare students for teaching and/or research in the broad area of life sciences. The program emphasizes the comparative approach to the study of the life sciences including courses such as biochemistry, anatomy, histology, cell biology, or others that are appropriate for individuals interested in the biomedical sciences. Students with professional degrees will have most of the above requirements so that entrance to graduate training usually will occur at the doctoral level.

All applicants for M.S. programs, except those with a professional degree, will be required to present evidence of satisfactory performance on the Graduate Record Examination.

Requirements for Admission to the Doctor of Philosophy Degree Program

Applicants for admission to a doctoral program will be expected to have a Master's degree in one of the biological sciences or a professional degree in one of the medical sciences.

Selected individuals with strong backgrounds in the physical and biological sciences who have the baccalaureate degree may be admitted upon presenting evidence of satisfactory performance on the Graduate Record Examination and, in addition, must obtain the approval of the Joint Coordinating Committee of the Comparative and Experimental Medicine program.

Exceptions to the above requirements may be made at the discretion of the Joint Coordinating Committee if the minimal requirements of The Graduate School have been met. Applicants who are admitted to graduate programs but who are lacking in course requirements will be required to correct these deficiencies early in their graduate program as directed by the Joint Coordinating Committee.

For additional information, see sections in this catalog on College of Veterinary Medicine and College of Medicine—Knoxville Unit, or write to Office of Research and Graduate Programs, P.O. Box 1071, Knoxville, Tennessee 37901.

Ecology

MAJOR

Ecology

DEGREES

M.S., Ph.D.

J. Frank McCormick, Director, Ph.D. Emory University

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 a natural landscape and consequent biological diversity which is truly unique. In addition, faculty research programs provide opportunities for student research elsewhere on this continent and abroad.

ADMISSION REQUIREMENTS

Requirements for admission to this program are: (1) at least 12 quarter hours of college chemistry, 9 quarter hours of college mathematics, and 4 quarter hours of ecology at the upper division level; (3) departmental application and 3 rating forms; (4) the Graduate Record Examination (optional).

Application forms for admission should be obtained from the Graduate School. Inquiries concerning the admission requirements should be addressed to the Director, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37916.

ADVISORS

Advisors are selected from ecologists in several departments of the University who have competence in the area in which the student expects to work. Entering students should consult early with the Director of the program on the choice of a faculty advisor who will become the chairperson of the student's faculty committee.

THE MASTER'S PROGRAM

The minimum 45 quarter hours of graduate credit shall include 18 hours of ecology courses (exclusive of thesis), of which 6 shall be in Ecology 5210-20 and at least 8 additional hours in ecology courses numbered above 5100; 9 hours of thesis in Ecology 5500, and 18 additional hours in ecology or supporting courses. To insure an interdepartmental program, the required minimum 45 hours shall include no more than 18 hours of non-thesis courses from any one department of instruction.

The general requirements for this Master's degree are listed on page 19. A minor in ecology is available.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of The Graduate School. In addition, the doctoral program must include Ecology 5210-26-30 and a minimum of 9 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


5000 Thesis (1-15) E
5100 Special Problems in Ecology (1-3) Individual investigations in ecology. May be repeated with consent of instructor. Maximum 3 hrs.
5210-20-30 Principles of Ecology (2, 2, 2) Theories and techniques in ecology. Comparisons between land, freshwater, and marine environments, including humanity’s role in the world’s ecosystems. Must be taken in sequence. Prereq: 4 hrs of ecology at the upper division level.
5310 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused changes have on living organisms. Lectures and field trips. For students in Graduate School of Planning and Environmental Engineering.
5320 Implementation of Environmental Policy (3) Goals and problems of environmental legislation, especially National Environmental Policy Act; purpose, preparation, and evaluation of environmental impact statements, and other multidisciplinary studies. Prereq: 5210 or 5310, or Environmental Engineering 4820.
5610 Environmental Toxicology (3) Same as Biochemistry 5610.
5640 Techniques in Environmental Toxicology (2) (Same as Biochemistry 5640).
6000 Doctoral Research and Dissertation (3-15) E
6100 Special Topics in Ecology (3) Seminars on advanced topics and recent developments in ecology. Prereq: Consent of instructor. May be repeated.
6110 Seminar in Animal Behavior (2)
6120 Seminar in Aquatic Ecology (2)
6130 Seminar in Physiological Ecology (2)
6140 Seminar in Community Ecology (2)
6150 Seminar in Radiation Ecology (2)
6160 Seminar in Systems Ecology (2)
6431 Current Topics in Environmental Toxicology (1) (Same as Biochemistry 6431.)

**Industrial and Organizational Psychology**

**MAJOR**

<table>
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<tr>
<th>DEGREES</th>
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<tbody>
<tr>
<td>Industrial and Organizational Psychology</td>
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<tr>
<td>M.S., Ph.D.</td>
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</table>

Committee:
J. M. Larsen, Jr. (Chairperson); W. H. Calhoun; F. A. Chamblin; H. D. Dwekh; M. E. Gordon; R. T. Ladd; J. W. Lounsbury; M. C. Rush; E. D. Sundstrom; D. J. Wheeler; G. H. Whitlock.

(For complete Faculty Listing, see Departments of Management and Psychology)

The Master's and doctoral programs are offered jointly by the Department of Psychology and the Department of Management. They are designed to prepare students for personnel, managerial, and organizational research, for university teaching, and for relationships with industry. The emphasis is upon applied research utilizing a thorough theoretical background, including classical and modern organization theory, organizational behavior, and 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.

**ADMISSION PROCEDURE**

Applicants for admission should request forms and materials from the Graduate Office and the Chairperson, Industrial and Organizational Psychology Program, 413 Stokely Center for Management Studies.

- Two separate applications must be completed and 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 1 if you wish financial assistance consideration. Standards: At least 9 quarter hours of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade-point average of 2.5 or above is required, with no evidence of special weakness in mathematics and physical sciences.
- Test scores on each section of the aptitude portion and the Advanced Psychology portion of the GRE are required. Customarily, those students admitted to the program have performed in the 63rd to 65th percentile on the aptitude tests. (This corresponds to a raw score of approximately 500 on each of the tests.) The GRE Advanced Psychology score will be used in making admission decisions, although special consideration will be given in the case of non-psycho-majors.

**THE MASTER’S PROGRAM**

I. Course Requirements
A. Management or Psychology 5170, 5180, 5190.
B. Statistics 5050-60-70 and 3 hours of applied psychometrics.
C. Eighteen hours of additional course work to be selected primarily from among the 5000-level course offerings in management and psychology (e.g., Management 5110, 5120, 5220, 5250)
D. Nine hours of Psychology or Management 5000 (Master’s Thesis).

II. Program Requirements
A. A report of a comprehensive examination in general psychology within no more than two years of entry by attaining a score of 630 or the 85th percentile on the GRE Advanced Test in Psychology.

B. The Ph.D. program requirements described below in sections II A, and II G comprise the major requirements for a Master’s degree. An oral examination covering the thesis and related topics must also be completed.

**THE DOCTORAL PROGRAM**

I. Course Requirements
A. Minimum course requirements:
   1. Management or Psychology 5170, 5180, 5190.
   3. Minimum of three 6000-level seminars to be selected from Psychology or Management 5170, 5180, 5190, Management or Psychology 6380*
   4. 36 hours of Psychology or Management.
B. Recommended electives:
   1. For students required to take additional course work.
B. Recommended electives:
   1. For students who require preparation in psychometrics: Applied psychometrics.
   2. For students who require preparation in management: Management 5110, 5120, 5220, 5230.
   3. For students who wish to pursue special research interests: The student may petition for 5210, 5220, 5230.
   4. For students who wish to pursue special research interests: The student may petition for 5210, 5220, 5230.

II. Program Requirements:
A. A report of the student’s dissertation, 5210, 5220, 5230.
B. A completion of a comprehensive examination in general psychology within no more than two years of entry by attaining a score of 650 or the 90th percentile on the GRE Advanced Test in Psychology.
C. Completion of a comprehensive examination in scientific methodology before the beginning of the third year of study. This examination covers the following specific areas: statistics, psychometrics, experimental design.
D. Completion of a special comprehensive examination in the area of the student’s major research and professional interest. A student is expected to take this examination by the end of the second year. 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. The student is expected to take the major comprehensive examination by the end of the second year. 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.
F. Completion of an oral examination following the presentation of a doctoral dissertation.

**Intercollegiate Programs**

97
Management Science

MAJOR
Management Science

DEGREE
M.S.

Committee:
R. S. Garfinkel (Chairperson), Management Science; R. W. Boling, Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; E. Glustoff, Economics; W. J. Morse, Accounting; R. E. Rosenthal, Management Science; R. E. Shrieves, Finance; C. C. Thigpen, Statistics; M. G. Thomason, Computer Science.

THE MASTER’S PROGRAM

The M.S. program in Management Science is designed as preparation for a career in the application of quantitative techniques for the solution of management problems in large organizations. The program’s flexibility also makes it appropriate as preparation for doctoral study in Management Science. Management Science course work will expose students to both the theoretical development of quantitative techniques and their application to managerial decision making. In addition to the development of sufficient mathematical maturity for creative use of quantitative skills, the program requires concentrated study in a supporting area. Supporting areas are available in other departments of the College of Business Administration (excluding statistics) as well as in computer science, public administration, ecology and other areas, subject to approval by the Management Science Committee.

Applications are encouraged from all majors, but mathematics 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 by full-time students entering in the fall quarter. However, students may start the program in any quarter and may pursue an M.S. degree in Management Science on a part-time basis.

Course Requirements

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Management Science 5310-20-30-35-40</td>
<td>14</td>
</tr>
<tr>
<td>Applied concentration area (approved by advisor)</td>
<td>12</td>
</tr>
<tr>
<td>Statistics 5110</td>
<td>3</td>
</tr>
<tr>
<td>Statistics elective (5000 level or above)</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (4000 level or above)</td>
<td>6</td>
</tr>
<tr>
<td>Electives selected from mathematics, statistics, computer science, and/or management science</td>
<td>6</td>
</tr>
<tr>
<td>Electives in any area approved by advisor</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
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</table>

A thesis option is available which substitutes 9 hours of thesis credit for the following 14 hours of course work: Management Science 5335-40, and one 3-hour course in the applied concentration area and 6 hours of electives in any area. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student’s first quarter and must approve all courses on a quarter-by-quarter basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. For example, an undergraduate mathematics major with a strong background may be allowed to take 6 additional hours of electives in place of the mathematics requirements. On the other hand, a student lacking experience in rigorous senior-level mathematics courses will be asked to take such courses to fulfill the 6-hour mathematics requirement. The total course load will remain 50 hours for all non-thesis students and 45 hours for all thesis students; however, the number of hours of electives can be reasonably expected to vary between 6 and 18 as a function of prior background.

For course listings and description of the Ph.D. program in Management Science, refer to the Department of Management Science, College of Business Administration.
The College of Liberal Arts offers programs leading to eight advanced degrees.* See page 9 for degrees and majors.

**General Information**

**FOREIGN STUDY COURSES**

Foreign study courses offered in some departments of the College provide an opportunity to undertake independent study outside the United States. Prior to departure the student must have a plan of study approved by the department head and a supervising faculty member of the department concerned. Credit will be given only upon fulfilling all requirements set by the department and may vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

**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.

**INDEPENDENT STUDY**

Certain educational goals may best be met through independent study done by an individual under the direction of a faculty member. Students who wish to do such independent work should obtain the approval of the faculty members and the departments concerned prior to embarking upon their study. Credit per quarter will vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

**Departments of Instruction**

**Anthropology**

<table>
<thead>
<tr>
<th>MAJOR</th>
<th>DEGREES</th>
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</thead>
<tbody>
<tr>
<td>Anthropology</td>
<td>M.A., Ph.D.</td>
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</table>

**Professors:**
- W. M. Bass (Head), Ph.D. Pennsylvania;
- C. H. Fauser, Ph.D. Indiana; A. K. Guth, Ph.D. Michigan; R. L. Jantz, Ph.D. Kansas; P. W. Parmalee, Ph.D. Texas A & M.

**Associate Professors:**

**Assistant Professors:**

The Department of Anthropology offers the Master of Arts and the Doctor of Philosophy degrees with concentrations in physical anthropology, cultural anthropology, archaeology, zoarchaeology, and folk culture.

**THE MASTER'S PROGRAM**

The formal requirements for the Master's degree include:
1. A minimum of three quarters of residence at The University of Tennessee, Knoxville.
2. A minimum of 45 quarter hours for graduate credit, including preparation of thesis. Thirty-six of these 45 hours must be in anthropology, 9 hours may be taken in closely related disciplines (at least one-half of the courses must be at the 5000 level).
4. A thesis. In addition to the two (2) copies required by the Graduate School, one bound copy of the thesis is to be presented to the department and one bound copy to the student's thesis advisor.

**THE DOCTORAL PROGRAM**

Although there is no minimum credit hour requirement for the Ph.D. degree, students in this program should plan to devote to its attainment no less than 3 years beyond the B.A. level and to complete the following requirements:
1. Admission to Ph.D. program through passing 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)

**3419 Principles of Cultural Anthropology (3)** Basic concept and objectives in study of culture. Range of cultural phenomena and approaches to its study. Recommended prerequisite: 2530. F or W

**3440 Religion of Primitive Peoples (3)** Religions of nonliterate peoples. Place of religion in their social and cultural systems. Recommended prerequisite: 2530. (Same as Religious Studies 3440.) F or Sp

**3450 Community Studies in Complex Culture (3)** Review of cross-cultural comparative urban and village communities and methodologies used in community studies. Recommended prerequisite: 2530. A

**3510 Peoples and Cultures of Mainland Asia (3)** Ethnographic survey of the indigenous cultures of mainland Asia. Cultural diversity and human ecol-
3630 Physical Anthropology (4) Survey of skeletal remains and morphology and genetics of human and non-human species. Prereq: 2530 or consent of instructor. A


4550 Indians of the Southeastern United States (3) Survey of Southeastern Indian cultures; emphasis on band and tribal aspects. Prereq: 3540 or consent of instructor. A

4560 Cherokee Ethnology (3) Intensive survey of ideology and material aspects of Cherokee culture existing at time of first European contact.

4570 Peoples of Southeast Asia (3) Survey of representative ethnic groups and indigenous cultures of mainland and island Southeast Asia. Problems of contemporary culture changes. Prereq: 2530, consent of instructor or an East Asian course.

4580 Asians in the Americas Since 1600: Anthropological Perspectives (3) Character, factors, and motivations in Asian immigration to North, Central and South America. Assimilation pattern and enclave communities are major topics. Major focus on United States.

4590 Peoples of Japan (3) Analysis of the culture diversity and unity of peoples of Japan. Prereq: 2530 or consent of instructor. Recommended: 3510 or an East Asian course.

4600 Method and Theory in American Archaeology (3) Historical development of New World archaeology with emphasis on theory and field techniques. Prereq: 2520 or consent of instructor. F

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: 2520 or consent of instructor. A

4640 Zooarchaeology (3) Basic osteological studies of faunal remains. Prereq: 2520 or consent of instructor. May be repeated. Maximum 9 hrs. E

4750 Mexican Folklore (3) Anthropological perspective on folklore of Mexico and Spanish speaking regions. Prereq: Consent of instructor. A

4760 Italian Folklore (3) (Same as Romance Languages 4760.)

4770 Language and Culture (3) Relationship between linguistic categories and patterns of culture. Prereq: Consent of instructor. A

4780 Animal Ethnology (3) Survey of the use of non-human animals in the human environment. Prereq: 4760. A

4800 Physical Growth and Constitution (3) Comparative growth patterns throughout the human life cycle, skeletal and dental maturation; sex differences in growth; growth in non-human species. Prereq: 2510 or consent of instructor. A

4940 Biology of Native Americans (3) American Indian origins and evolution from standpoint of skeletal remains and morphology and genetics of prehistoric cultures.
living populations. Emphasis on North American Indians. Prereq: 2510 or consent of instructor.

4950 Primate Studies (3) Survey of field and laboratory investigations of comparative anatomy and non-human primate behavior. Prereq: 2510 or consent of instructor. F


4975 Human Paleontology Laboratory (1) Detailed examination of casts and other materials pertinent to study of human paleontology. Prereq or coreq: 4970. Sp

5000 Thesis (1-15) E

5100 Graduate Research (1-9) Independent investigation of special problems in anthropology. May be repeated. Maximum 18 hrs. E

5101 Seminar in Cultural Anthropology (3-9)

5102 Off-campus Study (1-12) See page 99.

5103 Independent Study (1-12) See page 99.

5104 Seminar in Zooarchaeology (3) Approaches to analysis and interpretation of archaeological faunal remains. Emphasis on evaluation of recent and major fossil studies, utilization of zooarchaeology derived faunas. May be repeated. Maximum 8 hrs. A

5105 Seminar in the Vertebrate Skeleton (4) Examination and comparison of skeletons of major groups of fish, amphibians, reptiles, birds, mammals. Emphasis on correlation of skeletal form and function; utilization and definition of human skeletal remains. Prereq: 3900. A

5106 Seminar in Archaeology (3-9) Theoretical and practical issues central to contemporary archaeology. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. A

5107 Laboratory Study of the Molluscs (4) Examination and comparison of skeletons of mollusks of eastern U.S. Emphasis on living and fossil mollusks. Prereq: 2510 or consent of instructor. A

5108 Laboratory Studies of the Vertebrate Skeleton (4) Examination and comparison of skeletons of major groups of fish, amphibians, reptiles, birds, mammals. Emphasis on correlation of skeletal form and function; utilization and definition of human skeletal remains. Prereq: 3900. A

5109 Laboratory Study of the Molluscs (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. Sp, A

5110 Seminar in Anthropology (3) Seminar dealing with selected problems and aspects of non-human primate behavior. Prereq: 2510 or consent of instructor. A

5210 Community Anthropology: The Local Community (3) Ethical issues, researcher models and research methods on local community. Prereq: 4440 or consent of instructor. A

5340 Fieldwork in Archaeology (3-9) Practice in work surveying, excavating, processing, and analyzing of data, intensive reading. Prereq: 5 hours of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

5400 History of Anthropological Theory (3) Theoretical contributions of various anthropological contributors, development of modern perspectives in anthropology. A

5440 Laboratory Paleontology (3) Exercises illustrating biological diversity, laboratory techniques for processing and preparation of fossil material. Prereq: Consent of instructor. A

5450 Comparative Social Organization (3) Social structure in nonliterature societies. Kinship, age, sex, social stratification, social structure, and other factors in determining relationships between individuals and groups. Prereq: At least one area course. A

5460 Quantitative Methods in Anthropology (3) Application of statistical methods to anthropological data. Correlation and derivative procedures, data analysis, discriminant analysis, and implementation of computer routines. Prereq: Statistics 2100 or equivalent. F

5470 The Human in Cultural Perspective (3) Graduate seminar dealing with socialization, methods of diagnosis, and therapeutic modes of healers in predominantly non-Euro-American milieus. Prereq: 4260. W

5500 Theory in Archaeology (3) Review of development of archaeological theory. Coverage up to and including recent systems approaches. F

5510 Problems in North American Archaeology (3) Seminar to explore specific research problems in North American archaeology. Research topics on prehistoric and historic populations. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. A

5520 Problems in Old World Archaeology (3) Selected topics and research problems in Europe, African, and Asian prehistory investigated in depth. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. (Same as Classics 5520.)

5630 The Maya (3) Intensive survey of Mayan culture of Yucatan and Guatemala from pre-Columbian times to present. Prereq: 2550. Sp

5640 Archaeological Resource Management (3) Theory and practice—public, conservation, contract, and salvage/research archaeology. Legislation, concepts, responsibilities, and certification; agencies and policies; project design, administration, and logistics; standards of field work, analysis and publication, and evaluation in archaeological and public; conservation archaeology as a career. May be repeated. Maximum 6 hrs. W

5660 Seminar in Prehistoric Lithic Technology (3) Analysis of techniques employed in production of prehistoric stone industries; raw materials employed; resultants, implementations, morphology, and typology constructs utilized in archaeological analysis. Prereq: Consent of instructor.

5700 Seminar in Anthropological Archaeology (3) Seminar analyzing prehistoric and historic populations as adaptive units. Prereq: 3900. F

5920 Advanced Physical Anthropology (3) Examination and comparison of skeletons of non-human primates. Emphasis on living and fossil forms; origin and evolution of major primate adaptive patterns. Prereq or coreq: 3900. A

5930 The Human Skeleton in Forensic Medicine (3) Application of physical anthropology to problems in human identification. Determination of age, race, sex, and stature. Prereq: 3900. Sp

5945 Comparative Primate Anatomy (4) Laboratory-oriented course dealing with functional and anatomical anatomy of primates. Musculoskeletal system, and adaptive patterns in the evolution of various primate families. Prereq: Consent of instructor. A

5950 Paleopathology (4) Identification and descriptive analysis of pathological conditions affecting human skeleton. Roentgenological, histological, and gross visual examination of skeletal material. Prereq: 3900 and/or consent of instructor. Lecture and lab.

5960 Dermatoglyphics (3) Methods of dermatoglyphic analysis 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) Ancestry and evolutionary significance of Australopithecines. Prereq: 4970 or consent of instructor. W, A

5980 Neanderthal Man and Human Evolution (3) Morphology, distribution, and evolutionary relationships of Neanderthals. Prereq: 4970 or consent of instructor: W, A

5990 Human Variation (3) Nature of human biological variation with emphasis on microevolutionary processes responsible for establishing and maintaining variation and relationships of variation to population structure. Prereq: 3930 or consent of instructor. A

6000 Doctoral Research and Dissertation (3-15) E

6100-20-30 Seminar in Cultural Anthropology (3, 3, 3) Seminar is offered each quarter primarily for doctoral candidates.

6610 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 or consent of instructor.

Archaeology—Greek and Roman

See Classics

Art

MAJOR

AR/ART

DEGREES

M.A., M.F.A.

Professors:


M.A. Columbia.

Associate Professors:


Assistant Professors:


Instructors:

M. F. A. California (Los Angeles); L. Kocianski, M.F.A. California (Davis); C. A. Sapp, M.F.A. Wisconsin.
The Art Department offers two graduate degrees: Master of Arts and Master of Fine Arts. In order to become a candidate, the applicant must be admitted by the Graduate School and approved by the Department of Art. In addition to the admission requirements of the Graduate School, the Department of Art specifically requires the following:

1. A detailed letter of intent.
2. Three letters of recommendation from former professors or professionals in the field.
3. An undergraduate major in art or evidence of equivalent proficiency.
4. A portfolio to be evaluated by the faculty. Application forms and further information are available by writing to the Department of Art.

MESTER OF ARTS

Areas of concentration consist of ceramics, communication design, drawing, fiber-fabrics, painting, printmaking, sculpture, and watercolor. One year of residence is required.

Curriculum: Quarter hours

Quarter

Project in Lieu of Thesis

Area of concentration

Art history

Electives

Seminar in Art History

Total

Curriculum: Project in Lieu of Thesis

Quarter

Major area

Art history

Electives

Seminar in Art Criticism

Seminar in Art History

Total

Degree Requirements for M.F.A.

1. Successful completion of 30 hours of studio in concentration area. Inter-area studies must normally be approved by the faculty no later than the third quarter in residence. Fifteen hours of the major must be in second year courses.

2. Twelve hours of art history for graduate credit.

3. Seminar in Art History (4 hours) and Seminar in Art Criticism (4 hours).

4. Ten hours of electives which may consist of any committee-approved combination of graduate credit courses outside the student’s departmental concentration.

5. First year evaluation: At the end of the three quarters in residence the student must present work for evaluation by the faculty and be granted permission to continue in the program.

6. Second year evaluation: With completion of all course work the student must present work for evaluation by the faculty and be granted permission to register for Projects in Lieu of Thesis (Art 5999).

7. Art 5999, Projects in Lieu of Thesis (30 hours) is a third year of semi-independent study.

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

Graduate Minor in the History of Art

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

3516 Typography (4) Theories and techniques of typesetting and printing as fine art medium. Creative problems using type and printing presses. May be repeated. Maximum 12 hrs.

3517 Airbrush (4) Technique of airbrush. Emphasis on skill and creative applications. For art majors only. F, Sp.

3704 Medieval Art (4) Byzantine and western art of Middle Ages: manuscript illumination, mosaics, Romanesque pilgrimage church, Gothic cathedrals. F.

3705 Northern European Painting: 1350-1600 (4) From courtly art of late Middle Ages to Northern Renaissance. Van Eyck, Roger van der Weyden, Bosch, and Durer; early printmakers. A.


3716 The Art of Italy, 1475-1575 (4) Leonardo da Vinci, Michelangelo, Titian, Raphael, Pontormo and Giorgione. F.

3725 Art of Southern Europe and New World, 1500-1830 (4) Concentrated study of Bruegel, Rubens, Rembrandt, Georges de La Tour, Vermeer, Poussin and Hals. W.

3735 History of Nineteenth-Century Painting in Europe and America (4) Emphasis on France; Neoclassicism, Romanticism, Friedrich, Constable, Turner, Courbet and Barbizon landscape artists, Hudson River Group, pre-Raphaelite Brotherhood, Manet, Courbet, Impressionism, Eakins, Homer, Seurat through Cezanne. W.

3736 History of Twentieth-Century Painting in Europe and America (4) Fauvism, Die Brucke, Cubism, Der Blaue Reiter, Futurism, Dada and Surrealism, geometric abstraction, social commentary, abstraction in the U.S.A. and parallels in Europe; Pop, Op, Minimal, and Concept Art. F.

contemporary furniture. Prereq: 2450 or consent of instructor. May be repeated. Maximum 12 hrs.

4506 Special Topics in Communication Design (4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.


4516 Portfolio and Exhibition Techniques (4) Application of design principles to promotion, construction, display and evaluation for two-dimensional artists. Prereq: Senior or graduate standing or consent of instructor. Sp

4545 Visual Communications Seminar (2) Political, social, economic and ethical problems of contemporary designers. Sessions with outside guest speakers and field trips. Prereq: 4515. W

4606 Special Topics in Printing (4) Student or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.

4615 Intaglio IV (4) Photographic, collage techniques, combine printing with other print media. May be repeated. Maximum 12 hrs. F, W, Sp


4617 Screen Printing (4) Traditional hand cut and photographic stencils, combine printing on paper and other surfaces. May be repeated. Maximum 12 hrs. F, W, Sp

4656 Special Topics in Metal Design (4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.


4855 Studies in Art History (2) Concentration in selected areas. Prereq: 16 hrs of art history and consent of instructor. May be repeated. Maximum 6 hrs.


4970 Glaze Calculation (4) Prereq: Senior or graduate standing and consent of instructor. W

4971 Kiln Construction (4) Prereq: Senior or graduate standing and consent of instructor. Sp

5000 Thesis (1-15) E

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

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

5010 Foreign Study (1-12) See page 99.

5012 Off-campus Study (1-12) See page 99.

5013 Independent Study (1-12) See page 99.

5115 Graduate Drawing I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5125 Graduate Drawing II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5215 Graduate Painting I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5225 Graduate Painting II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

525 Graduate Fiber and Fibers I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5275 Graduate Fiber and Fibers II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5315 Graduate Watercolor I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5325 Graduate Watercolor II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5415 Graduate Sculpture I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5425 Graduate Sculpture II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5515 Graduate Communication Design I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5525 Graduate Communication Design II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5615 Graduate Printmaking-Lithography I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5616 Graduate Printmaking-Intaglio I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5617 Graduate Printmaking-Screen Printing I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5625 Graduate Printmaking-Lithography II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5626 Graduate Printmaking-Intaglio II (2-6) Individual problems with etching and engraving. May be repeated. Maximum 18 hrs. F, W, Sp

5627 Graduate Printmaking-Screen Printing II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5755 Reading and Research in Art History (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5770 Seminar in Art History (4) A

6000 Seminar in Art Criticism (4) Theory and practice. Intended for majors in studio art.

6055 Graduate Ceramics I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

6095 Graduate Ceramics II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5975 Graduate Ceramics II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5999 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by the graduate faculty. May be repeated. Maximum 30 hrs.

*Graduate II courses must be preceded by successful first year evaluation by the faculty.

Courses offered periodically only at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated.

4104 Drawing (1-4) Intermediate to advanced.

4204 Painting (1-4) Intermediate to advanced.

4254 Fiber Processes (1-4) Intermediate to advanced.

4264 Fiber Construction (1-4) Intermediate to advanced.

4274 Fabric Surface Design (1-4) Intermediate to advanced.

4284 Fabric Constructions (1-4) Intermediate to advanced.

4304 Watercolor (1-4) Intermediate to advanced.

4404 Sculpture (1-4) Intermediate to advanced.

4504 Communication Design (1-4) Intermediate to advanced.

4604 Printmaking (1-4) Intermediate to advanced.

4624 Fiber Construction (1-4) Intermediate to advanced.

4644 Enameling (1-4) Intermediate to advanced.

4904 Photography (1-4) Intermediate to advanced.

4954 Ceramics (1-4) Intermediate to advanced.

Audiology and Speech Pathology

MAJORS

Audiology

MA

Speech and Hearing Science

MA

Ph.D.

Speech Pathology

MA

DEGREES

Ph.D.

College of Liberal Arts

103

Professors:

H. L. Luper (Head), Ph.D. Ohio State; S. Adler, Ph.D. Ohio State; G. A. W. Barnovske, Ph.D. University of North Carolina; P. J. Carney, Ph.D. Iowa; D. M. Lipshitz, Ph.D. Washington; I. Nabelek, Sc.D. Prague; A. Petersen, Ph.D. Illinois; B. Silverstein, Ph.D. Purdue.

Associate Professors:

S. B. Burchfield, Ph.D. Michigan State; C. M. Mestler, M. Ed. Texas.

Assistant Professors:

A. O. Diefendorf, Ph.D. Washington; E. Ireland, Ph.D. Iowa; C. J. Ferrell, M. A. Tennessee.

THE MASTER'S PROGRAM

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

The intent of each major program is to provide the student with the scholarly and professional skills necessary for functioning as an independent professional clinician in any of the several related fields, the student may be required to complete the academic requirements for the typical broad M.A. program. Students interested in specializing beyond the typical broad M.A. program should consult the departmental office or their advisor for lists of suggested courses, practica and independent studies.

Students majoring in the two areas are expected to complete the academic requirements for the M.A. degree outside of the American Speech and Hearing Association, including the required number of clock hours of clinical practicum. An exception to this rule must be approved by the Department Curriculum Committee.

Enrollment in clinical practicum courses is required for all clinical practice experiences. If the undergraduate preparation does not include sufficient course work in speech pathology, audiology, psychology, and related fields, the student may be required to make up such deficiencies.

Students may elect either the thesis program or the non-thesis option. Students in both programs are required to take 5110 and 5119. The Master's program with the thesis will include a minimum of 45 quarter hours of approved graduate credit, including 9 quarter hours of 5000 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least one-half of these total courses must be at the 5000 or 6000 level, no more than 9 hours of which may be thesis courses. Students in the non-thesis option program must present a total of 48 quarter hours of approved graduate credit and pass a final written examination. A minimum of 24 quarter hours must be at the 5000 or 6000 level. The decision as to choice of the thesis or non-thesis program is normally made following completion of 5110 and a conference with the student's advisor.

THE DOCTORAL PROGRAM

The Ph.D. program in Speech and Hearing Sciences seeks to develop individuals for research or college teaching careers in the
field of speech and language 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 expertise in design which enable the student to investigate problems pertaining to speech and hearing processes.

The program will normally consist of three 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/her faculty committee. In addition to the general Graduate School requirements, specific requirements for the degree of Doctor of Philosophy in Speech and Hearing Science will include:

1. Successful completion of course work in the study of one or more research tools, or other specific scientific methodological vehicles pertinent to the research interests of the candidate. The choice of research tools(s) is subject to departmental approval.
2. A minimum of 9 quarter hours of graduate credit obtained in course work in a cognate field from 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 basics of audiological and speech 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 tests. Prereq: 3040, 3050, or consent of instructor. (Same as Special Education 4040.) F, Sp
4070 Free Association (4) Oral and written free association as process for diagnosing and treating of organic and functional voice disorders. Prereq: 3040, 3065, or consent of instructor. (Same as Special Education 4400.)
4150 Clinical Practice in Audiology (1-6) Prereq: 4720 and 4930. E
4200 Introduction to Clinical Practice in Speech Pathology (3) Prereq: 3040, 3050, 3310, 4040, and consent of instructor. (Same as Special Education 4320.) S/NC only. E
4300 Clinical Practice in Speech Pathology (1-6) Prereq: 4320 and consent of instructor. (Same as Special Education 4330.) S/NC only. E
4340 Clinical Practice in Speech Pathology (1-6) Prereq: 4330 and consent of instructor. (Same as Special Education 4340.) May be repeated. S/NC only. E
4400 Voice Disorders (4) Etiology, diagnosis, and treatment of organic and functional voice disorders. including clinical, educational and socioemotional implications of such disorders. Prereq: 4610 or consent of instructor. F
4500 Clinical Practice in Audiology (1-6) Prereq: 4720 and 4930. E
4600 Clinical Practice in Audiology (1-6) Prereq: 4600, 4720, and 4930. E
4700 Clinical Practice in Audiology (1-6) Prereq: 4460, 4720, and 4930. May be repeated. Maximum 9 hrs. E
4520 Speech Pathology (3) Independent study of special problems of speech pathology. Prereq: Consent of instructor. E
4550 Problems in Speech Pathology (1-6) Prereq: Consent of instructor. E
4650 Problems in Audiology (1-6) Prereq: Consent of instructor. May be repeated: Maximum 6 hrs. E
4610 Introduction to Language Pathology in Children (4) Nature, etiology and treatment of language retardation. Observation in language clinic is available. Prereq: 3040, 3200, or consent of instructor. F, Sp
4620 Birth Defect Syndromes and Language Retardation (3) Examination of research literature relevant to birth defects and language retardation including clinical, educational and socioemotional implications of such disorders. Prereq: 4610 or consent of instructor. F
4630 Practical Applications of Language Habilitation Techniques (3) Discussion and demonstration of various methods and procedures used in treating language retarded children. Prereq: 4610 or consent of instructor. F
4640 Parent Participation in Language Habilitation Programs (3) Nature of counseling and educational relationships with parents of exceptional children including early childhood education, behavior management strategies, home training methods. Prereq: 4610 or consent of instructor. Sp
4650 Speech and Language of the Culturally Different Child (3) Discussion of speech and language differences of children of various minority groups, of different ethnic and class membership and from different geographic regions; their causes, and their effects upon educational programs. F, W, Su
4660 Topics in Language Retardation and Its Habilitation (3) Lectures on selected topics by representatives of such fields as special education, early childhood education, educational psychology, genetics, and psychology. Prereq: 4610 or consent of instructor. F
4720 Audiology II (4) Basic principles of clinical audiology: pure-tone, speech, masking and overview of special auditory tests. Prereq: 3710. (Same as Special Education 4830.) F, W, Su
4930 Aural Rehabilitation: Speechreading and Auditory Training (3) Rehabilitation of acoustically impaired by maximizing use of residual hearing and utilizing speechreading as receptive communicative process. Prereq: 4720. (Same as Special Education 4930.) F, W, Su
4940 Introduction to the Verbo-Tonal System (4) Prereq: 3710 or 4700. Recommended prereq: 4930 and 3050. (Same as Special Education 4940.) F, W, Su
5000 Thesis (1-15) E
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Maximum 9 hrs. F
5040 Advanced Clinical Practice in Audiology Study and Practice (1-6) Prereq: 4720 and 4930. May be repeated. Maximum 12 hrs. (Same as Special Education 5040.) E
5045 Practicum in Hearing Aid Orientation and Communication Counseling (1-6) Practical exposure to counseling hard of hearing and family members of hearing aids, suggestions for better use of communication skills. Prereq: 4720, 4930, and consent of instructor. May be repeated. Maximum 9 hrs. E
5050 Practicum in Verbo-Tonal Habilitation (1-6) Prereq: 4940, 5950, or consent of instructor. May be repeated. Maximum 9 hrs. E
5051 Practicum in Aural Rehabilitation (1-6) Prereq: 4940, 5950, or consent of instructor. May be repeated. Maximum 9 hrs. E
5060 Anatomy and Physiology of Speech (3) Structure and function of neuromuscular system involved in breathing, phonation, resonation, and articulation. Prereq: 3065. F
5070 Anatomy and Physiology of Hearing (3) Structure of human ear, pathology of hearing impairment, and psychacoustics of audition. Prereq: 3710. F
5071 Physiological Acoustics and Electrophysiology (3) Techniques for electrophysiological measurement of auditory sensitivity, sound transmission by ear, distortion in ear, and ear as analytic mechanism. Prereq: 4720, 5070 or consent of instructor. Sp, Su
5100 Comparative Anatomy of the Peripheral Auditory Structures (3) Tutorial laboratory course in comparative anatomy of temporal bone employing microspectroscopic dissection techniques. Prereq: 5070 or consent of instructor. E
5110 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, application of statistics, and pilot research project. Prereq: Elementary statistics. F, W, Su
5117 Instrumentation in Audiology and Speech Pathology (2) Principles of instrumentation used in audiology and speech pathology. Prereq: 3010 W, Sp
5119 Laboratory in Instrumentation in Audiology and Speech Pathology (1) Laboratory assignments designed to familiarize student with instruments for measuring speech and hearing processes. Prereq: 5117. E
5200 Seminar on Stuttering (3) Current significant research in problem of stuttering. Prereq: 4310 or consent of instructor. W, Su
5201 Aphasia (3) Historical review of aphasia literature; theories of brain functioning, aphasic classification and terminology, tests and rationale for testing, atiology, therapy considerations and prognosis for recovery. Prereq: 5060 or equivalent or consent of instructor. W, Su
5320-30-40 Advanced Clinical Practice in Speech Disorders (1-4, 1-6, 1-6) Prereq: Consent of instructor. Prereq: 5340 may be repeated. Maximum 9 hrs. S/NC only. E
5350-60-70 Advanced Clinical Practice in Speech Diagnosis (1-6, 1-6, 1-6) Prereq: 4040, 4340 or equivalent. 5370 may be repeated. Maximum 9 hrs. S/NC only. E
5380 Cerebral Palsy (3) Neurological foundations of speech and language and speech training. Prereq: 5060. (Same as Special Education 5380.) F

Audiology and Speech Pathology. These
...
5381 Adult Dysarthria (3) Neurornotor organization for speech production, types of adult dysarthria and associated neuromuscular symptomatology; diagnosis, evaluation, and management of adult dysarthric speakers. Prereq: 5060. Su
5390 Cleft Palate (3) Etiology, diagnosis and clinical management of cleft palate speakers, emphasis on speech, language, and hearing. Prereq: 5060 or 5070. (Same as Special Education 5390.) W, Su
5450 Sound Measurement and Audiometer Calibration (3) Noise measuring systems and techniques; factors in military and industrial audiometry, role of audiologist in industry. Prereq: Basic Acoustics or consent of instructor. W
5460 Advanced Audiology (3) Theory and practice of advanced pure tone and speech audiometry; instrumentation and interpretation of audiometric findings with differential diagnosis. Prereq: 4720. F
5470 Impedance Measurement in Audiology (3) Theoretical considerations behind emergence of impedance measurement in clinical measurement of hearing. Practical experience in using several impedance measuring devices. Prereq: 4720 and 5070. W
5490 Practicum in Hearing Conservation (1-6) Supervised on-site experience in hearing conservation programs at industrial settings. Prereq: 5040. May be repeated. Max. 9 hrs. E
5500 Seminar in Audiology (3) Significant research in various areas of audiology. Prereq: Consent of instructor. May be repeated. Maximum 16 hrs. F, S, Sp
5503 Special Auditory Tests (3) Theoretical and practical aspects of auditory procedures used for differentiating between cochlear vs. retrocochlear auditory lesions, identifying central auditory disorders and nonorganic hearing loss. Prereq: 5460. S
5505 Special Problems in Audiology (1-6) Prereq: 4720 or equivalent and consent of instructor. May be repeated. Maximum 6 hrs. E
5530 Seminar in Speech Pathology (3) Current significance research in speech pathology. Topics vary from quarter to quarter. Prereq: 12 hrs in speech pathology. May be repeated with consent of department. Maximum 12 hrs. E
5540 Seminar in Language Pathology (3) Nature, etiology and treatment of retarded language development in children. Prereq: 4610. (Same as Special Education 5540.) W, A
5550 Special Problems in Speech Pathology (1-3) Prereq: Consent of instructor. Maximum 6 hrs. E
5560 Independent Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
5570 Management and Supervision for Speech-Language-Hearing Professionals (3) Management systems, personnel management, administrative functions and clinical supervision. For audiologists and speech-language pathologists interested in private practice, supervisory or administrative positions.
5580 Independent Study in Audiology (1-6) Special reading, consultation, and research activities in field of audiology. May be repeated. Maximum 6 hrs. E
5610 Practicum: Language Pathology in Children (3) Seminar and/or practicum involving discussion and utilization of testing tools and analyses of habilitative philosophies, specialties and techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
5611 Seminar in Language Differences (3) Significant research relevant to language differences of culturally different children. Prereq: 4850. S
5730 Hearing Disorders (3) Advanced study of auditory disorders commonly encountered in medical environment. Etiology, pathology and evaluative processes to differentiate lesions of auditory mechanism. Field trips may be required. Prereq: 4720 or equivalent and 5070. Su
5740 Pediatric Audiology (3) Advanced study of theoretical and practical considerations of procedures to evaluate hearing of infants and small children. Prereq: 4720 or equivalent. Sp
5750 Educational Audiology (3) Advanced case management of hearing impaired child: audiologic follow-up, educational alternatives, teacher and parenthood counseling, social adjustment, classroom acoustics and state and federal guidelines. Prereq: 5040 and 5440.
5790 Seminar in Psycholinguistic Concepts in Speech Pathology (3) Psycholinguistic concepts and implications in studying the normal acquisition of language and certain disorders of language. Prereq: Consent of instructor. (Same as Psychology 5780.) Sp
5950 The Verbo-Tonal System (3) Theory, procedures and instrumentation of Verbo-Tonal System in habilitation, rehabilitation, diagnosis, speech therapy, and foreign languages. Prereq: 3710. Recommended prereq: 3050, 4720, and 4930. F, W, Su
6000 Doctoral Research and Dissertation (1-15) E
6010 Experimental Phonetics (3) Acoustical and physiological analyses of speech production and perception. Prereq: 5119 or consent of instructor. F
6019 Experimental Phonetics Laboratory (3) Must be taken concurrently with 6010.
6020 Psychoacoustics (3) Auditory reception and perception of non-speech stimuli. Prereq: 6010. W
6029 Psychoacoustics Laboratory (2) Must be taken concurrently with 6020. W
6060 Applied Anatomy and Physiology of Speech Mechanism (3) Dissection and related readings. Prereq: 5060 or equivalent. Sp
6069 Laboratory in Applied Anatomy & Physiology of Speech Mechanism (2) Must be taken concurrently with 6060. Sp
6070 Experimental Techniques in Cochlear Physiology and Neurophysiology (3) Prereq: 5070 or equivalent. A
6080 Seminar in Speech Science (3) Advanced study of experimental areas such as speech physiology, acoustic analysis, recognition, perception and intelligibility of speech, communication theory, and psycholinguistic measurement of speech and language. Topics vary from quarter to quarter. Prereq: 6010 or consent of instructor. May be repeated. Maximum 9 hrs. S, W
6090 Seminar in Hearing Science (3) Advanced study of perception of non-speech acoustic signal: detectability, pitch, loudness, differential threshold, adaptation, and detection. Prereq: 6020 or consent of instructor. May be repeated. Maximum 9 hrs. W, A
6110 Experimental Design in Speech and Hearing (3) Analysis of experimental design in theses and dissertations and related readings. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. Sp
6117 Theories of Hearing (3) Physiological process basic to classical theories of hearing related to sensitivity, loudness, pitch, and discrimination of acoustic stimuli. Prereq: 5070 or consent of instructor. W, A
6119 Advanced Instrumentation in Speech and Hearing Science (3) Selection, use and calibration of instrumentation used in speech and hearing research. Prereq: 5117, 5119 or equivalent. W, A
6500 Advanced Seminar in Audiology (3) Prereq: Consent of instructor. May be repeated. Sp
6520 Advanced Seminar in Speech and Language (3) Topical examination. Topics vary from quarter to quarter but include advanced study of aberrations of voice, articulation, speech, hearing, and communication development, phonetics, and/or language symbolism. Prereq: Consent of instructor. May be repeated. F, Sp
6560 Directed Research (1-6) Participation in ongoing or non-dissertational research. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. E
6570 Directed Study in Speech Pathology (1-3) May be repeated. Maximum 9 hrs. E
6580 Directed Study in Audiology (1-3) May be repeated. Maximum 9 hrs. E
6590 Directed Study in Speech Science (1-3) May be repeated. Maximum 9 hrs. E
6600 Directed Study in Hearing Science (1-3) May be repeated. Maximum 9 hrs. E

Biochemistry

MAJOR

DEGREE: Biochemistry M.S., Ph.D.

Professors: W. D. Wicks (Head), Ph.D. Harvard; J. E. Churchill, Ph.D. Sheffield (England); J. G. Joshi, Ph.D. Poona (India); K. J. Monty, Ph.D. Rochester; T. P. Sato (Associate Head), Ph.D. Michigan.

Associate Professors: S. W. Hawkinson, Ph.D. Chicago; L. Huang, Ph.D. Michigan State.

Assistant Professors: L. B. Birmann, Ph.D. Illinois; R. Bryant, Ph.D. Illinois; R. H. Feinberg, Ph.D. Carnevia (Berkeley).

The graduate program consists of an orientation examination to determine the most suitable course work for the incoming graduate student, successful completion of a series of graduate courses and seminars, and a qualifying examination. The student must be in good standing at the end of the first year. In addition, the M.S. degree requires research leading to the writing and oral defense of a thesis, while the Ph.D. degree requires successful completion of a comprehensive examination and dissertation leading to the Ph.D. dissertation and its oral defense.

The orientation examination: Given fall quarter at 9:00 a.m. on the Thursday prior to the week in which classes begin, is taken by all incoming students without exception. The purpose of the examination is to aid in placing students in the proper courses to help ensure their success in the graduate programs. The examination will cover analytical, organic and physical chemistry and biochemistry. If the student's undergraduate program does not show appropriate courses in one of the subject areas, the student will not take that part of the examination but will be enrolled in a suitable course. The results of the examination will help determine appropriate course work.

The qualifying examination: At the conclusion of the first year's work in 5510-20-30, 5310-20-30 and 4230, a comprehensive qualifying examination covering all of the material will be taken by all first year graduate students, without exception, in the first week of the summer quarter. On the basis of results of the examination, the student will be counseled concerning his/her future in the biochemistry program.

THE MASTER'S PROGRAM

This program requires about two years of full-time study and provides both breadth and depth of training by mixing classroom instruction with research laboratory experience. Students completing this program will have a sound foundation in modern biology and chemistry and will be equipped to follow and absorb future advances in these fields. Recent graduates of this program are now involved in such occupations as industrial pharmaceutical
research, junior college and high school teaching in hospital laboratory work, course research, scientific journalism, and pursuit of Ph.D. degrees. Candidates usually should offer course work covered by an undergraduate major in either Biology or Chemistry. Departmental requirements consist of the satisfactory completion of 45 credit hours of graduate work and the mastery of the subject matter of the following courses:

1. Introductory Organic Chemistry with laboratory (at least one year)*, at least one quarter of analytical chemistry, and a minimum of three quarters of approved physical chemistry.
2. A minimum of 12 quarter hours of approved biology courses beyond the introductory level, including at least 3 hours of genetics and 3 hours of physiology.
3. An orientation examination as described above.
4. Biochemistry 5510-20-30, 5310-20-30, 4230; and at least one special topics course (5450), or 5610 or 5110 or 5120 or 5210 or 5230.
5. A qualifying examination as described above.
6. At least 9 hours of advanced lecture-seminar courses from the following: Biochemistry 6410, 6510.
7. At least 9 hours of Master's research and a thesis.
8. A final comprehensive examination which will cover both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

An incoming student must present course work covered by an undergraduate major in either chemistry or biology. Departmental requirements for the awarding of the Ph.D. include mastery of the subject matter indicated in the following list of courses. Course contents listed in items 1 and 3 are prerequisites to taking the comprehensive examination; applicants usually should expect to complete these requirements within the first two years of graduate school.

1. Introductory Organic Chemistry with laboratory (at least 1 year)*, at least one quarter of analytical chemistry, Chemistry 4110-20-30, Introduction to Integral Calculus*, at least three quarters of approved graduate courses in chemistry or physics, for example: Chemistry 5110-20-30-35, Chemistry 5340, Physics 5210-20-30, Physics 5440, Physics 5510-20-30; plus minimum of three quarters of approved physical chemistry (Biochemistry 4210-20-30, or Chemistry 4910-20 and Biochemistry 4230, or Chemistry 4110-20-30) and at least 18 hours of biology beyond the introductory level including at least 3 hours of genetics and 3 hours of physiology. At least 3 hours must be graduate credit in an approved area of specialization which should be identified early so that necessary prerequisites can be taken.
2. Orientation examination.
4. In addition to the coursework listed in item 3 above, four courses selected from those numbered 5110 or higher, excluding 5300 or 5610.
5. Qualifying examination.
6. Participation in Biochemistry 6410 and in the advanced biochemistry seminars 6010 during the entire period of residence.
7. Comprehensive examination: Students who pass the comprehensive examination with sufficiently high marks and those who complete a mandatory M.S. degree (required prior to the comprehensive examination) will take the examination, at a time and of a format compatible with Graduate School requirements as determined by the student's committee.
8. A dissertation reporting the results of original and significant research carried out during the term of candidacy.
9. 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 are as follows:

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; and 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; chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; synthetic metabolism; nucleic acid function, protein synthesis and biochemical genetics; regulation of biological processes. Must be taken in sequence. Prereq: Chemistry 3211-21-31, 3219-29-39, and 1 course from Biology 1210-20-30 or Botany 1110-20. 3 lectures and discussion. F, W, Sp; W, Sp. Su

4119 Cellular and Comparative Biochemistry Laboratory (2) Basic biochemical procedures of general application in animal and molecular biology. Prereq or coreq: 4110. F, W

4210-20 Introduction to Physical Biochemistry (3, 3) 4210—Introduction to thermodynamics; phase stability and phase change; chemical potential; osmotic pressure; activity and the Debye-Huckel model; electrochemistry; membrane permeability. 4220—Elements of statistical mechanics, diffusion, collision theory; chemical kinetics and transition state theory, higher order kinetics; specialized kinetics of enzymatic processes; some biopolymer considerations. Prereq: Mathematics 1840-50-50, Chemistry 3211-21-31 and 3219-29-39, and an introductory course in biology. F, W

4230 Introduction to Physical Biochemistry (3) Physical characterization of macromolecules; polarized light, absorption and fluorescence, sedimentation and transpores, importance of importance in biochemistry and molecular biology. Prereq: 4119 or equivalent. Open to undergraduates with consent of department.

5000 Thesis (1-15) E

5010 Biochemical Techniques (2) Theory and laboratory practice in chromatographic and electrophoretic techniques in isolation and characterization of macromolecules and transpores of importance in biochemistry and molecular biology. Prereq: 4119 or equivalent. Open to undergraduates with consent of department.


5120 Biochemistry of Mitochondria and Selected Organelles (3) Organization of compartmentalized metabolic systems and their role in cellular organisms. Supramolecular organization, bioenergetics, transport systems, drug metabolism, oxygen toxicity and other conformational change, structure-function correlations; conenzyme-specific models of catalysis; state-steady, transient, relaxation, and allostatic kinetics of catalysis. Prereq: 4110 and either 4230 or Chemistry 3430.

5210 Structure and Function of Biological Membranes (1) Structural organization of biological membrane components. Dynamic properties as studied biochemically and biophysically. Selective topic(s) of membrane functions related to structural organization.

5220 Structures and Functions of the Nucleic Acids (3) Chemistry of nucleic acids; hydrogen bonding and double-stranded structures; colliding, superhelical, and other higher order structural considerations; biosynthesis of DNAs and RNAs; repair mechanisms; degrading mechanisms; mechanisms of genetic information storage and retrieval. Prereq: 4110-20 or equivalent.

5230 Protein Synthesis and Its Role in Metabolic Regulation (3) Membrane structure and function; ribosome structure and function; deciphering and genetic code; regulation of transcription and translation events (induction, repression, etc.). Prereq: 4110-20.

5300 Graduate Research Participation (3-9) May be repeated. Maximum 12 hrs.

5310-20-30 Experimental Techniques (2, 3, 3) Tutorial laboratory course in modern experimental methodology and instrumentation. Intended primarily for departmental majors. F; W; Sp

4550 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated.

5610 Properties of Biomolecules Related to Function (3) The structures, chemical and physical properties of biomolecules developed from theoretical and experimental points of view to explain actions and interactions. Prereq: Biochemistry 3211-21-31. Chemistry 2140 recommended.

5520 Molecular Basis of Metabolism and its Regulation (3) Regulation of metabolic pathways dependent on energy demands of organism and on synthesis of macromolecules. Laboratory exercises focus on the detection of presence, toxicity, and impacts of pollutants in the environment. Prereq: 5510 or consent of department.

5530 Biosynthesis and Regulatory Functions of Informational Molecules (3) DNA, RNA, and Proteins: Roles in replication, transcription, translation and metabolic regulation. Prereq: 5520.

5610 Environmental Toxicology (3) Basic concepts in toxicology, interactions at subcellular, cellular, organ, organismal, population, and environmental levels, legal aspects. Major emphasis on biochemical, chemical, and physical properties of pollutants and their impacts on the global ecosystem. Laboratory exercises focus on the detection of presence, toxicity, and impacts of pollutants in global ecosystem. Prereq: 4110-20. Chemistry 3211-21-31, Chemistry 4910-20-30, or consent of instructor. (Same as Ecology 5610.) W

5640 Techniques in Environmental Toxicology (2) Survey of experimental techniques for assessment of presence, toxicity, and impacts of pollutants in global ecosystem. Laboratory exercises focus on analytical, biochemical, and bioassay methods employed in toxicological studies. Prereq: Chemistry 2140-2149 and 3219-21-31, 3219-29-39. (Same as EOSC 5640.) Sp

6000 Doctoral Research and Dissertation (3-15) E

6010 Advanced Biochemistry Seminar (1) Topics to be covered in seminar in spring quarter for following year. Invited speakers of note will participate. May be repeated. Maximum 9 hrs. S/N/C only. F; W; Sp
57 quarter hours (including that in items 1, 2, sciences (or appropriate supporting fields) of requirement 2 (not including special the MACT program in Biology. interdepartmental committee administering 36 quarter hours of graduate credit in Biology will meet a minimum distribution of biology courses. mathematics.


6450 Advanced Special Topics (1-3) Registration only by prior arrangement with department. For students who have passed Ph.D. preliminary examination or are in advanced state of graduate studies. Topic title posted in advance. May be repeated. Maximum 9 hrs.

**Botany**

Major | Degree
---|---
Botany | M.S., Ph.D.

Professors:
- R. W. Holton (Head), Ph.D. Michigan
- E. C. Clebeck, Ph.D. Duke
- H. R. DeSelm, Ph.D. Ohio State
- A. M. Evans, Ph.D. Michigan
- W. R. Hendron, Ph.D. Vanderbilt
- L. W. Jones, Ph.D. Texas
- J. F. McCormick, Ph.D. Emory
- H. N. Currey (Emeritus), Ph.D. Ohio State
- S. L. Welsh, Ph.D. Texas

Associate Professors:
- C. C. Amundsen, Ph.D. Colorado
- D. J. Caponetti, Ph.D. Harvard
- A. S. Helm, Ph.D. Ohio State
- R. R. Henke (Emeritus), Ph.D. Miami
- K. W. Hughes, Ph.D. Utah
- O. J. Schmidt, Ph.D. North Carolina State
- H. H. Shugar, Ph.D. Georgia

Assistant Professors:
- L. G. Hickok, Ph.D. Massachusetts
- B. Mullin, Ph.D. North Carolina
- W. J. Currey, Ph.D. Indiana
- D. K. Smith, Ph.D. Tennessee
- W. O. Smith, Ph.D. Duke

The Department of Botany offers the Master of Science and Doctor of Philosophy degrees with concentrations in anatomy, taxonomy, cytology, cytogenetics, ecology, genetics, lichenology, morphology, mycology, phycology, physiology, phylogeny, pteridology, and taxonomy.

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 Examination, 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
4. Organic chemistry and physics highly recommended
5. College mathematics, 9 quarter hours

General degree requirements are given on pages 19-20 Special departmental requirements include successful completion of the following.

**THE MASTER’S PROGRAM**

A. Thesis Program
1. Satisfactory preparation of a written formulation and oral defense to the student’s committee of a research proposal suitable for a thesis problem. Must be completed before enrollment in Botany 6000.
2. Satisfactory performance on an examination in one modern foreign language or an A or B in French 3030 or German 3030.
3. Satisfactory completion of 2 credit hours at the 6000 level.

*Comparative Animal Research Laboratory, Oak Ridge.

- 3019-20 Plants in Evolution (4, 4) Monera to angiosperms; emphasis on evolutionary relationships, morphology and development. Prereq: 6 hrs. in biological sciences. (F, W)
- 3030 Field Botany (4) Study of plants in natural environments including plant identification, collection, preservation and basic ecological concepts. Prereq: 6 hrs in biological sciences. (Sp, Su)
- 3031-32 Field Botany (4, 4) Emphasis on fall and winter flora respectively. Prereq: 3030. Need not be taken in sequence. W

- 3050 Socioeconomic Impact of Plants (3) Significance of plants in origin and development of human cultures, evolution of cultivated plants, and role of plants in present civilizations. Occasional field trips. Sp, Su

*Not for graduate credit for botany majors.
3070 Genetics and Society (3) An introduction to genetics, anthropology and evolution with emphasis on their implications for human society. (Same as Anthropology 3070.) F; W
3090 Biology and Human Affairs (3) Basic biological principles involved in deterioration and preservation of an environment in which human cultures may survive. F; W
3210 Introductory Plant Physiology (4) Organismal physiology of plants; water relations, mineral nutrition, photosynthesis, elements of metabolic physiology, effects of light, temperature, and other environmental factors. Lecture and lab. Prereq: 1 yr general chemistry and 1 yr biology. Botany 3010-20 or equivalent. F; W; Su
4017 Field Mycology (3) Field experience on identification of higher fungi. Frequent field trips, field recognition of species and habitats, laboratory sessions. Prereq: 6 hrs of botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4021 Field Bryology (3) Field experience on identification of mosses and liverworts. Frequent field trips, field recognition of species and habitats, laboratory sessions. Prereq: 6 hrs of botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4022 Field Lichenology (3) Field experience on identification of lichens. Frequent field trips, field recognition of species and habitats; laboratory sessions. Prereq: 6 hrs botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4023 Field Agrostology (3) Field experience on identification of grasses. Frequent field trips, field recognition of species and habitats; laboratory sessions. Prereq: 6 hrs botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4030 Mechanisms of Plant Speciation (3) Processes of plant speciation emphasizing population genetics, isolation, drift, hybridization, variation in population barriers and other aspects of plant speciation. Prereq: 3030 or equivalent. 2 hrs and 2 labs. W
4049 Aquatic Vascular Plants (3) Field experience on identification of aquatic vascular plants. Frequent field trips, field recognition of species and habitats; laboratory sessions. Prereq: 6 hrs botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4050 Synanthropology (3) Field experience on identification of compositeae. Frequent field trips, field recognition of species and habitats; laboratory sessions. Prereq: 6 hrs botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4055 Identification of Woody Plants (3) Field identification of native trees, shrubs and woody vines of South Carolina. Prereq: 3030 or equivalent. 2 hrs and 2 labs. W
4061 Field Physiology (3) Field experience on identification of native vascular plants. Frequent field trips, field recognition of species and habitats; laboratory sessions. Prereq: 6 hrs botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4075 Botanical Photography (3) Photography of natural history subjects and achievement of technical and aesthetic skills and knowledge to produce illustrations for classes, seminars, or public lecture. Landscape, habitat, close-up and small object photography, in color, using 35 mm format. Limited supplies available for students to use own equipment. Film and processing costs paid by student. Photos processed and critiqued in class. Prereq: 6 hrs of botany. Recommended prereq: Botany 3010-20 or equivalent. Su, A
4120 Plant Anatomy (4) Comparative structure of vascular plants. Prereq: 3030. 3 hrs and 3 labs. W
4240 Paleobotany (4) (Same as Geology 4240.) F
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during the current quarter. May be repeated. S/NC only. W
5003-04 Non-Thesis Research (3, 3) Library, field, or laboratory research under supervision of staff members. Not for thesis candidates. F; W
5011 Mycology (4) Intensive study of fungi, including all major classes, utilizing lecture, laboratory and field information. Occasional field trips. Prereq: 3010. 3 hrs and 1 lab. Sp
5012 Morphology and Evolution of the Phylomyces (4) Similar to 5090, but dealing with Phylomyces fungi. Prereq: 5011 or consent of instructor. E
5021 Biology (4) Taxonomy, phylogeny, ecology, physiology, and developmental morphology of higher plants. Prereq: 3010 and current research. Prereq: 3020, 1 hr and 3 labs. W
5022 Lichenology (4) Taxonomy, phylogeny, ecology, economics and siphosis of lichens with emphasis on field and current research. Prereq: 3010, 5011 or 4017. Recommended prereq: 5061. 1 hr and 3 labs. F, A
5031 Vascular Plant Taxonomy (4) Familiar characteristics of vascular plants, including principles of phylomyces and classification, based primarily on plants of local flora. Prereq: 3030 or equivalent. 2 hrs and 2 labs. W
5065 Phytoplanktolc Ecology (4) Interaction between environment and phytoplankton. Nutrient uptake, primary production, competition, ecological theory applied to phytoplankton communities, and ecological adaptations by populations to environment. Prereq: 3010 or consent of instructor. F
5070 Principles of Biological Illustration (3) Principles and applications of techniques including photomicrography and photomacrography, drawing graphics, and other methods for recording and presentation for research and publication of data in pictorial or graphic form. 1 hr and 2 labs. W
5080 Pteridology (4) Evolutionary study of lower vascular plants: morphology, cytology, ecology, life cycles and reproduction. Biostatistical studies and recognition of local species. Prereq: 3020-30 or consent of instructor. 2 hrs and 2 labs or field trips. F, A
5090 Morphology and Evolution of Basidiozymes (4) Structure and function of somatic and sexual life cycles as applied to evolution in group. Cultures and specimens in laboratory. Prereq: 3010 or equivalent. F, A
5120 Agrostology (4) Collection, identification, classification, and phylomyces of tribes of grasses. Prereq: 3020 or consent of instructor. 2 hrs and 2 labs. W
5150 Advanced Morphology of Flowering Plants (4) Vegetative and reproductive organography: regulatory physiology, differentiation of flora, hormonal mechanisms, embryology and deviations, seed and fruit development. Prereq: 3020-30 or 4120: 3210 or consent of instructor. Su, A
5160 Biosystematics (4) Major experimental methods used in systematics and application to specific types of systematic problems. Cytotaxonomy, nomenclature, phytochemistry. Prereq: Consent of instructor. F, A
5210 Advanced Plant Physiology I (3) Plant cell metabolism: carbon, nitrogen and sulfur assimilation, respiration and biosynthesis of specialized plant products such as terpenoids, alkaloids and pigments. Prereq: 4120.
5220 Advanced Plant Physiology II (3) Physiological response of plants to light: photochemistry, photosynthesis, and phytotoxic mechanisms of responses, translocation, respiration, transpiration, uptake, and metabolism; translocation and fundamentals of mineral nutrition. Prereq: 5210 or Biochemistry 4120 and consent of instructor. Recommended prereq: 1 yr of physics. W
5290 Quantemary Problems (4) (Same as Geology 5290) W
5300 Plant Geography (4) Distribution of ecosystems with emphasis on American types. Vegetation, climate and historical aspects. Prereq: 4310. 2 hrs and 2 labs. W
5350 Analysis of Plant Communities (4) Plants as species and ecosystems components considered from standpoint of genecology, ordination, and ecosystem function. Prereq: 4310. 2 hrs and 2 periods (field trips). Sp
5360 Marine Ecology (3) Relationships of marine organisms to environment and their interactions with each other. Tropic relationships in marine, coastal and estuarine ecosystems; succession; deep-sea ecology. Prereq: One previous ecology course. W
5410-20-30 Seminar in the Teaching of College Botany (1, 1, 1) Objectives in teaching of general botany. Supervised teaching in general course; selection of techniques for teaching; preparation of self-study materials. Required of teaching assistants. Prereq: Consent of instructor. S/NC only. F; W; Sp
5440 Seminar in Botany (1) Readings and discussions of current literature and/or selected topics in botanical research. May be repeated. Maximum 12 hrs. S/NC only. E
5530 Plant Cytology (4) Structure and function of cellular organization, and function, with emphasis on correlation between complex structure, physics and function of subcellular organelles. Principls and application of various analytical and electron microscopic techniques; cell fractionation and isolation of subcellular components; differentiation, proliferation, growth, death, respiration, photosynthesis, and microscopy. In- tended for graduate students in the biological sciences. Prereq: 2 hrs and 2 labs. F, A
5810 Cytogenetics (4) Chromosome structure and behavior during mitotic and meiotic divisions in relation to structural changes, genetic controls, hybridization, speciation, and polyploidy. Laboratory emphasis on normal and aberrant meiotic systems and stochastic chromosome viability from plants and animals. Prereq: Biology 3110 and at least 6 additional hrs in biological sciences. Sp
5820-21-22-23-24 Methods and Instrumentation in Laboratory Investigation (1, 1, 1, 1, 1) Laboratory course providing project experience and theoretical background in various research methods. In-
exchange resins, adsorption spectrometry, disc electrophoresis, polargraphy, zonal and ultracentrifugation, gas chromatography, automatic analyzers, microscopy, culture methods, use and detection of radioisotopes, and others. Prereq: Course in plant physiology. Chemistry 3211-2131 or equivalent. Physics 2210-20-30 or equivalent. S/NC only. E

5830 Field Methods in Plant Ecology (4) Analysis of plant communities and environments, including field research. Prereq: Chemistry 4310, 5340, 5350. 2 hrs and 2 periods (field trips). Sp

5850-51-52-53-54 Methods and Instrumentation in Field Investigations (1, 1, 1, 1, 1) Intensive field work in plant ecology and instrumentation. Topics vary according to needs of students. May be repeated with consent of instructor. S/NC only.

5870 Experimental Plant Genetics (4) Genetics of plants stressing molecular aspects and including mechanisms of gene action, controlling elements, transformation, cyttoplasmic inheritance, and adaptation. Prereq: Biology 3110 and Chemistry 5251. 3 hrs and 1 lab. W

5910-20 Developmental Plant Morphology (3,1, Developmental morphology of plants from aspect of phenomena of morphogenesis-correlations, polarity, symmetry, differentiation, regeneration, tissue mixtures, abnormal growth, environmental and genetic factors. Prereq: Chemistry 5210-20 or 4120, and 5210 or 5210 or 5910; 5910 or 5920. 2 hrs and 1 lab for 5910; 1 lab for 5920. F, A, W

6000 Doctoral Research and Dissertation (3-19) E

6010 Advanced Topics in Morphology of Vascular Plants (3-4) Needs of students determine topic. Topics vary according to needs of students. May be repeated with consent of department. W

6060 Advanced Topics in Cryptogenic Botany (2-4) Advanced studies and current research in experimental cytology, mycology, phycology, or developmental morphology of cryptogams. May be repeated with consent of department.


6310 Advanced Topics in Cytology and Cell Biology (2-3) Requirements and interests of students determine topic. Topics vary according to needs of students. May be repeated with consent of department.

6320 Ecosystems of the World (3) Classification and characterization of world’s regional ecosystems. Vegetation relations to climate, topography, soils, vegetation, and fauna. Prereq: 5340.

6420 Advanced Topics in Genetics (2-4) Literature survey of selected topics from all areas of genetics. Prereq: Biology 3110; Biochemistry 4110. 20-30 may be repeated with consent of departmen. T

6520 Seminar in the History of Botany (2)

6820 Advanced Topics in Plant Physiology (4) Requirements of student determine content, including growth and growth hormones; minor element nutrition; and aging effects. Prereq: 5210; 1 yr college physics. May be repeated with consent of department.

6830 Advanced Topics in Ecology (2-4) Needs of student determine content, including community analysis; biogeochemistry; bioclimatology; genec and paleoecology; radiation ecology; and system ecology. Prereq: Chemistry 5110; 5350. May be repeated with consent of department.

6930 Advanced Topics in Systematic Botany (2-4) Needs of student determine content, such as morphophysics, systematic literature and code of nomenclature; experimental taxonomy; current research in systematic classification. Seminars or lectures and labs depending on subject. Prereq: 3020-30, 5351. May be repeated with consent of department.

Chemistry

Majors

DEGREES

Chemistry

M.S., MACT, Ph.D.

Professors:

G. Mamantov (Head), Ph.D. Louisiana State; H. B. Bowman (Assistant to the Dean), Ph.D. Purdue; A. Buehler (Emeritus), Ph.D. Ohio State; W. E. Bull, Ph.D. Illinois; J. G. Chambers, Ph.D. Kansas; J. A. Dean, Ph.D. Illinois; J. F. Eastham, Ph.D. California (Berkeley); W. H. Fletcher, Ph.D. Minnesota; C. W. Kneen, Ph.D. Texas; D. C. Kneifel, Ph.D. Wisconsin; J. W. Larson, Ph.D. Purdue; M. H. Lititzke, Ph.D. Wisconsin; G. D. O'Keary, Ph.D. California (Berkeley); J. R. Peterson, Ph.D. California (Berkeley); G. K. Schweitzer, Ph.D. Illinois; D. A. Shirley (Emeritus), Ph.D. Purdue; I. S. Habib, Ph.D. Illinois; E. W. Hyrap, Ph.D. Purdue; T. F. Williams, Ph.D. London; J. H. Wood (Emeritus), Ph.D. North Carolina State.

Associate Professors:

J. E. Bloom, Ph.D. Manchester; F. A. Grimm, Ph.D. Cornell; G. W. Kabaka, Ph.D. Purdue; J. F. Bitter, Ph.D. Akron; C. A. Lane, Ph.D. California (Berkeley); A. M. Magid, Ph.D. Yale; R. M. Pagini, Ph.D. Wisconsin; M. Schell, Ph.D. Indiana.

Assistant Professors:


Students majoring in Chemistry for the Master’s or doctoral degree are required to present a prerequisite one year each of general, analytical, organic and physical chemistry with a satisfactory record. Students lacking any of these prerequisites may be admitted with appropriate deficiencies which must be removed without graduate credit.

For students minoring in Chemistry, the prerequisite is two years of chemistry including quantitative analysis.

THE MASTER’S PROGRAM

The department offers specialization in seven areas for the M.S. degree: analytical chemistry, environmental chemistry, energy, inorganic chemistry, organic chemistry, polymer science, and physical chemistry. The requirements for the M.S. degree in Chemistry consist of the satisfactory completion of:

1. Research and a thesis to give 9 to 18 hours of graduate credit (5000).

2. Chemistry 4160-70, 5531, 5140-50, Polymer Engineering 4910.

3. Sufficient additional graduate course work in chemistry and/or related fields to make an overall total of 45 hours.

4. Participation in Chemistry Seminar (5911-23-31) and the Polymer Seminar Program during the entire period of graduate study.

5. A final oral examination.

The requirements for the M.S. degree in Chemistry with specialization in environment or energy consist of the satisfactory completion of:

1. Research and a thesis on an environment- or energy-related problem to give 9 to 18 hours of graduate credit.

2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.

3. Sufficient additional graduate course work in chemistry and/or related fields to give a total of 45 hours. For emphasis in environment, these additional courses must include Chemistry 5220, 5250-59-60-69-70-79, Ecology 5310, and Mechanical Engineering 4180. All course selections must be approved by the appropriate departmental committee.

4. Participation in seminar (5911-21-31) during the entire period of graduate study. (No more than 3 credit hours of seminar may be applied to the above requirements.)

5. A final oral examination.

MASTERS OF ARTS IN COLLEGE TEACHING.

The requirements for the MACT degree in Chemistry consist of the satisfactory completion of:

1. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.

2. Research and a thesis to give 9 hours of graduate credit (5000).

3. Sufficient additional graduate course work in chemistry and/or a related field to make an overall total of 60 hours. The additional hours must include two of the following sequences: 5110-20-29-30, 5250-59-60-69-70-79, 5340-50, 5410-20-30, 5710-20-30, and Mechanical Engineering 4180. All course selections must be approved by the appropriate departmental committee.

4. Participation in seminar (5911-21-31) during the entire period of graduate study. No more than 3 credit hours of seminar may be applied to the above requirements.

5. A final oral examination.

THE DOCTORAL PROGRAM

The department offers specialization in nine areas for the Ph.D. degree: analytical chemistry, environmental chemistry, energy, inorganic chemistry, organic chemistry, physical chemistry, polymer science, and theoretical chemistry. For the Ph.D. degree in Chemistry with specialization in analytical, inorganic, organic, physical, or theoretical chemistry, the satisfactory completion of the following is required:

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).

2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.

3. Participation in seminar (5911-21-31)
during the entire period of graduate study. 4. Thirty-nine hours of additional graduate course work including at least 6 hours at the 6000 level and one of the following groups: (a) for analytical emphasis: Chemistry 5110-20-29-30-35; (b) for physical, 5110-20-29-30-35 and at least 9 hours from the following courses: 5250-60-70, 5340-50, 5410-20-30-50, 5710-20-30; (d) for theoretical, 5340-50, 5410-20-30-50, Physics 5210. Graduate course work in related fields may be used for undesignated course work in this requirement upon approval of the student's faculty committee. 5. A comprehensive advanced examination in the field of specialization. 6. Demonstration of a reading knowledge of one of the following languages: French, German, Russian, or an approved alternate. 7. A final oral examination. The requirements for the Ph.D. degree in Chemistry with specialization in environment or energy consist of the satisfactory completion of the following: 1. Research and a dissertation on an environmental or energy-related problem to give at least 36 hours of graduate credit. 2. Chemistry, French, German, 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 6 hours at the 6000 level. For emphasis in environment, these additional courses must include Chemistry 5000-50, 5520-39, 5630, Environmental Engineering 4030, 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 5410,5610-20-30,a chemistry sequence (Chemistry 5110-20-30-35 or 5250-60-70, 5340-50, 5710-20-30), Mechanical Engineering 4180, plus other course selections from areas such as catalysis, heterogeneous equilibria, kinetics, thermal science, combustion and propulsion engineering, atmospheric science, environmental engineering, and electrical engineering. All course selections must be approved by the appropriate departmental committee. 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. 4. Chemistry 5410-20-30-50, 5110-20 or 5710-20, 6730 or 6810; Mathematics 4540, 4610-4710; Physics 4610-20-30, 5110-20-30, 5210, 5610-20-30. 5. The requirements listed in items 3, 5, 6, and 7 above.

The program in chemical physics is conducted jointly with the Physics Department which offers a similar degree. A program leading to the Ph. D. degree with specialization in chemical physics is conducted jointly with the Department of Chemical, Metallurgical, and Polymer 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, Polymer Engineering 4910. 3. Participation in Chemistry Seminar (5911-21-31) and the Polymer Seminar Program during the entire period of graduate study. 4. Forty hours of additional graduate course work, including at least 6 hours at the 6000 level and at least 12 hours from the Department of Chemistry offerings. 5. A comprehensive advanced examination in 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) Compounds of carbon, hydrogen, and other elements; mechanism, spectroscopic and other physical properties. Must be taken in sequence. Prereq: 1110-20-30. Corresponding laboratory course for chemistry majors not having credit for the laboratory. E *3219-29-39 Organic Chemistry Laboratory (1, 1, 1) Experiments on topics discussed in 3211-21-31. Corre-sponding lecture (3211-21-31) is a coreq for students not having credit for the lecture. E *3410-20-30 Physical Chemistry (3, 3, 3) 3410—Kinetic theory of gases. 3430—Thermodynamics; equilibrium. 3470—Chemical equilibria, phase equilibria and properties of solutions, irreversible processes. Kinetic theory of gases. 3430—Kinetics of chemical reactions. Introduction to quantum mechanics, application to simple systems. Molecular spectroscopy and structure. Prereq: 1 yr of 2000-level physics and Mathematics 1860, 2460-50 or equivalent. Coreq: Analytical chemistry. F, W, Sp *3429-39 Physical Chemistry Laboratory (1, 1) Gases, liquids, chemical equilibria, solutions, phase equilibria, and elementary kinetics. Prereq or coreq: 3420-39. 1 lab. F, W, Sp *3511-21-31 Principles of Organic Chemistry (3, 3, 3) Structure and reactivity of aliphatic and aromatic compounds and synthetic organic chemistry. Photometric and titrimetric techniques, tracer procedures and safety precautions in laboratory work. Prereq: 1110-20-30. Not for graduate credit for chemistry majors. 4110 Physical Chemistry Laboratory (3) Theoretical aspects of chemical kinetics. Quantum mechanics of atomic and molecular systems. Molecular symmetry, crystal structures, and magnetic properties. Prereq: 3430. Coreq: 4119. F, W

4119 Physical Chemistry Laboratory (1) Solutions, phase equilibria, reaction kinetics and spectroscopy. The corresponding course 4110 is coreq. F

1600-70 Intermediate Physical Chemistry (3, 3) (Designed for entering graduate students who have had one year of physical chemistry.) 4100—The three laws of thermodynamics and solutions, and chemical equilibria. 4170—Gases and kinetic theory, chemical kinetics, molecular spectroscopy, and introduction to chemical statistics. F, W

4210 Advanced Analytical Chemistry (3) Chemical separations including chromatography, ion exchange and solvent extraction; spectroscopic techniques. Prereq: Analytical chemistry. W

4219 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4210. Coreq: 4210. W

4220 Advanced Analytical Chemistry (3) Electroanalytical methods of analyses (including potentiometry, coulometry, polarography, and voltammetry); magnetic resonance methods; mass spectrometry; x-ray absorption and fluorescence techniques. Prereq: Analytical chemistry. Recommended: 3420 or 4920. Sp

4229 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4220. Coreq: 4220. Sp

4420 Physical Inorganic Chemistry (3) Theoretical concepts leading to an understanding of inorganic chemical compounds; electronic structure, bonding, magnetic properties, catalysis, and reaction mechanisms of molecular structure, and elementary nuclear chemistry. Prereq: 3410-20-30, 4110. W

4430 Intermediate Inorganic Chemistry (3) Application of theoretical concepts to inorganic compounds, their chemical states, and their reactions. Prereq: 4220. Sp

4510 Organic Qualitative Analysis (3) Identification of organic compounds by physical and chemical methods. Prereq: 3219-21-31, 3219-29-39 or 3219, 3529-39. 3 labs. Not open to students who have completed 4610. F

4550 Organic Reaction Mechanisms (3) Prereq: 1 yr of organic chemistry. W

4610-20 Advanced Chemical Experimentation (2, 2) Laboratory course in application of modern experimental techniques to solution of chemical problems. Synthesis and characterization of organic and inorganic compounds with emphasis on independent study using advanced techniques. Prereq: 3219-39 or 3531-39, 3439-39, 4220. 4610 not open to students who have completed 4510. W

4910-20-30 Biophysical Chemistry (3, 3, 3) Physicochemical principles with application to biological systems. Prereq: 1 yr of general chemistry. Not open to students having 3410-20-30. 4910—Gases; first, second and third laws of thermodynamics, equilibrium. 4620—physical chemistry; electrochemistry; kinetics; nuclear chemistry. 4850—Elementary quantum chemistry; optical and magnetic properties of matter; light scattering, macromolecular properties. Prereq: 1110-20-35; Mathematics 1540-50 or equivalent. F, W, Sp

5000 Thesis (1-15) E


5129 Advanced Organic Chemistry Laboratory (3) Synthesis of organic compounds illustrating modern techniques. Prereq: 1 yr of organic chemistry. Sp

5139 Spectroscopic Characterization of Organic Compounds (2) Spectroscopic characterization of organic compounds via nuclear magnetic resonance and infrared spectroscopy. Prereq: 3211-19-29-31-39 or equivalent. W

5140 Introductory Polymer Chemistry (3) Fundamental principles, role of chemistry in interdisciplinary field of polymer science; relation of molecular structure to bulk properties of polymers. Prereq: 1 yr each undergraduate organic and physical chemistry.

*Not for graduate credit for chemistry majors.
5150 Kinetics of Polymerization (3) Kinetics of formation and molecular weight distribution of polymers from monomer to macromolecules, physical factors affecting growth and chain growth polymerizations. Prereq: 5140 and 4160-70 or equivalent.

5160 Organic Chemistry of Polymers (3) Synthesis of organic and inorganic polymers, biopolymers, macropolymers, and synthetic polymers. Prereq: 5150 and 5351. A

5170 Physical Chemistry of Polymers (3) Rubber elasticity, solution properties of macromolecules; structure and conformational statistics of polymers. Prereq: 5150. A

5220 Analytical Chemistry of Environmental Pollutants (3) Application of modern analytical chemistry to problems in aquatic and atmospheric pollution. Prereq: 5250-60-70 or consent of instructor. Sp

5240 Electronics for Chemists (4) Includes material of Chemistry 4640 plus special project. Prereq: Consent of instructor.

5250-60-70 Advanced Analytical Chemistry (3, 3, 3) 5250—Absorption and emission spectrophotometry, structure elucidation by IR, NMR, UV, and mass spectra; 5260—Chemical separation methods; solvent extraction, chromatography, electrophoresis; radiochemical methods; fluorescence; x-ray methods; 5270—Electroanalytical, magnetic, and gravimetric analytical methods; on stream and automatic analysis. Prereq: 1 yr of physical chemistry. F, W, Sp


5350 Quantum Chemistry (3) Electronic excited states; introduction to group theory; perturbation theory, reactivity of organic molecules. Prereq: 5340. W

5410-20-30 Advanced Physical Chemistry (3, 3, 3) 5410—Classical thermodynamics, 5420—Molecular spectroscopy and structure, 5430—Chemical kinetics. Prereq: 4110 or 4160-70. F, W, Sp

5450 Statistical Thermodynamics (3) Statistical treatment of equilibrium and nonequilibrium statistical mechanics, Boltzmann statistics to chemical systems. Prereq: 5410-20-30. A

5511 Survey of Inorganic Chemistry (3) Atomic structure, wave mechanical atoms, ionic and covalent bonds, periodic relationships of elements, inorganic stereochemistry, coordination chemistry, and descriptive chemistry of the elements. F

5521 Survey of Analytical Chemistry (3) Volumetric and gravimetric analysis, pH-metric analysis, titration, flame photometry, atomic absorption, colorimetry, electroanalytical, and separation methods. F

5531 Survey of Organic Chemistry (3) Bonding in organic molecules, chemistry of hydrocarbons, halogen compounds and combustion analysis, monofunctional oxygenated derivatives, carbonyl compounds, stereochemistry, aromatics, and functional analysis of organic molecules by infrared, ultraviolet, nuclear magnetic resonance and mass spectral techniques. F

5550 Industrial Chemical Research (3) Practice of modern industrial research taught by case studies and problems. Corequisite: Chemistry 5550. Prereq: Completion of a 5000 chemistry course sequence.

5610-30-60 Energy Conversion (1, 1, 1) Chemistry of various energy and fuel interconversion systems. Introduction to homogeneous and heterogeneous catalysis, thermodynamics of energy conversion systems, fossil fuels chemistry, and electrochemical and photochemical conversion systems. Prereq: 5410 and one 5000 sequence. F, W, Sp

5710-20-30 Theoretical Inorganic Chemistry (3, 3, 3) 5710—Nuclear structure and properties of covalent, metallic, molecular, 5720—Coordination compounds. 5730—Investigational methods of structural inorganic chemistry. Prereq: 1 yr of physical chemistry. F, W, Sp

5810 Nuclear Chemistry (3) Nuclear properties, radioactivity, radioactive decay processes, nuclear structure and models, nuclear reactions, radiations and matter, radiation detection. Prereq: 1 yr of physical chemistry. A

5911-21-31 Chemistry Seminar (1, 1, 1) Discussion of departmental research, current research literature and general topics. May be repeated. Registration required each quarter except summer resident graduate students. S/N only. F, W, Sp

6000 Doctoral Research and Dissertation (3-15) E. Rapp (Emeritus), Ph.D. Illinois

6130 Natural Product Chemistry (3) Structure, chemistry, and synthesis of naturally occurring substances of biological or environmental significance. Course content may vary with each offering to reflect areas of current chemical interest. Prereq: Two of 5110-20-30-35.


6165 Orbital Symmetry Control (3) Application of Woodward-Hoffman rules and other theories to mechanism and stereochemistry of concerted organic reactions. Prereq: Two of 5110-20-30-35.

6175 Organic Photochemistry (3) Physical and chemical effects of electron excitation of organic molecules. Experimental and theoretical techniques of photochemical importance. Inter- and intramolecular reactions of alkenes, ketones, dienes, dienes, aromatic compounds, and other photoactive species. Prereq: Two of 5110-20-30-35.

6190 Organo Metallic Chemistry (3) Structure, bonding, and reaction of organometallic compounds. Application to current problems in organic synthesis. Prereq: Two of 5110-20-30-35.

6210 Advanced Analytical Spectroscopy (3) Newer methods of spectroscopic analysis, including transform methods, lasers in spectroscopy, fiber optics, introductory nonlinear optics, and spectroscopic techniques for remote sensing. Prereq: 5250.

6211 Selected Topics in Analytical Chemistry (3) Subject matter varies among important topics of current significance: environmental chemistry, spectroelectrochemistry, modern liquid chromatography, new electroanalytical methods, bioanalytical methods, and microminiprocess and microprocedures in chemical instrumentation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. A

6211 Selected Topics in Polymer Chemistry (3) Subject matter varies among important topics of current significance. Prereq: Two of 5410-50-60-70 or consent of instructor. May be repeated.

6230 Natural Polymers (3) Structure, modification, and properties of natural polymers; sources; physical properties; biosynthesis; biodegradation. Prereq: 5420 or one of two of 5250-60-70.

6240 Nuclear Magnetic Resonance (3) Theory of nuclear magnetic resonance spectroscopy with emphasis on high-resolution methods. Applications to problems in physical and chemical structure and behavior. Prereq: Two of 5110-20-30-35.

6340 Photochemistry and Radiation Chemistry (3) Fundamental physical and chemical processes pursuant to excitation of molecules by photons and electrons; multiphoton processes and uses of laser sources; fluorescence and phosphorescence; radiationless transitions studied by ophtoacoustic spectroscopy, chemical reactivity of excited states; ion-molecule and free radical reactions; electron capture and electron-transfer processes. Prereq: 5430.

6450 Electrochemistry (3) Electrical double layer; electrode kinetics; transport properties of electrolytes; electroanalytical methods. Prereq: 5450 or 5270.

6457 Electronic Structure of Radicals (3) Applications of electron spin resonance to study of molecular conformation, structure, and bonding in organic and inorganic radicals; comparison of experimental results with theoretical predications based on Walsh rules and other quantum orbital calculations. Prereq: 5340-50 and 5450.

6470 Statistical Thermodynamics (3) Application of statistical mechanical methods to systems of chemical significance: such as effects on equilibrium and rate processes, phase equilibria, condensation phenomena. Prereq: 5410, 5450.

6495 Advanced Chemical Kinetics (3) Mechanism and rate chemistry of chemical reactions on 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 transfer, chemical luminescence, and chemical lasers. Prereq: 5430.

6510 Thermodynamics of Solutions (3) Theory of regular solutions and of electrolyte solutions; measurement of activity coefficients and other thermodynamic properties; selected topics from literature. Prereq: 5410.

6520 Magnetic Resonance (3) Principles of magnetic resonance spectroscopy underlying nuclear magnetic resonance and electron spin resonance. Chemical applications to solid and liquid systems. Prereq: 5340.

6711 Selected Topics in Inorganic Chemistry (3) Subject matter varies among important topics of current significance: photoelectron spectroscopy, transuranium chemistry, organometallic compounds, inorganic solution kinetics and mechanisms, crystal chemistry, nonaqueous chemistry, chemistry of halogens and compounds. Prereq: Consent of instructor. May be repeated. Maximum 5 hrs. A


6750 Molten Salt Chemistry (3) Structure, spectroscopic properties, solution thermodynamics, electrochemistry and phase equilibria of molten salts. Solutions of metals in molten salts. Prereq: 4110 and 5410 or equivalent.

6810 Vibrational Problems in Molecular Spectra (3) Same as Physics 6810.

6811 Selected Topics in Nuclear Chemistry (3) Subject matter varies among important topics of current significance: nuclear decay schemes, nuclear models, nuclear reaction theory, nuclear detection techniques, activation analyses. Prereq: Consent of instructor. May be repeated. Maximum 5 hrs. A

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: G. C. Gesell, Ph.D. North Carolina; J. E. Shelton, Ph.D. Vanderbilt.

Assistant Professors: C. P. Craig, Ph.D. North Carolina; W. T. Tandy, Ph.D. Yale.

The graduate courses in the Classics include the wider reading of Greek or Latin authors in a selected field or 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) A
3020 Herodotus (3) A
3030 Euripides (2) A
4020 Aeschylus, Sophocles (3) A
4030 Lysias (3) A
4040 Aristophanes (3) A
4500-60-70 Directed Readings in Greek (3, 3, 3) F; W; Sp

Latin

3440 Livy (3) A
3450 Pliny and Martial (3) A
3460 Elegiac Poets (3) A
4120 Horace, Satires and Epistles (3) A
4310 Selected Readings from Latin Literature (3, 3) May be repeated. A; A
4340 Horace, Odes (3) A
4350 Tacitus (3) A
4360 Lucretius (3) A
4370 Readings in Medieval Latin (3) A
5410-20-30 The Latin Epic: Lucretius, Vergil, Lucan (3, 3, 3) A; A
5510-20-30 Roman Comedy; Plautus, Terence (3, 3, 3) A; A; A

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 the gods and Greek myths on art, music, and literature of ancient Greek and later cultures. (Same as Religious Studies 3210.) F

3220 Greek Mythology in the Classical Period (3) A study of use 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 3220.) W

3230 Roman Mythology (3) Study of myths created by Romans, as well as those the Romans borrowed from the Greeks, with reference to Roman attitude toward history, religion, and society. Readings, lectures, and discussion. (Same as Religious Studies 3230.) Sp

3230 Roman Mythology (3) Study of myths created by Romans, as well as those the Romans borrowed from the Greeks, with reference to Roman attitude toward history, religion, and society. Readings, lectures, and discussion. (Same as Religious Studies 3230.) W

3350 Shrines and Sanctuaries of the Greek and Roman World (3) Study of shrines and sanctuaries of Greek and Roman world with emphasis on archaeological remains. Such sites as Olympia, Epidaurus, Paestum, Cumae, Praeneste, and Baalbek will be considered. Readings in selected classical authors will add to understanding of place of shrines and sanctuaries in Greek and Roman life. Sp

4010 Greek Drama in English Translation (3) Survey of dramatic masterpieces of Greek literature. A

4210 Teaching of Latin (3) Carries no language credit. Purposes, techniques, mate- rial, and evaluation; directed observation in public schools; preparation of teaching plans and materials. A

4220 Seminar in Classical Studies (3) Special problems in literatures and other arts of Greece and Rome. May be repeated with consent of department. W

4230 Classical Mythology and its Uses (3) Intensive review and survey of Greek and Roman mythology. Emphasis on classical mythology in literature, music, and plastic arts, especially of modern times. F

4510 Selected Readings in Latin Literature in Translation (3) Content varies; may be repeated with consent of department. A

5620 Problems in Old World Archaeology (3) (Same as Anthropology 5620.) A

Computer Science

MAJOR

Degree

Computer Science

M.S.

Professors: F. Donaldson, Ph.D. Texas; R. C. Gonzales, Ph.D. Florida (Electrical Engineering); R. W. Heiser, Ph.D. Pennsylvania (Mathematics); G. J. applications. (Same as Electrical Engineering; Computer Science 4550, 5100 and 5109.

2. Electrical Engineering/Computer Science 5175 and 5940.

3. One of the three courses Computer Science 4710, 4730, or 4225. The student may then select either Plan A or Plan B.

Plan A: Thesis Option

1. Complete 36 hours of courses at the 4000 level or above, including at least 18 hours at the 5000 level, exclusive of Electrical Engineering/Computer Science 5175 and 5940.

2. Complete at least 9 additional hours of thesis credit, Computer Science 5500.

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 Electrical Engineering/Computer Science 5175 and 5940.

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.

3150 Introduction to Numerical Algorithms and Programming (3) Roots of equations, systems of linear equations, least-squares data fitting, numerical integration, numerical methods for ordinary differential equations. Introduction to programming in FORTRAN. 3150 and 3155 may not both be taken for credit. Students with a knowledge of FORTRAN should take 3155. Prereq: coreq. Mathematics 2860. (Same as Mathematics 3150.) E

3155 Introduction to Numerical Algorithms (3) Roots of equations, systems of linear equations, least-squares data fitting, numerical integration, numerical methods for ordinary differential equations. 3150 and 3155 may not both be taken for credit. Students with a knowledge of FORTRAN should take 3155. Prereq: 1510 or 1610 or consent of instructor. Prereq: coreq. Mathematics 2860. (Same as Mathematics 3155.) E

3510 Computer Organization and Programming I (3) Problem formulation and advanced programming in FORTRAN: operation and control of digital computers. Prereq: 1510, 2510, 3150, or consent of instructor. E


3715 Discrete Structures (3) Introduction to discrete structures useful in computer science. Sets, logic, relations, functions, proof techniques, induction, logic. Graphical representations and algorithms. Prereq: 1510 or 1610 or 3150 or equivalent. Prereq: coreq. Mathematics 2860. (Same as Mathematics 3715.) F, Sp

3725 Advanced Discrete Structures (3) Advanced topics in discrete structures useful in computer science. Graphs and algorithms for manipulating data, algebraic structures, Boolean algebra, lattices, groups, monoids. Prereq: 3715 or equivalent. Prereq: coreq. Mathematics 3725. (Same as Mathematics 3725.) F, Sp

4950 Number Systems for Digital Computers (3) Floating-point number representation, mixed-radix number representation, multiple-modulus residue number representation, finite-segment p-adic
number representation, errors in floating-point computation, finite fields and exact computation using digital computers. Prereq: 3150. A.

4710 Introduction to Artificial Intelligence (3) Intelligence, reasoning, knowledge, uncertainty, and learning using computer. Computer representation of knowledge, problem solving and search, game playing, automata and natural language understanding, computer vision and learning. Computer implementation of AI problems. Prereq: 4510.

4725 Numerical Solutions to Equations and Numerical Approximations (3) (Same as Mathematics 4242.) W, F

4735 Statistical Data Processing (3) FORTRAN language for organization and analysis of scientific data. SPSS and SAS programs for standard statistical analyses: frequency distributions, percentiles, data reduction correlation and regression, analysis of variance. Not for credit for science computer majors. Prereq: Statistics 2100 or equivalent. F, Sp

4740 Independent Study in Computer Science (1-3) Students' major projects and/or independent studies. To be directed by Computer Science faculty, perhaps jointly with student's faculty advisor. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

4750 Interactive Statistical Data Processing (3) Statistical data processing using interactive computer systems. Emphasis on utility and statistics programs; StatPack, editors, and FORTRAN. Not for credit for computer science majors. Prereq: Statistics 2100 or equivalent and 4310 or knowledge of a procedure-oriented language such as FORTRAN. W

4770 Programming Languages (4) Comparison and analysis of programming languages, design, features and implementation. Processors, operation systems, sequence control, data control, and storage management. Detailed discussion and programming experience in LISP and other SNOBOL, APL, or SIMULA. Prereq: 4510.

4510 Data Structures and Non-Numeric Programming (3) 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 structure. Prereq: 2710 and 1610 or 2610.


4570 Data Base Management Systems (3) Hierarchical, network and relational models; logical and physical views of data. Data definition and data manipulation languages. Data independence, implementation and operational considerations; performance, integrity, security, and reliability. Prereq: 4510 and 4550 or equivalent. W

4610 Operating Systems—Concepts and Facilities (3) Detailed examination of major operating system. Memory, processor, device, and data management. Interrupts, processes, device drivers, loaders and relocation, device characteristics, data set organizations, SPOOLing. Prereq: 4510 and 4550. F

4620 Operating Systems—Case Studies (3) Alternative design goals, design, implementation, implementation, logging, segmentation, time sharing, time slicing, protection, concurrency, real time systems. Execution of operating systems. Prereq: 4610 or equivalent as appropriate. Prereq: 4610 or equivalent or consent of instructor. W

4680 Computer Organization Level (3) Practical experience with design of compilers. Scanning, parsing, semantic processing, code generation and optimization. Computer implementation. Comprehensive term project includes a complete compiler for a small block-structured language. Prereq: 4510. W


4750 Interactive Computer Graphics (3) Point plotting, vector generation, interactive graphical techniques, two- and three-dimensional transformation, perspective depth, hidden line elimination, shading, software and hardware system design. Discussion of use of these techniques in design, problem solving, mapping, architecture, and many other areas. Prereq: Senior standing in Computer Science. Electrical Engineering or Geography and a knowledge of computer programming, or consent of instructor. (Same as Geography 4750.)

4820 Introduction to Pattern Recognition (3) (Same as Electrical Engineering 4820.) W

4830 Digital Image Processing (3) (Same as Electrical Engineering 4830.) Sp

4850 Small Computer Systems (3) (Same as Electrical Engineering 4850.) E

4910 Analysis and Management of Computer Installations (3) Analysis and design of computer systems; implementation, justification, personalization in systems; perspective on system. Prereq: 3520 or equivalent. F

4980-90 Special Topics In Computer Science (1-4) Credit determined at registration. Prereq: Recommendation of Computer Science staff. May be repeated with consent of department. Maximum 9 hrs.

5000 Thesis (1-15) E

5020 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered in Computer Science. Use university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Maximum 15 hrs.

5010 Computer-assisted Instruction (3) History and development of CAI systems. Emphasis on teaching success and failure of major projects, future role of CAI in education. Use of a CAI programming language to implement a CAI course. Prereq: 3510 or consent of instructor.

5050 Computer Modeling and Simulation of Physical Systems (3) Computer models for computer modeling and simulation. Inputs, driving functions, errors, outputs, interactive simulations as applied to various physical systems and systems simulation. Prereq: 3150 or 3155, and 3520 and Statistics 3450. A

5100 Immigration to Computer Science (3) Designed for students who are coming to computer science background who wish to enter computer science major or minor program. Advanced programming techniques in FORTRAN, control of input-output devices, machine organization and assembly languages programming; introduction to data structures and algorithm analysis. Prereq: 1510 or 1610 or 3150 or consent of instructor.

5109 Immigration to Computer Science Practicum (3) Design and implementation of medium to large-scale computer systems. Prereq: 5100.

5175 Introduction to Logic Design (3) (Same as Electrical Engineering 5175.)

5210 Artificial Intelligence (3) Simulation of intelligent processes by computer. Techniques of representation and inference for various areas: problem solving, game playing, pattern perception, theorem proving, semantic information processing. Computer simulation of AI problems. Prereq: 4510 or consent of instructor. (Same as Electrical Engineering 5690.) W

5250 Medical Computing (3) Achievements and problems associated with application of computer technology to field of health care. Various areas of medical computing; laboratory data systems, patient monitoring systems, diagnostic assistance, patient records, automatic history taking, and hospital administration systems. Prereq: 4510. Sp

5430 Theory of Compilers (3) Development of major components of compiler using constructed languages. Prereq: 4710, or consent of instructor. Coreq: Basic symbols, semantic routines, allocation of storage, code optimization. Prereq: 4510, 4550, and 5780. A

5450 Finite Difference Methods for Partial Differential Equations (3) (Same as Mathematics 5456.) F

5455 Finite Elements Methods (3) (Same as Mathematics 5465.) W

5475 Advanced Topics in Numerical Partial Differential Equations (3) (Same as Mathematics 5475.) Sp

5570 Advanced Data Base Management Systems (3) Data model theory, comparison of several existing data base systems, implementation technology, selection and evaluation techniques, integrity, security, authorization and protection, hardware architectures, and future trends in DBMS area. Prereq: 4570 or equivalent background. W

5665-75 Numerical Mathematics (3, 3, 3) (Same as Mathematics 5665-85-75.) W, Sp


5730 Computability and Computational Complexity (3) Computability and decidability. Turing machines and halting problems. Recursive and recursively enumerable sets; partial and total recursive functions. Time space bounded computations; the P vs NP problems. Prereq: 4710. Sp

5750 Theory of Formal Languages (3) Phrase-structure languages, their generators and processors. Type 0, 1, 2, and 3 languages; operations on languages and grammars; deterministic context-free languages. Theory of translation. Prereq: 4710. W

5770 Combinatorial Algorithms (3) Algorithms for solving optimization problems in graphs, networks and matroids. Precise notions of time and space complexity. Prereq: 4730. (Same as Mathematics 5770.) F

5810 Information Organization and Retrieval (3) Organization, storage, searching and retrieval of information. Development of IR systems from off-line to online systems. Information storage, retrieval and dictionary construction and operations. Search and matching procedures; retrieval process. Information dissemination systems. Data base retrieval systems. Prereq: 4510 or 4550. F


5880 Data Security (3) Need for security and methods for achieving it: encryption, machine architecture, hardware and software implementations, historical and current approaches. Case studies in fraud and misuse. Prereq: 3520 or consent of instructor.

5920-25 Special Topics in Computer Science (1-6, 1-6) May be repeated. Maximum 9 hrs.

5940-50 Advanced Small Computer Systems (3, 3) (Same as Electrical Engineering 5940-50.)
Cultural Studies

Asian Studies

4010-20-30 Readings in Asian Literature (4, 4, 4) Prereq: Mastery of intermediate level of Japanese, Chinese, Sanskrit, or Arabic and consent of instructor. May be repeated. Maximum 9 hrs.

4012 Selected Topics in Asian Studies (4) Content varies. May be repeated. Maximum 12 hrs.

4531-32-33-34 Advanced Chinese (4, 4, 4, 4) Taped language program. Prereq: 3511-32 or equivalent or consent of instructor. Must be taken in sequence.


Black Studies

3140-50-60 Directed Readings in Black Studies (1, 1, 1) Designed for students who are interested in doing intensive reading in some area of Black Studies which is defined by the student and the instructor. Prereq: 2010 or 2020 and consent of instructor.

4200 Senior Seminar on Pan-Africanism (4) Explores concepts and philosophers of Pan-Africanism and implications of this ideology for various societal institutions.

4300 Resource Materials in Black Studies (4) Introduction to basic references such as bibliographies, indices, and listings of audiovisuals in Afro-American history, African history, and children's literature. Prereq: 2010 or 2020 or consent of instructor.

4310 Research in Black Studies (4) Deals with Black experience and research process.

4500 Current Issues and Topics in Black Studies (3-4) Problems, topics and issues in area of Black Studies. Consent and credit determined by instructor. May be repeated. Maximum 12 hrs.


4880 Afro-American Psychology (4) (Same as Psychology 4880.)

Comparative Literature

4012-22-32 Special Topics in Comparative Literature (3, 3, 3) Content varies: may be repeated. F, W, S.

4050-60-70 Dante and Medieval Culture (3, 3, 3) (Same as Italian 4050-60-70). A. A. A

5012 Comparative Theories of Literature (3) Croce, Richards, Frye, Wellek, and others. Prereq: Completion of three literature courses in foreign language above 3000, or equivalent.

5022 Approaches in Comparative Literature (3) French and American schools; "comparative literature" vs. "general literature"; Van Tieghem, Carré, Balzdenkarger, Wellek. Prereq: 5012; completion of three literature courses in foreign language above 3000, or equivalent.

5032 Studies in Comparative Literature (3) Independent research problems. Prereq: 5012 and 5022.

Cultural Studies

5101 Foreign Study (1-12) See page 99.

5102 Off-campus Study (1-12) See page 99.

5103 Independent Study (1-12) See page 99.

Linguistics

4000 Topics in Linguistics (3) Content varies. May be repeated. Maximum 9 hrs.

4020-30 Historical Linguistics, Neogrammarian School, and Growth of Structuralism (3, 3) 4020-30 Traces development of scientific approach to linguistics from Jacob Grimm and Franz Bopp through nineteenth century. 4030-30 Traces change in linguistic interest brought on by Saussure's Cours and growing impact of anthropology and behaviorism on linguistic studies.

4250 Introduction to Descriptive Linguistics (3) (Same as French, German, Russian, Spanish 4250.)

4260 Introduction to Historical and Comparative Linguistics (3) (Same as French, German, Russian, Spanish 4260.)

4270 Introduction to Romance Linguistics (3) (Same as French, Spanish 4270.)

4271 Introduction to Slavic Linguistics (3) (Same as Russian 4271.)

4440 Sociolinguistics (3) (Same as English 4440.)

4450 Dialectology (3) (Same as English 4450.)

4460 Special Topics in English Linguistics (3) (Same as English 4460.)

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:

J. B. Treherne (Head), Ph.D. Princeton; E. M. Carse, Ph.D. Illinois; R. M. Kelly (Director of Graduate Studies), Ph.D. Texas, R. Y. Drake, Jr., Ph.D. Yale; A. R. Enser, Ph.D. Indiana; J. H. Fisher, Jr., Ph.D. Pennsylvania; B. J. Leggett, Ph.D. Florida; J. E. Reese (Chancellor), Ph.D. Kentucky.


Associate Professors:


Assistant Professors:

D. R. Cox, Ph.D. Dalhousie; T. A. Hefferan, Ph.D. Cambridge; M. A. Lofaro, Ph.D. Maryland; C. J. Maland, Ph.D. Michigan; M. L. Pryse, Ph.D. California (Santa Cruz).

Visiting Lecturers:

W. Dykeman, B. A. Northwestern; G. Griffith, Ph.D. Vanderbilt; F. M. O'Hara, Ph.D. Illinois.

Detailed information about the Master's and doctoral programs, and about individual graduate courses, may be obtained by writing the Director of Graduate Studies of 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) thesis and 36 quarter hours of courses in the Department of 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.

For the degree of Master of Arts in College Teaching (MACT) the requirements include (1) 45 quarter hours of courses in English, arranged as for the non-thesis M.A., (2) 2 hours in a special course designed for MACT students, (3) 3 hours of a tutorial in the teaching of freshman composition, (4) a thesis or 9 additional quarter hours of 5000- and/or 6000-level courses in English, (5) evidence of proficiency in one foreign language, (6) a final examination, and (7) a program of supervised teaching approved by the department.

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 at least 72 quarter hours (or the equivalent) in English: 36 hours at the 6000 level; 24 additional hours at the 5000-6000 level; and 12 hours for graduate credit at any level, including the 3000-4000 level. In addition, 9 (or 6) hours approved by the department must be taken for graduate credit in a subject or subjects other than English. Normally a student with the M.A. from another university may transfer at least 36 quarter hours.

After all, or most, of the course work has been taken and after the two language requirements have been satisfied, the student will take four comprehensive examinations from several areas divided as the department directs. Successful completion of these examinations will be followed by the writing of the dissertation and by an oral examination in the field of the dissertation.

Any course in the 5000 or 6000 series may be repeated for credit with the permission of the department.

*1211 Written and Oral English for Foreign Students (6) Rapid review of English grammar structures and pronunciation with intensive oral, aural, and written drill. Required during the first quarter of residence of all foreign students (graduates, undergraduates and transfer students) who are not exempted from it on the basis of the English Proficiency Examination required of every new foreign student. A, B, C, I, F, W grading. Students registered for this course are permitted to register for only 2 other courses.

*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 demonstrated the need for work in English structure, but not at the intensive level of English 1211. Required also of foreign students who complete 1211. A, B, C, I, F, W grading. Students registered for this course are permitted to register for only 2 other courses.

3070 Modern British Poetry (3) From Housman and Thomas and more recent poets.

*Not available for graduate credit.
Geography

MAJOR

DEGREES

Geography

M.S., Ph.D.

Professors:

S. R. Jumper (Head), Ph.D. Tennessee;
C. S. Aiken, Ph.D. Georgia; E. H. Hammond,
Ph.D. California (Berkeley); C. W. Mitchell,
Ph.D. Syracuse; T. H. Schmudde, Ph.D. Wisconsin.

Associate Professors:

J. B. Rehder, Ph.D. Louisiana State.

Assistant Professors:

W. N. Cherry, M.S. Tennessee; R. Foresta,
Ph.D. Rutgers; L. Pulsipher (Visiting);
Ph.D. Southern Illinois; B. Ralston,
Ph.D. Northwestern.

The Department of Geography offers the degrees of Master of Science and Doctor of Philosophy with concentrations in geography of development, physical geography and human systems, urban geography, geography of Anglo-America, and rural and nonmetropolitan geography.

THE MASTER'S PROGRAM

The department requires a minimum of 45 quarter hours beyond completion of a sound undergraduate major program. At least one-half of the total courses in the graduate program must be at or above the 5000 level, of which no more than 9 hours may be thesis courses, and must include 5150, 5160, and (at each offering during residency) 5100. Thesis and final examination required.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those persons who demonstrate proficiency in conducting independent investigation. Students must have achieved the equivalent of a comprehensive Master's program before they will be admitted to the doctoral program. Course requirements for the degree shall be determined by the student's faculty committee in accordance with specific interests and needs. The program of study must include sufficient course work within the independent research. All coursework, independent, but outside the areas of specialization, to give a broad foundation and understanding of the discipline. The program must include 5160, 5170, 5720, and (at each offering during residency) 5710. A minimum of 15 hours in credit must be earned in related fields outside the department. Competence in a foreign language, cartography, and quantitative techniques is required. Other techniques pertinent to the student's area of specialization may be required. The language work for the foreign language requirement may be certified by the student's faculty committee. Comprehensive examinations required for admission to candidacy include a written comprehensive, written examinations on two special fields and an oral examination on the dissertation proposal. Also required is a final oral examination on the dissertation and on other aspects of the program as determined by the student's doctoral committee.

3410 Intermediate Economic Geography (4) Concepts, theories, and practices in location planning. Localational patterns in agriculture, manufacturing, and service activities. F or W

3430 Urban Geography (4) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities. F, W, Summer

3450 Rural Geography (4) Geographical appraisal of rural areas of the United States, including small towns and urban fringes. Problems and potentials of rural America. W

3490 Geography of Resources (4) Study of factors related to variations in resource availability from time to time and from place to place, with emphasis upon energy and metallic resources. F, W

5320 Climatology (4) General circulation system leading to world pattern of climates. Climatic change and modification, and interrelationship of climate and human activity. F

5330 The Land-Surface System and Man (4) Nature and regional variations in relationships among surface form, water, vegetation, and surface materials. Human as evaluator and agent of change. W, Su

3610 Political Geography (4) Importance of geographic factors for understanding political relations and processes within and between nations, spatial implications of political decision-making process; geography of administrative units. F, W

5660 Cultural Geography (4) Basic concepts of culture, methods and background of cultural geography; world patterns of cultural phenomena. A

5790 Geography of Middle America (4) Covers Mexico, Central America, and the West Indies. W

3800 Geography of South America (4) F, Sp

3870 Geography of Asia (4) A survey of the physical, cultural and economic characteristics of the countries of Asia, foci to be selected in consultation with student. F

3910 Regional Geography of United States and Canada (4) Major physical, economic, and social distributions as they interrelate to give distinctive character to regions of United States and Canada. F, W, Sp

3920 Geography of the American South (4) Geographical appraisal of southeastern United States, including physical environment and human resources, Origin and development of contemporary economic and cultural traits of the area. F, Sp

3940 Geography of Appalachia (4) Interrelation of physical, economic, and social patterns to give distinctive character to the region and its parts, especially Southern Appalachia. Appalachia in perspective in the current American scene. W

4075 Geography of Transportation (4) Geographic examination of transportation systems, emphasizing transport of people on highways and by public facilities. Relationships between transportation systems and their relationship to environments. Examine the role of transportation pattern, development of agricultural regions and patterns of urban development. Sp

3400 Historical Geography of the United States (4) Survey of changing human geography of United States during four centuries of settlement and development. Emphasis on the use of space in man's interaction with environment, changing pattern of settlement, development patterns, development of agricultural regions and patterns of urban development. Sp

5410 Principles of Geomorphology (4) (Same as Geology 5240)

4550 Geography of Soils (4) Soils as physical systems and their relationship to environments. Investigation of specific cases of the role of soil in management of the environment. F

5610 Industrial Geography (4) Factors affecting location of manufacturing activities, with emphasis on the United States. Prereq: 3410 or consent of instructor. A

4630 Geography of Agriculture (4) A

4710 Cartographic Design and Production (4) Principles and practice of design, construction, and reproduction of maps. Recommended prereq: 3700. 2 hrs and 2 labs. Sp

4720 Data Mapping (4) Automated techniques of representing surfaces, using geographic information systems. Recommended prereq: 3700 and knowledge of a computer language. F

4730 Advanced Cartography (4) Map production from design through color proofs. Prereq: 3700, 3710, and 4720 or consent of instructor. W

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. W

4750 Interactive Computer Graphics (3) (Same as Computer Science 4750)

4799 Practicum in Cartography/Remote Sensing (2-6) May be repeated. Maximum 6 hrs.

5000 Thesis (1-15) E

5100 Colloquium in Geography (1) Discussion of departmental research, current research literature, and general topics. Registration at each offering required of resident graduate students. May be repeated. Maximum 8 hrs. SMC only. W, Sp

5101 Foreign Study (1-12) See page 99. E

5102 Off-campus Study (1-12) See page 99. E

5110 Introduction to Geographical Research (3) Aims of geographical research; survey of printed source materials; practice in effective presentation of research findings. F

5180 Research Design and Field Problems (4-6) Development of research problems, preparation of appropriate study designs, and practical field application. W

5170 Geographic Concept and Method (3) Traditional and modern thought regarding nature, scope, problems, and methods of geography. A

5200 Special Problems in Geography (2-6) 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. E

5250 Topics in Historical Geography (3) Examination of trends, concepts and methods in historical geography. Prereq: 4240 or consent of instructor. May be repeated with consent of instructor. Maximum 9 hrs. F

5260 Advanced Cultural Geography (3) Geographic analysis of rural settlement in Eastern United States, with emphasis upon New England, Tidewater East, and Upland South, and specific application to Southern Appalachians. Includes field work and final projects. Prereq: 3860 or consent of instructor. Sp

5310 Topics in Regional Geography of the United States (3) Intensive analysis of problems and trends in one or more regions of United States, excepting Appalachian South. May be repeated with consent of instructor. Maximum 9 hrs. A

5320 Topics in the Geography of the American
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 5999. A minimum of 24 hours in geology courses, in addition to thesis, is required. Students who enter without having had an acceptable background are required to take Geology 4440, or an equivalent course elsewhere, as part of the above department requirements. One year of general physics is required, if not taken as an undergraduate. Thesis committee must be approved by graduate committee. Qualifying examination is given the second quarter.

THE DOCTORAL PROGRAM

Specific course program and thesis topic determined by candidate's faculty committee.

1. Program to be determined by faculty committee. Requirements include minimum of 84 quarter hours in courses for graduate credit, in addition to dissertation. These courses must include a minimum of 45 hours in the 5000 or 6000 series, of which at least 15 hours must be in the 6000 series. Up to one-third of the required hours may be taken in related fields. A Master's degree is recommended.

2. Comprehensive examination will be both written and oral. The exam must be taken by the end of the second academic year.

3. Each Ph.D. student must satisfy a research 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 Course B grade 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) Study of minerals and rocks. Laboratory includes both hand specimen and analytical methods of identification. Prereq: 1410; Chemistry 1110-20 or equivalent. 3 hrs and 1 lab.

*3160 Mineralogy (4) Introduction to crystallography and study of minerals. Laboratory includes hand specimen, chemical and x-ray methods of identification. Prereq: 1410; Chemistry 1110-20 or equivalent. 3 hrs and 1 lab.

*3210-20 Invertebrate Paleontology (4, 4) Systematic review of important Metazoa invertebrate fossil groups. 3210—Porifera to Annelida, including cnidarians, echinoderms, crinoids, and conodonts. 3220—Mollusca through lesser Chordata, including arthropods and echinoderms. May be taken separately or in sequence. Prereq: 3260; Biology 1210-20 or consent of instructor. 3 hrs and 1 lab or field period.

*3250 Micropaleontology (4) Microscopic remains of animals and plants with special emphasis on stratigraphically important groups. Prereq: 3210 or consent of instructor. 3 hrs and 1 lab or field period.

*3260 Paleobiology (4) Introduction to principles and materials of paleontology as applied to interpretation of earth history. Prereq: 1420. 3 hrs and 1 lab or field period.

*3270 Geological History of Land Organisms (4) Geological history and development of terrestrial biotas and ecosystems. Study of fossil record of plants and vertebrates. Prereq: Biology 1210-20 or consent of instructor. 3 hrs and 1 lab or field period.

*3310 Introductory Petrology (4) Introduction to classification and properties of igneous and metamorphic rocks, processes which produce them, and tectonic and tectono-climatic interpretation of igneous rocks. Laboratory emphasizes both hand specimen and microscopic study of important rock types. Prereq: 3180. 3 hrs and 1 lab.

*3330 Geology of Eastern Tennessee (4) Lectures and field excursions. Prereq: 12 hrs of geology and consent of instructor.

*3350 Stratigraphy-Sedimentation (4) Introductory study of stratigraphic principles and practices and of sedimentary processes and interpretation of depositional environments. Prereq: 1420 and 3180. 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 involves field mapping of depth and thickness problems, structure sections, structure contour maps. Prereq: 1420; Mathematics 1540-50 or equivalent. 3 hrs and 1 lab.

*3410 Principles of Ground Water Geology (3) Geological materials and processes affecting the occurrence and behavior of water. 2 hrs and 1 lab.

*3510 Introductory Environmental Geology (4) Geologic problems involving earth environment and resources, and geologic parameters associated with their control and misuse. Prereq: 1420 or consent of instructor. 2 hrs and 1 lab.

*3610 Quaternary Geology for Engineers (3) Erosional and depositional processes, landforms, ground water. Prereq: 2610 or equivalent. 2 hrs and 1 lab or field period.

4110 Principles of Economic Geology (4) Formation of mineral deposits. Prereq: 3180, 3370, or equivalent.

4115 Elementary Applied Geophysics (Basic principles of electrical, seismic, gravity and magnetics surveying. Recommended: 1420, Physics 2220 or 2320. 3 hrs and 1 lab.

4130 Sedimentology (4) Introduction to physical processes of sedimentation: transport of sediments and formation of sedimentary structures, river flows, waves, tides, and ocean circulation. Prereq: 3310. 3 hrs and 1 lab.

4230 Paleocology (4) Principles of environmental analysis applied to fossil assemblages and associated lithologies. Prereq: 3260 or consent of instructor. 3 hrs and 1 lab.

4240 Paleoecology (4) Survey of fossil record of plants with particular emphasis on comparative morphology and evolutionary trends in major plant groups, and chronological succession and geologic distribution of past floras on earth. Prereq: 1420 or 2210; Botany 3010-20 or consent of instructor. (Same as Botany 4240.) 3 hrs and 1 lab or field period.

4250 Evolution of Higher Taxa (4) Current evolutionary theory in context of paleontology, patterns of evolution in fossil organisms at family level or higher. Prereq: 3260. Recommended prerequisite: 3210-20, 2 hrs and 1 hr seminar.

4260 Biostratigraphy (3) Application of paleontological data to stratigraphic study, codification of stratigraphic time and correlation and recommended practice. Prereq: 3260 and 3360, 1 hr and 1 2-hr seminar.

4310 Geologic Mapping (4) Interpretation of maps and field problems. Prereq: 12 hrs geology. 3 hrs and 1 lab or field period.

4331 Quaternary Geology of North America (4) Quaternary geologic processes, stratigraphy, paleoecology and geomorphology of glaciated and unglaciated North America and oceans. Prereq: 3180. 4 hrs and 1 lab or field period.
Consent of instructor. May be repeated. Maximum 4

4810 Special Problems in Geology (1-4) Prereq: Consent of instructor. 2 hrs and 3 labs.

4820 Tectonic Styles (4) Elements, habitats, and geotectonic causes of basic styles of tectonic de-
formation are presented on maps, sections, aerial photographs and fabric diagrams. Prereq: 3370 or consent of instructor. 3 hrs and 1 seminar or lab.

4440 Field Geology (5) Five-week field course, first term summer quarter. Advanced undergraduates or first-year graduates in geology, employs entire time of students. A report is required, to be submitted no later than end of fall quarter. Prereq: 12 hrs geology and consent of instructor.

4460 Geologic Photography and Photogrammetry (4) Principles of terrestrial and aerial geologic pho-
tography, including photographic principles and practice, geometry of terrestrial and aerial pho-
tography and interpretation. Prereq: Consent of instructor. 3 hrs and 1 lab.

4510 Principles of Geomorphology (5) Gravitational processes acting on earth's surface and landforms produced thereby are studied. Prereq: Consent of instructor. Same as Geophysics 4510. 3 hrs and 1 lab.

4550 Optical Mineralogy (4) Identification of minerals and determination of crystal-chemical parame-
ters using petrographic microscope.

4610 Principles of Geochemistry (4) Application of chemical principles to geologic problems. Empha-
sis on crystal chemistry and relation between basic atomic structure and distribution and behavior of elements in the earth's crust. Prereq: Chemistry 1110-20 or equivalent. Recommended: 3310.

4650 Mineral Phase Equilibria (3) Principles of phase chemistry and application of phase equilibria in studies of rock-forming mineral systems as aid to understanding conditions of formation and modification of rocks. Prereq: 4610 or consent of instructor.

4770 Evolution of Oceans and Continents (4) Intro-
ductive study of origins and changes that have oc-
curred in earth's crust with emphasis on modern concepts of continental drift and plate tectonics. Prereq: 1420.

4780 World Geology of Petroleum (4) Geologic habitat of petroleum deposits, methods of explo-
ation for economic deposits, economic and geologic values of petroleum, and distribution of known and potential reserves. Prereq: 1410 or equivalent and 3380 or equivalent.

4790 Uranium Deposits (4) Distribution, charac-
teristics, and origin of different types of uranium deposits. Prospecting and evaluation of uranium deposits with special reference to domestic poten-
tial resources. Prereq: 4110 or consent of instructor. 3 hrs and 1 lab/field/semester period.

4810 Special Problems in Geology (1-4) Prereq: Consent of instructor. May be repeated. Maximum 4 hrs.

5000 Thesis (1-15) E

5050 Geochemistry of Ore Mineral Deposits (3) Study of ore deposits based on experimental, empirical,
etical, and theoretical geochemical considerations. Prereq: Consent of instructor.

5090 Experimental Geochemistry Laboratory (1-3) Independent lab study of problem in geochemistry using lab techniques. Prereq: Consent of instructor.

5120 Geophysics—Gravity and Magnetic Methods (4) Principles of gravitation and geophysical and paleomagnetism. Prereq: 4115, differential and in-
tegral calculus or consent of instructor. Advanced engineering and physical geology. Prereq: 4130 or equivalent. 3 hrs and 1 lab.

5130 Geophysics—Seismic Exploration Methods (4) Seismic refraction and reflection methods, intro-
duction to earthquake seismology and earth's inter-
ior. Prereq: 4115 or consent of instructor. 3 hrs and 1 lab.

5210-20-30 Special Problems in Geology (1-4, 1-4, 1-4) Prereq: Consent of instructor.

5290 Quaternary Problems (4) Interdisciplinary ap-
proach to study of geologic, paleoecologic, and biologic phenomena directly or indirectly influenced by Pleistocene glaciation. Prereq: Elements of geology 2 quarters or consent of instructor. (Same as Botany 5390 and Zoology 5290.)

5310 Depositional Environments and Models for Exploration (4) Modern depositional environments and recognition of ancient analogs; depositional facies applica-
tions to exploration and production geology.

5340 Seminar in Local Stratigraphy (1) Stratigraphy of Knoxville area.

5350 Selected Topics in Geology (1) Presentation of graduate research, topics from current literature, and subjects of general interest. Registration re-
quired each quarter except summer for resident full-time graduate students. S/NC only.

5370 Metasomatic Analysis (4) Techniques of gather-
ing, processing, and interpreting tectonic meso-
sopic fabric data. Prereq: 3370. 3 hrs and 1 lab or field period.

5460 Photologic Interpretation (4) Advanced photoscopic techniques and theoretical and practical 
methods of photographic measurements from aerial photographs. Practice in photo interpretation of imagery covering selected geologic features. Prereq: Consent of instructor.

5470 Plate Tectonics and Orogeny (4) Geometry and kinematics of plate motion are used to devise models of geosynclines, fold belts, metamorphic and plutonic belts, with recent and ancient examples. Prereq: 3370. 3 hrs and 1 seminar or lab.

5520 Igneous Petrology (4) Genesis and emplace-
mament of magma, and mineralogical, chemical, and textural properties of resulting igneous rocks. Labo-
atory emphasizes petrographic description and classification of rocks in thin section. Prereq: 3310 and 4550. 2 hrs and 2 labs.

5530 Metamorphic Petrology (4) Physical and chemical characteristics of metamorphic environ-
ment, and effects on texture, chemical composition, and mineral equilibria. Laboratory emphasis petro-
graphic description and interpretation of metamor-
phic rocks in thin section. Prereq: 3310 and 4550. 2 hrs and 2 labs.

5560 Terrigenous Clastic Sedimentary Petrology (4) Field and microscopic analysis of terrigenous clastic rock types, role of transport and depositional processes in affecting sediment texture and compo-
sition. Prereq: 3360 or equivalent. 3 hrs and 1 lab.

5560 Carbonate Sedimentology (4) Environments of deposition of modern and ancient carbonates. Prereq: 4610 or consent of instructor. Recom-
manded: 4550. 3 hrs and 1 lab.

5620 Electron Microprobe and X-Ray Spectro-
graphic Analysis: Theory and Application (4) Theory and application of electron microprobe and x-ray spectrometry to analysis, emphasis on earth sciences. Prereq: 3180 or con-
sent of instructor. 2 hrs and 2 labs.

5630 X-Ray Diffraction: Theory and Application (4) Production and use of x-rays in identify-
ing crystal-line substance; powder camera, diffractometer, Gandolfi camera, and single crystal methods. Prereq: 3180 or consent of instructor. 2 hrs and 2 labs.

5635 X-Ray Diffraction: Single Crystal Techniques (3) Single crystal diffraction techniques, emphasis on X-ray and Weissenberg photography. Cry-
sal symmetry and diffraction, reciprocal lattice and Ewald sphere constructions, space group determi-
nation and application to geological problems. Prereq: Knowledge of introductory crystallography and consent of instructor.

5640 Clay Mineralogy (4) Origin of clay minerals; structures and properties; application of mineralog-
ic techniques in clay mineral studies. Prereq: 3180 and 4550. 2 hrs and 2 lab.

5650 Thermodynamics for Geologists (3) Principles of chemical thermodynamics related to geologic processes. Prereq: Chemistry 1110-20-30 and calcul-
us of a single variable or equivalents.

5570 Geochemical Prospecting (3) Theory and practice of geochemical prospecting for metallic ore deposits, i.e., use of chemical analyses of rocks, soil, plants, water, and stream sediment for locating ore. Prereq: 4110 and Chemistry 1110-20-30 or equivalents.

5690 Cathodoluminescence Petrography (2) Application to geological problems. Prereq: 3180 and 4550 or consent of instructor. 1 hr and 1 lab.

5710 Advanced Paleontology (4) Fossil inverte-
brates.

5720 Paleontological Nomenclature and Tech-
niques (4) Codification of biologic nomenclature as it applies to paleontology; basic techniques in prepara-
tion and illustration of fossil materials and manuscript preparation for publication. 3 hrs and 1 lab.


5820 Strata-bound and Stratiform Sulfide Deposits (4) Classification, distribution, characteristics and genesis of strata-bound and stratiform sulfide de-
posits. Mississippi Valley-type Pb-Zn deposits, stratiform Cro-Mo deposits, and sedimentary and stratiform Cu deposits. Prereq: 4110 or consent of instructor. 2 hrs and 2 lab/field/semester periods.

5840 Ore Petrology (4) Ore mineral assemblages by reflected-light microscopy. Identification of ore minerals and interpretation of paragenesis from tex-
tures. Typical samples from different types of ore deposits, suite of choice. Prereq: 4110 and 4550, or consent of instructor. 2-2 hrs/week.

5850 Regional Studies in Geology (1-3) Literature study and seminars on specific regions of geologic interest, supplemented by field trip. Prereq: Consent of instructor.

5860 Coal Depositional Environments (4) Coal stratigraphy and depositional environments. Car-
boniferous rocks of Appalachian region, problems of coal mining and coal quality. Prereq: 3360 or 4130.

5915 Regional Geomorphology (4) Selected geographic and geologic aspects of geologic regions, same as Geology 5915.

6000 Doctoral Research and Dissertation (3-15) E

*6110 Seminar in Stratigraphic Geology (3)

*6210 Seminar in Paleontology (3)

*6310 Seminar in Structural Geology (3)

*6410 Seminar in Mineralogy (3)

*6510 Seminar in Petrology (3)

*6610 Seminar in Economic Geology (3)

*6710 Seminar in Geochemistry (3) Prereq: 4610 or consent of instructor.

*6810 Seminar in Geomorphology (3) Prereq: 4510 or consent of instructor.

NOTE: Registration for 6000-level courses may be repeated with consent of department. Maximum 9 hrs per course.
Germanic and Slavic Languages

MAJORS

German

Slavic Languages

MAJOR

GERMAN

SLAVIC LANGUAGES

DEGREES

M.A.

M.ACT

Ph.D.

Emmanuel Professors:

E. T. Hanks, Professor Emeritus, Bonn (Germany); R. L. W. Nordrhein, Ph.D., Ohio State. 

Professors:

H. Kritz (Head), Ph.D., Ohio State; J. E. W. Seifert, Ph.D., Pennsylvania; H. W. Fisk, Ph.D., Wisconsin; R. E. Miller, Ph.D., Cornell; J. C. Osborne, Ph.D., Northwestern; M. P. Rice, Ph.D., Vanderbilt. 

Associate Professors:

J. L. Elliott, Ph.D., Michigan; D. M. Flane, Ph.D., Indiana; W. A. LaFauci, Ph.D., Wisconsin; D. E. Lee, Ph.D., Stanford. 

Assistant Professors:

C. J. Miller, Ph.D., Chicago; U. Rittenhoff, Ph.D., Connecticut.

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 (MACT) in German, and the Doctor of Philosophy (Ph.D.) in German Language and Literature.

THE MASTER'S PROGRAM

In addition to the general Graduate School requirements as stated on page 19, the department requires 36 quarter hours in approved courses, including at least 18 hours in courses numbered above 5000. In addition to course work, the student is required to write a thesis, for which he/she may get a maximum of 9 hours credit. The minimum quarter hour credit for the M.A. is 45 quarter hours.

MASTER OF ARTS IN COLLEGE TEACHING PROGRAM

The MACT program is essentially an expanded M.A. program. The minimum requirement is 60 hours of graduate study, including 9 hours of thesis and a 3 quarter-hour seminar in college teaching. The aim of this program is to prepare highly qualified college teachers. Students receiving the MACT degree would be well prepared to go to the Ph.D.

THE DOCTORAL PROGRAM

The student must fulfill the general requirements for the Ph.D. degree set by the Graduate School. The candidate for the doctoral degree must complete a minimum of 81 quarter hours of course work beyond the Bachelor's degree in addition to 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 proseminar (5200) and the literary or philological seminars (5210-20-30-40-50-60 and 6310-20-30). At least 9 hours must be taken in a cognate field. Students are encouraged to take additional work in allied fields. A minor in an allied field must consist of at least 15 hours of 5000 or 6000 courses. Students must show a fluent command of German, both oral and written, and a knowledge of two foreign languages, French and another language, such as Italian, Latin or Russian, appropriate to the field of research. A 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.

3010-30-30 Elements of German 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. Kelecut: 3600. 

3210-20-30 German Language in English Translation (3-4, 3-4, 3-4) No foreign language credit. No change in credit hours after add deadline. Students opting for 4 hrs credit will be expected to present an appropriate amount of extra work above that required for 3 hrs. 

3860 Old Norse Literature in English Translation (3-4) Prose readings of sagas of Norwegian kings, great Icelandic family sagas, and Vinland sagas, narrating discovery of America around year 1000. Mythological and heroic poems of the Edda.

4110-20-30 Studies in Classical and Modern Writers (3, 3, 3) Content varies. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30, or courses in English translation) or equivalent. May be repeated with consent of department.

4140-50 Selected Topics in German Literature from 1750 to the Present (3, 3) Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30, or courses in English translation) or equivalent. Prereq: 3600. 

4160 Studies in German Authors (3) Life and works of a single outstanding German literary figure. Content varies. Prereq: Prose courses (exclusive of 3010-20-30, or courses in English translation). May be repeated. 

4170 Theatrical German (1-3) Performance in one or more German plays. Prereq: Intermediate German or equivalent or consent of instructor. May be repeated with consent of department. W, Sp

4210-20-30 Studies in German Literary Types (3, 3) 4210-Lyrical poetry. 4220-Drama. 4230-Narrative prose. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30, or courses in English translation). 

4250 Introduction to Descriptive Linguistics (3) (Same as French, Russian, Spanish, and Linguistics 4260.) F

4260 Introduction to Historical and Comparative Linguistics (3) Linguistic change, protolanguages, and historical and comparative linguistics. Phono logical and morphological change. Cultural, historical, sociological influences upon the development of language. Semantic change. Lexicography. All these topics copiously illustrated by selected examples from Indo-European languages. Prereq: 9 hrs of upper division English, or 9 hrs of upper division courses in a modern or ancient language (exclusive of German and French 3010-20-30, or courses in literature in other languages, and general courses in Latin and Greek requiring no knowledge of these languages), or consent of department. (Same as French, Russian, Spanish, and Linguistics 4260.) W

4310-20 History of German Language (3, 3)

4610-20-30 German Civilization (3, 3, 3) Prereq: Intermediate German or equivalent.

4810-20-30 Advanced Conversation and Composition (3, 3, 3) Prereq: 3610-20-30 or equivalent or consent of department. F, W, Sp

5000 Thesis (1-15) E

5101 Foreign Study (1-12) See page 99. E

5102 Off-campus Study (1-12) See page 99. E

5103 Independent Study (1-12) See page 99. E

5200 Proseminar (3) Bibliography; methods; illustrative problems; language history. Prereq: 4000. 

5210-30 College Teaching of German (1, 1, 1) Required of all M.A., MACT, or Ph.D. candidates, except those whose previous teaching experience warrants excuse from this requirement or who wish to pursue vocations other than teaching. F, W, Sp

5410-20-30 Medieval German Language and Literature (3, 3, 3) 5410—Introduction to Middle High German. 

5500 Studies in German Literature (3) Content varies. May be repeated. Maximum 9 hrs. Su

5510 German Humanism and the Reformation (3)

5520 German Baroque Literature (3)

5530 The Enlightenment and the Rococo (3)

5540 German Classicism (3)

5550 Goethe's Faust (3)

5560 German Romanticism (3)

5570 German Realism and Naturalism (3)

5590 Modern German Literature (1889-1945) (3)

5590 Modern German Literature (1945-Present) (3)

5600 German Literary Theory and Criticism (3) W

5610-20-30-40-50-60 Directed Readings in German Language and Literature (3, 3, 3, 3, 3, 3) E

5710 Introduction to Old Norse (3) Phonology, morphology, and syntax of Old Norse. Representative readings in Old Norse.

5720 Readings in Old Norse Prose (3) Intensive reading of Old Norse prose works. Icelandic saga as literary genre.

5730 Readings in Old Norse Poetry (3) Intensive reading of Eddic poems as a literary genre and re- pository of ancient Germanic customs, legends, and mythology.

6000 Doctoral Research and Dissertation (15-19) E

6100 Gothic (3) Phonology, morphology, and syntax of Gothic language. Relationship to Indo-European languages and other Germanic languages. Readings from Gothic Bible.

6120-30 Old High German (3, 3) 6120—Introduction: phonology, morphology, and syntax of Old High German of eighth and ninth centuries. Dialects, Representative prose readings. 6130—Literature and Linguistics; prose and poetry of period from linguistic and literary point of view. Development of language in Old High German period.

6140 Old Saxon (3) Phonology, morphology, and syntax of Old Saxon. Representative readings.

6210-20-30-40-50-60 Seminar in German Literature (3, 3, 3, 3, 3, 3) E

6310-30 Seminar in German and Germanic Philology (3, 3, 3) May be repeated. E

Russian

3010-30-30 Elements of Russian for Graduate Students and Seniors (3, 3, 3) For graduate students preparing for language examinations and seniors desiring reading knowledge of a second foreign language. Prereq: 2 years of some foreign language in college or consent of department. Undergraduate credit only. No credit for students having completed 1 yr of Elementary Russian.

3210 Nineteenth-century Russian Literature in En...
C. O. R. W. Haskins, Chicago; E. V. Chmielewski, P. H. History

MAJOR

See Classics

' Distinguished Service Professor. (Emeritus), Ph.D. Princeton; L. P. History

Greek

History

MAJOR

DEGREES

History

M.A., M.A.T., Ph.D.

Professors:

P. H. Bergeron, Ph.D. Vanderbilt;
E. V. Chmielewski, Ph.D. University of California (Berkeley);
R. E. Duncan, Ph.D. California (Berkeley);
H. S. Pink (Emeritus), Ph.D. Princeton;
L. P. Graf, Ph.D. Harvard;

Ph.D. Columbia; R. G. Landen, Ph.D. Princeton.

Associate Professors:

J. D. King, Ph.D. Indiana;
S. R. Blackman, Ph.D. Bryn Mawr;
J. R. Finger, Ph.D. Washington; C. W. Johnson, Ph.D.

Ph.D. Michigan; P. A. M. Vann, Ph.D. Harvard;
M. C. McDonald, Ph.D. Pennsylvania; J. H. Morrow,

Ph.D. Pennsylvania; J. M. O'Grady, Ph.D.

Yale; P. J. Naughton, Ph.D. Harvard;
E. H. Trainor, Ph.D. Emory; J. G. Utley,

Ph.D. Illinois; W. B. Wheeler, Ph.D. Virginia.

Assistant Professors:

S. D. Bedett, Ph.D. Case-Western Reserve;
J. Bonstedt, Ph.D. Harvard; N. L. Brann,

Ph.D. Stanford; R. B. Rice, Ph.D. Harvard.

THE 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 of which 3 hours must be 6300 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 5240-50-60, 5271-72-73, and Continuing and Higher Education 5110. Students must spend one year as a graduate assistant and one year as a teaching assistant. Total hours, including thesis—60. Students seeking the MACT degree may substitute 9 quarter hours of courses numbered 6300 or above for the Master's thesis.

THE DOCTORAL PROGRAM

1. Admission: (a) Acceptable scores on the Graduate Record Examination (General Aptitude and History Achievement).

(b) Students successfully completing the M.A. degree at The University of Tennessee must be recommended by the Department of History.

(c) Students from other institutions should have an M.A. degree and must be reviewed and approved by the Graduate Awards and Review Committee after their first year of study at The University of Tennessee.

2. Residence and Course Work: Beyond the Bachelor's degree a minimum of 75 credit hours in course work is required, of which not less than 45 must be 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 must possess a reading knowledge of one foreign language and such additional languages as may be determined by the student's committee. Under normal circumstances, those specializing in European history will need two languages. The committee may also specify other research tools, such as statistics, essential for the student's preparation. Upon student petition, may accept in place of a language a B or better performance in appropriate statistical courses and History 5290.

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 coursework. Upon consultation with the advisor, a student may elect to complete an appropriate 3010-20-30 sequence in a language department (or an intermediate sequence in a language in which no 3010-20-30 sequence is available). Satisfactory completion requires that a student must have at least a B in the final quarter.

4. Comprehensive Examination and Committee: Incoming students will be advised by the department head.

The comprehensive examination must be taken after all course work is completed, language requirements fulfilled, and at least nine months before the degree is expected. This exam should normally be taken before the beginning of the third quarter of work toward the doctorate. The candidate must present four fields, distributed as follows: one major field (history); two minor fields (history); and one minor field which may be either in history or outside the department. In any case, the student is required to have 9 hours of graduate work outside the History Department. Three of the four areas listed below must be represented by a major or a minor field, or both.

I. Ancient and Medieval

(1) Ancient Near East

(2) Greece

(3) Rome

(4) Early Middle Ages, 375-1122

(5) Late Middle Ages, 1095-1450

II. Early Modern

(1) Renaissance and Reformation

(2) Europe, 1559-1615

(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, 1789-present

(5) Eastern Europe, 1879-present

(6) Middle East, 1798-present

IV. National, Sectional and Topical

(1) England, 1485-1763

(2) Great Britain, 1765-present

(3) France, 1559-1815

(4) France, 1789-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 States

(11) Social and Cultural History of the United States

(12) The South

(13) Frontier and Westward Movement

(14) Afro-American

The comprehensive examination 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.

3060-70-80 History of Western Religious Thought
Students may not take examinations in both d. and e. nor may they take examinations in both f. and g. as their comprehensive examination subjects. Those students who choose four from this list must choose two from a. and d. and one each from e. and g. Students who choose only three from this list must choose one from a. to e.

A student selecting only three from the above list will also be required to pass a written examination in an applied mathematics (e.g., Fluids, Elasticity, Mathematical Ecology) approved as an examination topic for that student by the Graduate Committee and the Applied Mathematics Committee. For a given student and a given area, the Graduate Committee will appoint a section of faculty whose responsibility is to submit a list of topics and references to the Graduate Committee and the Applied Mathematics Committee for its approval.

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

1. The exams to be taken must be approved in advance by the student's supervisory committee.

2. A student may take a collection of written examinations a maximum of four times, but no one failing five exams, counting possible repetitions, will be permitted to take another round of exams.

3. The conditions for the doctoral degree are to include a demonstrated proficiency in one foreign language, normally from among French, German, or Russian; this requirement is to be met prior to the examination in the area of specialization. The student's doctoral committee may require that the student pass a second language exam.

In addition, the department requires that each student take a one year, 6000-level course in mathematics outside of his/her area of concentration. The use of the course selected to fulfill this requirement must be approved by the department head and either the student's supervisory committee or the student's Doctoral Committee. (Such approval may occur after completion of the course.)

The written exams mentioned in 1. are normally given twice each year, once in the fall and once in the spring. The fall exams usually are given before the fall quarter begins, and the spring exams are given during the spring quarter.

*3050 Elementary Probability and Statistical Analysis (3) Combinatorial problems; sample spaces, sets, and events; statistical independence; axioms, probability theory; random variables and their distributions; simple random processes. Does not satisfy requirements of major or minor in mathematics. Prereq: W, W, or equivalent. W, Sp

3060 Elementary Statistical Analysis (3) Elementary probability distributions used in statistics: binomial, Poisson, and normal and their properties; sampling distributions; tests of hypotheses; least squares and linear regression. Does not satisfy requirements of major or minor in mathematics. Prereq: 3050 or consent of instructor. Sp, Su

3090 Polynomials and Rings (3) An introduction to abstract algebra, beginning with study of integers followed by a notion of rings, integral domains, and fields. Emphasis is given to certain ring theoretic properties shared by integers and polynomials in one variable. Prereq or coreq: 3100 or consent of instructor.

3100 Logic and Sets (3) Elements of mathematical logic; elementary algebra of sets. Primarily for students in the College of Education. Does not satisfy requirements of major or minor in mathematics. Prereq: 1 yr college mathematics. Su

3110 Real Number System (3) Laws of arithmetic; rational and irrational numbers; fields. Prereq: 1 yr of college mathematics. Primarily for students in the College of Education. Does not satisfy requirements of major or minor in mathematics. Prereq: 3110 or equivalent.

3140 Mathematical Modeling (3) Survey of construction and development of mathematical models used in science and industry. Markov chains, linear optimization, differential and integral equations, understanding of model and associated scientific problem it approximates. Projects to include at least one from each list. Prereq: 3190.

3150 Introduction to Numerical Algorithms and Programming (3) (Same as Computer Science 3150.) E

3155 Introduction to Numerical Algorithms (3) (Same as Computer Science 1550.)

3220 History of Mathematics (3) Survey of development of various branches of mathematics, from ancient to modern times. Prereq: 1860 or 2550 or equivalent.

3310 Advanced Euclidean Geometry (3) Triangles and circles; constructions; modern concepts. Prereq: 1 yr of college mathematics.

3320 Non-Euclidean Geometry (3) Foundations of geometry. Elliptic and hyperbolic plane geometry. Prereq: 1 yr of college mathematics.

3330 Transformational Geometry (3) Fundamental transformations in Euclidean geometry. Classification of isometries and similarities; symmetry of a polygon. Prereq: 1 yr of college mathematics.

3510 Intermediate Analysis for Teachers (3) Primarily for students in secondary mathematics education covering elementary calculus from an advanced viewpoint with emphasis on proofs of basic theorems. Topics covered include limits of sequences and functions, continuous functions, derivatives, definite integral, and fundamental theorem of integral calculus. Does not satisfy requirements of major or minor in mathematics. Prereq: 1550-60 or 1860. Su

3550-60 Intermediate Analysis (3, 3) Infinite series, convergence, uniform convergence, Taylor series, Fourier series, Taylor series in several variables. Prereq: 1 yr college mathematics. W, Sp


3725 Advanced Discrete Structures (3) (Same as Computer Science 3725.)

3760-90 Introduction to Combinatorial Theory (3, 3) Introduction to problems of arrangement and selection in discrete mathematics. Enumeration by recurrence relations and generating functions, graph theory, finite geometries and finite fields, partitions, block designs. Prereq: 2860 or consent of instructor. F, W; or W, Sp

3810 How To Prove It (3) Course is designed to improve understanding of nature and methods of mathematical proof. Participation in seminar setting. Variable content but will include certain standard topics such as elementary set theory, relations and functions, and mathematical induction. Coreq: 2850 or 2560.

3861 Mathematical Models in the Life Sciences (3) Introduction to difference equations and differential equations, systems, Mathematical modeling techniques applied to biological phenomena. Does not satisfy requirements of major or minor in mathematics. Prereq: 1841-51 or consent of instructor.

3900-30 Topology of Euclidean Spaces (3, 3) Topology will include topology of line and plane, separation properties, compactness, connectedness, completeness and topological invariants. Must be taken in sequence. Prereq: 3810, 2868, or consent of instructor.

3990 Studies in Mathematics (1-4) Credit determined at registration. Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

4050-60 Matrix Algebra and Applications (3, 3) Vector spaces, linear transformations, eigenvalues and eigenvectors, similarity and unitary transformations, singular value decompositions, linear algebraic eigenvalue problems. Prereq: 2850.

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: 2860 or 4050.

4150-60 Abstract Algebra (3, 3) Equivalence relations and partitions, properties of integers, elementary theory of groups and rings, polynomial rings, integral domains, divisibility, unique factorization domains. fields. Must be taken in sequence. Prereq: 2860.

4225 Numerical Solution to Equations and Numerical Approximations (3) Numerical solution to equations and numerical approximations. Introduction to computation, introduction of a single nonlinear equation; introduction to iterative methods for linear and nonlinear systems. Polynomial equations, solving linear systems, numerical integration, approximation by polynomials, piecewise polynomials, trigonometric and other orthogonal polynomials. Prereq: 3150. (Same as Computer Science 4225.) F, W


4250-60 Introduction to Complex Analysis (3, 3) Complex numbers, Cauchy-Reimann equations, Cauchy's theorem. Taylor and Laurent series, residues and their applications, 4260—Conformal mapping, Schwarz-Christoffel transformations, Dirichlet problem, applications (steady temperatures, electrostatics, fluid flow), additional topics in complex analysis. (Same as Computer Science 4250.)
plex function theory. Must be taken in sequence. Preq: 2850; one 4000-level mathematics course recommended.


4540 Infinite Series and Functions of Several Variables (5) General theory, power series and Taylor's formula, uniform convergence. Partial differentiation and directional derivatives of several variables. LaGrange multipliers. Preq: 2980.

4550 Partial Differential Equations (3) Fourier series; orthogonal functions; the vibrating string; solution by series; heat flow. Bessel functions. Preq: 2850. Recommended: 4610 or 4710. E


4640 Calculus of Finite Differences (3) Real difference equations, application to problems in engineering and economics. Preq: 4610.

4650-60-70 Introduction to Mathematical Statistics (3, 3) 3 Introduction to probability; discrete and continuous distributions, correlation, regression, and statistical independence; foundations of sampling theory; significance tests. Must be taken in sequence. Preq: 2980. F, W, Sp.

4710 Vector Analysis (3) Fundamental operations, basis vectors, dot and cross products, directional derivatives, divergence and curl of vector fields, line and surface integrals, divergence theorem of Gauss, and Stokes' theorem. Does not satisfy requirements of major or minor in mathematics. Preq: 2860. E.


*4810 Elementary Number Theory (3) Divisibility; congruences; theorems of Fermat and Wilson, primitive roots; indices, quadratic reciprocity. Preq: 2850 or consent of instructor. F, Su.

4890 Readings in Mathematics (1-3) Open to superior students with consent of department head. Independent study with faculty guidance. May be repeated. Preq: Consent of instructor.

4900 Studies in Mathematics (1-4) Credit determined at registration. Preq: Recommendation of Mathematics Department faculty member and consent of department. May be repeated. Maximum 9 hrs.

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise recommended by the department. May not be used toward degree requirements. May be repeated. S, N only. E

**5011 Elementary Functions from an Advanced Standpoint for Teachers (3-4) Order and completeness of real numbers; limits of sequences, derivatives of functions; definitions and derivatives of exponential, logarithmic and trigonometric functions; infinite series; convergence; Taylor's and Maclaurin's series; applications; construction of logarithmic and trigonometric tables. Preq: 3510 or 4110 or consent of instructor.

**5012 Differential Geometry for Teachers (3-4) Advanced techniques applied to graphing functions. Curves, surfaces, parametrizations, singular points, tangent lines, osculating planes, arclength of curves in plane and curves on surfaces, curvature, torsion, asymptotes, local coordinates, Frenet formulas. Preq: 1 yr of calculus, or consent of instructor.

**5013 Geometry for Teachers (3-4) Primarily for high school teachers of geometry. Historical and modern presentations of topics encountered in a high school geometry class: axioms, synthetic and metric; models; betweeness; congruence of segments and triangles; parallel postulate; similarity; area; ruler and compass constructions; Klein's Erlanger Program. Preq: Consent of instructor.

**5014 Analysis for Teachers (3-4) Functions of several variables, directional derivatives and gradient, implicit function theorem, maxima and minima, transformations. Preq: 3510 or consent of instructor.

**5015 Probability and Statistical Inference for Teachers (3-4) Probability distributions including binomial, normal, Poisson, and exponential distributions including Chi-square, F, and t distributions; interval estimation of means and variances; simple hypothesis testing. Preq: 1 yr of calculus and 3505 or consent of instructor.

5050-60-70 Mathematical Logic (3, 3, 3) Truth functions; syntax and semantics of some propositional and predicate theories; Godel's completeness and incompleteness theorems; rules of natural deduction; algebraic logic; syntax and semantics of first order theories; elementary model theory; consistency, completeness, decidability.

5051 Introductory Business Mathematics (3) Graphing of simple equations, straight lines, circle, parabolas, functions, algebra of functions, limits, continuity, derivatives of algebra functions, applications to maxima and minima, convexity and concavity, implicit differentiation, chain rule, higher derivatives, and applications. Credit available only to satisfy MBA core requirement. Preq: Math 1550 or equivalent.

5052 Mathematics for Business Decisions (3) Exponential function, applications to growth and decay models, antilogarithms and natural logarithms, anti-logarithms, compound interest, annuities, present value and future value, amortization of mortgages, and basic concepts of sampling theory. Preq: Math 1550 or equivalent.

5053 Modern Mathematics for Business (3) Linear and matrix algebra, application to solution of simultaneous equations, Cramer's rule, and linear programming. Preq: Math 1550 or equivalent.


5310-20-30 Introduction to Higher Geometry (3, 3, 3) Projective spaces; coordinates and transformation; conics and quadrics; conformal mapping; generalized and invariant geometry from viewpoint of projective geometry. Preq: 4530; 4540 or consent of instructor.

5370-80-90 Mathematical Principles of Fluid Mechanics (3, 3, 3) Equations of motion for ideal, viscous, and nonideal fluids, boundary layer phenomena, additional special topics. Preq: 4530 or 4710 or consent of instructor. F, W, Sp.


5400 Calculus of Variations (3) Function spaces, variation of functional, strong and weak extrema, necessary conditions for extremum—Euler's equation, Lagrange multipliers. Preq: 4530 or 4710 or consent of instructor. F, W, Sp.

5430 Integral Equations (3) Solution of integral equations by methods of Fredholm, Volterra, and Hilbert. Preq: 4530 or 4710 or consent of instructor. A

5440 Calculus of Variations (3) Function spaces, variation of functional, strong and weak extrema, necessary conditions for extremum—Euler's equation, Lagrange multipliers. Preq: 4530 or 4710 or consent of instructor. F, W, Sp.

5450-60-70 Introduction to Partial Differential Equations (3, 3, 3) Linear second-order equations in two variables; properties of elliptic, hyperbolic and parabolic equations. Generalized notion of solution. Fourier series, fundamental solutions and Green's functions. Preq: one 4000-level mathematics course and one 3000-level mathematics course and permission of instructor.

5455 Finite Difference Methods for Partial Differential Equations (3) Finite difference techniques for solving parabolic, hyperbolic, and elliptic partial differential equations on rectangular and curved boundaries; solution of linear systems. Preq: 3150 or 3155, or one 4000-level mathematics course. (Same as Computer Science 5455.) F

5460 Finite Element Methods (3) Finite element techniques for solution of ordinary and partial differential equations. Variational principles, local bases, rates of convergence, and computer implementation. Preq: 3150 or 3155, or consent of instructor. (Same as Computer Science 5460.)

5475 Advanced Topics in Numerical Partial Differential Equations (3) 5 Advanced topics in numerical methods for eigenvalue problems, IV problems, BV problems with singularities. Other topics, such as special methods for other systems of equations. Prereq: 5430, etc. at discretion of instructor. Preq: 5455-65. (Same as Computer Science 5475.)


5510-20-30 Introduction to Higher Algebra (3, 3, 3)
5950 Theory of Rings (3) Direct and subdirect sums of modules. Involutive algebras.

5960 Combinatorial Algorithms (3) (Same as Computer Science 5775.) F, W, Sp

6000 Doctoral Research and Dissertation (3-15 E)


6450-60-70 Partial Differential Equations (3, 3, 3) Advanced topics in classical and modern theories of 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 branches of algebraic theory. Subject matter will vary according to interests and preparation of students. Prereq: 5510-20-30.

6540-50-60 Theory of Semigroups (3, 3) Congruences and homomorphisms; ideal theory; representations, decompositions, and extensions; free, regular, inverse, simple, and completely simple semigroups. Prereq: 5520.

6570 Theory of Groups (3) Structure of groups, free groups, nilpotence and solvability, extensions and products, permutation groups, abelian groups.

6610-20-30 Advanced Ordinary Differential Equations (3, 3, 3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature on methods and applications. Prereq or coreq: 5110-20-30 and 5210-20-30 or consent of instructor.


6810-20-30 Topological Algebra (3, 3, 3) Topics from topological semigroups, topological groups, Lie groups, transformation groups, topological lattices, relations in topological spaces, topological rings, fields, algebras. Prereq or coreq: 5910-20-30.

6910-20-30 Modern Topology (3, 3, 3) Technical background to current literature in topology. Topics vary from year to year.

6940-50-60 Introduction to Algebraic Topology (3, 3, 3) Homology, cohomology, and homotopy theories. Homology and cohomology groups; the Eilenberg-Steenrod axioms; singular, simplicial, and cup and cap products; duality theories, homotopy equivalence, higher homotopy groups, fiber spaces, spectral sequences. Prereq: 4180 and 5900.

5540 Galois Theory (3, 3) Fields and their extensions, separable and normal extensions, algebraic closure, groups of automorphisms, fundamental theorem, solution of equations by radicals. Prereq or coreq: 5520.

5550-70-80 Theory of Matrices in Numerical Analysis (3, 3, 3) Elementary matrix theory. Functions of matrices, inclusion and exclusion of roots of matrices; the field of values; minimax and maximin theorems for Hermitian matrices. Variational principles, Kantorovic inequalities. 5580—Computational methods for inverting matrices, direct and by successive approximation; methods of reduction to normal form; successive approximations to roots of matrices; measures of error. Prereq: Consent of instructor.

5980-60-70 Mathematical Systems Theory (3, 3, 3) Analytic and discrete and continuous dynamical systems, fundamentals of control theory, linear problems, linear perturbation theory, nonlinear analysis, bifurcation and stability aspects, applications to ecological systems, role of dynamical systems in ecological modeling, optimal control problems. Prereq: 5110, 4510 or consent of instructor. F, W, A

5990 Graduate Reading in Mathematics (1-3) Open to graduate students with consent of 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) May be taken for S/NC or letter grade.

NOTE: Registration for seminars may be repeated with consent of department.

6990 Graduate Reading in Mathematics (1-3) Open to graduate students with consent of department head. Independent study with faculty guidance. May be repeated. Maximum 9 hrs.
response to infection. Derangement of host-metabolism stimulated by microbial invasion, exotoxins, endotoxins and other factors related to virulence. Alteration of genetic and hormonal controls resulting from progressive infection. Prereq: 5730.

5750 The Oncogenic Viruses (3) Lectures and special laboratory exercises dealing with known tumor-inducing viruses. Prereq: 4430 or consent of instructor. Prereq: 2 and 1 lab.

5769 The Bacterial Viruses (3) Lectures and discussions dealing with bacterial viruses with emphasis on the biological and chemical consequences of bacteriophage infection. Text supplemented by readings from literature. Prereq: 4420; Biochemistry 4110-20.

5819 Molecular Genetics Laboratory (3) Principles and methods of research in molecular genetics. Fundamental genetics concepts (mutation, complementation, recombination) at molecular level. Lectures, laboratory exercises and discussions based on current literature. May be repeated with 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: 4140 and Biochemistry 4110-20.

5850 Seminar in History of Microbiology (1) Microbiologists and their achievements from Pasteur to present. S/NC only.

5910-20 Seminar in General Microbiology (1, 1, 1, 1) Reviews of current literature. May be repeated with consent of instructor. S/NC only.

6000 Doctoral Research and Dissertation (3-15) May be repeated.

6320 Seminar in Microbial Pathogenesis (1) Readings and discussions based on current literature. May be repeated. S/NC only.

6340 Seminar in Microbial Genetics (1) Readings and discussions based on current literature. May be repeated. S/NC only.

6350 Seminar in Virology (1) Readings and discussions based on current literature. May be repeated with consent of department. S/NC only.

6360 Seminar in Medical Microbiology (1) Readings and discussions based on current literature. May be repeated. Maximum 9 hrs. S/NC only.

6370 Current Topics in Environmental Microbiology (2) Reading, discussions, and critical evaluation of current literature. May be repeated. Maximum 8 hrs. S/NC only.

6410 Concepts of Immunity (3) Discussion and readings of recent advances in immunology and immunopathology.

6420 Current Topics in Biological Membrane Research (3) Literature surveys and laboratory methods for development and interpretation of microbiological research. May be repeated.

6470 Advanced Topics in Microbial Physiology (2) Prereq: 5720. May be repeated with consent of department.

6740 Advanced Topics in Virology (3) Prereq: 4420 or 4430. May be repeated with consent of department.

6760 Advanced Topics in Microbial Genetics (3) Prereq: 6340. May be repeated with consent of department.

8180-20-30 Problem Seminar (1, 1, 1) Research problems and methods, critical analysis of experimental data and validity of conclusions. May be repeated with consent of department. S/NC only.

5730 Pathogenesis of Infectious Disease (3) Host

College of Liberal Arts


5430 Medical Mycology (3) Disease-producing microorganisms including bacteria, rickettsia, and chlamydia. Prereq: 3200. W.

5439 Medical Mycology Laboratory (2) Laboratory exercises designed to accompany 4270. Prereq: 4320; Coreq: 4330. Sp.

5440 Molecular Virology (3) Molecular aspects of the replication, assembly and expression of viruses, with emphasis on bacteriophage. Prereq: 3700. F.

5430 Medical Virology (3) General virology with emphasis on medical aspects. Prereq: 3200. W.

5449 Medical Virology Laboratory (2) Laboratory procedures for isolation, handling and culturing of animal viruses. Prereq: 3519. Coreq: 4430. W.

5000 Thesis (1-15) May be repeated with consent of department. S/NC only.

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

5011-12-13-14-15-16 Mini-course in Microbiology (1, 1, 1, 1, 1, 1) Selected, advanced topics in microbiology, concentrated in time and subject matter. Consult departmental listing for topics offered. Prereq: as posted. May be repeated. Maximum 9 hrs. S/NC only.


5350 Advanced Microbiology for Secondary Educators (2) Survey of major bacterial populations encountered in natural habitats; laboratory exercises designed to accompany 4270. Prereq: 3519. Coreq: 4150 or consent of instructor. Prereq: 1 hr and 2 labs. Sp.

4370 Immunology (3) Principles of inflammation and immunity, immunoglobulin structure and function. Emphasis on methodology of isolation and identification. Prereq: 4270. F.

4279 Advanced Immunology Laboratory (2) Laboratory exercises designed to accompany 4270. Prereq: or coreq: 4270. F.

4320 Pathogenic Bacteriology (3) Disease-producing microorganisms including bacteria, rickettsia, and chlamydia. Prereq: 3200. W.


4330 Medical Mycology (3) Disease-causing fungi; correlation of pathology, effects in immune mechanisms, abnormalities of the immune system. Prereq: Biology 3120. (Same as Zoology 4270.) F.

5720 Microbial Physiology (3) Lectures and seminars dealing with current advances in bacterial physiology, growth and structure. Prereq: 4110; Biochemistry 4110-20.

4199 Experimental Microbial Ecology (3) Survey of techniques, theoretical foundations, factors, activities, and interactions in a variety of habitats. Prereq: 3519. Coreq: 4150 or consent of instructor. Prereq: 1 hr and 2 labs. Sp.

4110-20 or equivalent.

5730 Pathogenesis of Infectious Disease (3) Host

College of Liberal Arts
German School. 3271—1600-1800; 3281—1800 to present.

**3500 Flute (1-4)
**3505 Oboe (1-4)
**3510 Bassoon (1-4)
**3515 Clarinet (1-4)
**3520 Saxophone (1-4)
**3525 Horn (1-4)
**3530 Trumpet (1-4)
**3535 Trombone (1-4)
**3540 Baritone (1-4)
**3545 Tuba (1-4)
**3550 Percussion (1-4)
**3555 Voice (1-4)
**3560 Violin (1-4)
**3565 Viola (1-4)
**3570 Cello (1-4)
**3575 String Bass (1-4)
**3580 Flute (1-4)
**3585 Harpsichord (1-4)
**3590 Organ (1-4)
**3595 Guitar (1-4)
**3597 Composition with Electronic Media (1-3)

Prereq: Consent of instructor.

**3599 Composition (1-3) Prereq: Consent of instructor.

3950 Evolution of Jazz (3) Study of origin, development and style of jazz music and its expolents.

4003-04-05 The Organ and Its Literature (3, 3, 3) Development of organ and organ literature from Middle Ages to present; problems of style and interpretation; liturgical and historical periods. Prereq or coreq: 2310-20-30-40 and organ design. Prereq or coreq: 2310-20-30-40 and organ design.

4007-17-27 String Techniques (1, 1, 1) Problems of string playing, technique, and interpretation; programming and music building. Prereq: Consent of instructor.

4036-37-38 Advanced Piano Literature (2, 2, 2) Piano music for pre-college and graduate students to present. Prereq: Consent of instructor.

4041 Styles in Opera Acting (3) Study and practices of styles in opera acting based on historical and national characteristics. Prereq: 2035 or consent of instructor.

4045 Projects in Opera Theatre (1-3) Prereq: Consent of instructor. May be repeated.

4050 Advanced Instrumental Conducting (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and different styles to the conductor's art; musical analysis and practice in conducting. Prereq: Music Education 4430 or equivalent.

4055-56-57 Elementary and Intermediate Piano Pedagogy (3, 3, 3) Piano methods and materials designed for teaching pre-college level students. Prereq: Consent of instructor.

4060 Choral Techniques I (3) Techniques and methods in producing total choral program.

4074-84 Church Music Seminar (3, 3) History and philosophy of church music, liturgics and liturgical music; church music administration. Prereq: Consent of instructor.

4085 Harspichord Techniques (1) Techniques of practice, performance, and continuo playing, with a thorough keyboard background. Prereq: Consent of instructor. Maximum 3 hrs. May be repeated.

4111-21-31-41 Analysis of Music Literature (3, 3, 3, 3) Detailed examination of music compositions by historical period with emphasis on harmony, thematic material, form and structure. Traditional and contemporary analytical techniques. 4111—1600-1760. 4121—1750-1825. 4131—1825-1900. 4141—1900 to present. Prereq: 3123.

4112 Twentieth-Century Compositional Techniques (3) Styles and compositional devices from Debussy to present. Analysis of scores; idiomatic writing. Prereq: 2131 or equivalent.

4113 Pedagogy of Music Theory (3) Techniques, methods and materials involved in college-level theory programs. Prereq: Consent of instructor.

4114 Stage Band Arranging (3) Study of scores and scoring for the stage band. Prereq: 3312 or consent of instructor.

4115 Variation (3) Study and application of variation procedures. Prereq: 3312 or equivalent.

4116 Set Structure in Musical Composition (3) Theory of sets and its application to analysis of music. Prereq: Consent of instructor.

4117 Choral Arranging (3) Analysis of scores and writing of arrangements for men's, women's and mixed choruses. Prereq: 3312 or consent of instructor.

4124 Marching Band Arranging (3) Study and application of techniques employed in scoring for marching band. Prereq: 3312 or equivalent.

4134 Concert Band Arranging (3) Study and application of techniques employed in scoring for concert band. Prereq: 3312 or equivalent.

4190 Music in the Roman Period (3) Survey of music from Beethoven through post-Romantic instrumental and vocal styles.

4230 Contemporary Music: 1945 to Present (3) Survey of new and avant-garde music in Europe and America since World War II.

4241 American Music (3) American music from colonial times to present. Emphasis on both folk and cultivated traditions. Prereq: 2120-25 or equivalent.


4290 Gregorian Chant (3) Chants of Latin rite. Masses and Offertories examined as functional music as well as by type.

4310 History of Art Song (3) Survey of art song from fifteenth century to present.

4315 Wind Chamber Music (3) Study of wind chamber music from eighteenth through twentieth century. Emphasis placed on style interpretation, rehearsal techniques, programming and musical significance, both historical and theoretical.

4340-50 Works of Bach (3, 3) Detailed examination of sonatas, chamber, keyboard, and orchestral works; cantatas, motets, psalms and oratorios. 4340—instrumental works. 4350—vocal works.

4400 Jazz Directing (1) Rehearsal techniques for jazz ensembles: special conducting techniques, repertoire, library systems, programming, and supervised laboratory experience in rehearsing university jazz ensembles. Prereq: Enrollment in Applied Music with jazz emphasis or consent of instructor.

**4500 Flute (1-4)
**4505 Oboe (1-4)
**4510 Bassoon (1-4)
**4515 Clarinet (1-4)
**4520 Saxophone (1-4)
**4525 Horn (1-4)
**4540 Baritone (1-4)
**4535 Trombone (1-4)
**4530 Trumpet (1-4)

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Prereq: Consent of instructor.

• • 4595 Guitar (1-4)

• • 4590 Organ (1-4)

• • 4585 Harpsichord (1-4)

* 4580 Piano (1-4)

* 4575 Violon (1-4)

* 4570 Cello (1-4)

* 4575 String Baas (1-4)

* 4580 Piano (1-4)

* 4585 Harpischord (1-4)

* 4590 Organ (1-4)

* 4595 Guitar (1-4)

* 4597 Composition with Electronic Media (1-3)

Prereq: Consent of Instructor.

4840 Jazz Pedagogy (1) Methods and materials relating to teaching of jazz and administering of jazz program. Prereq: Enrollment in Applied Music with jazz emphasis or consent of instructor.

4850 Jazz Composition (3) Prereq: Music 4114 and consent of instructor.

4860 Advanced Improvisation (2) Emphasis on further development of individual skills and solving individual problems in jazz improvisation. Prereq: 3052-53.

5000 Thesis (1-15) E


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

* 5010 Organ Literature Seminar (3) Topics vary. Prereq: Organ literature.

5012-22-32 Pedagogy of Voice (2, 2, 2) 5012—Survey of voice production processes in singing including: voice classification, quality, diction registration, breath support, and control. 5022—Examination of teaching materials, preparation of programs for various vocal categories and levels of study. Observation of studio teachings. 5032—Analysis of the vocal problems of a selected group of students. Supervised teaching. Prereq: 4012-22-32 or consent of instructor.


* 5030 Choral Literature Seminar (3) Topics vary.

* 5040 Vocal Literature Seminar (3) Topics vary.

5050 Graduate Recital (3)

5061 Opera Performance (3)

5062 Vocal Chamber Music Performance (3)

5053 Choral Conducting Performance (3)

5054 Lecture-Recital (3)

5055-56 Practicum for Instrumental Conductors (1, 1) Intern experience in choral music and in an instrumental field other than the area of major interest. S/N only.

5057 Instrumental Conducting Seminar (3) Rehearsal and performance problems and techniques applied to score reading and preparation. Particular attention to individual problems. Prereq: 4050 or equivalent.

5060 Seminar in Choral Performance (3) Rehearsal and performance problems and techniques applied to score reading and preparation. Particular attention to individual problems. Prereq: 4050 or equivalent.

5061 Choral Conducting (3) Development of choral conducting skills.

5070 Opera Production (1-3) Prereq: Consent of instructor.

5080 Instrumental Conducting Performances (1) Jury performance; conducting band or orchestra in public.

* 5090 Special Topics in Performance (1-3) Prereq: Consent of department head.

* 5100 Independent Study in Music Theory (1) Prereq: Consent of instructor.

5111 Advanced Harmony (3) Analytic survey of harmonic trends in compositions from 1700 to present. Exercises employing and illustrating these techniques. Prereq: Consent of instructor.

5114 History of Music Theory (3) Work and contributions of theorists from ancient Greece to present. Prereq: Consent of instructor.

5116 Musical Styles (3) Elements of design and their role in the development of musical styles. Exercises in aural and visual identification. Prereq: Consent of instructor.

5121 Analytical Techniques (3) Analytical techniques with emphasis on contemporary approaches. Tonal and neotonal music. Prereq: Consent of instructor.

* 5125 Practicum in Computers and Music Research (3) Programming languages, design and implementation of projects in musical analysis, composition and indexing. Prereq: Consent of instructor.

5126 Musical Styles (3) Elements of design and their role in the development of musical styles. Exercises in aural and visual identification. Prereq: 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) Principles and techniques of research. Required of all candidates with concentrations in musicology or in music theory. Recommended for all music students who intend to enroll in a doctoral program.

5220 Music Bibliography (3) Bibliographic methods; illustrative projects in information retrieval and problem solving in music.

* 5270 Seminar in Musicology (3) Topics vary. Prereq: Consent of instructor.

5315 Band Literature (3) Band literature and origins of band emphasizing its important, expanded cultural and artistic activities.

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) From 1400 to 1600. Mass, motet, chansons, madrigal, and other vocal and instrumental forms and genre.

5353 Music in the Baroque Period (3) From 1600 to 1750; rise of opera and oratorio, church and secular cantata, instrumental forms, performance practice.

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.

5400 Musical Aesthetics (3) Nature of music and musical experience, sense perception and emotions, value in music, and role of artist in society. Aesthetic viewpoint of individuals and historical eras through selected writings.

* 5500 Flute (1-4)

* 5505 Oboe (1-4)

* 5510 Bassoon (1-4)

* 5515 Clarinet (1-4)

* 5520 Saxophone (1-4)

* 5525 Horn (1-4)

* 5530 Trumpet (1-4)

* 5535 Trombone (1-4)

* 5540 Baritone (1-4)

* 5545 Tuba (1-4)

* 5550 Percussion (1-4)

* 5555 Voice (1-4)

* 5560 Violin (1-4)

* 5565 Viola (1-4)

* 5570 Cello (1-4)

* 5575 String Bass (1-4)

* 5580 Piano (1-4)

* 5585 Harpsichord (1-4)

* 5590 Organ (1-4)

* 5595 Guitar (1-4)

* 5597 Composition with Electronic Media (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

* 5599 Composition (1-3) Prereq: Consent of instructor.

* 5600 Small Ensemble (1)

* 5602 Brass Choir (1)

* 5604 Jazz Ensemble (1)

* 5606 Trombone Choir (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)

* 5655 Laboratory Band (1)

* 5657 Marching Band (1)

* 5670 Symphony Orchestra (1)

* 5680 Concert Choir (1)

* 5682 University Chorus (1)

* 5684 Campus Chorus (1)

* 5685 Men's Glee Club (1)

* 5687 Women's Chorale (1)

* 5699 Accompanying (1)

* May be repeated.

** May be repeated. Maximum 6 hrs.

Philosophy

MAJOR

Philosophy

DEGREES

M.A., Ph.D.
The Master's Program

See general requirements on page 19. Courses below 4000 may not be taken for graduate credit by philosophy majors except with special permission.

The Doctoral Program

Specific requirements for doctoral students in philosophy include a minimum of three academic years of graduate study involving at least 72 quarter hours credit in course work (normally 24 quarter courses or the equivalent). The average semester (4 credit hours) of the thesis and dissertation) of which not less than 45 shall be in courses numbered over 5000, and of which at least 9 shall be in a subject other than philosophy. The specific number and distribution of courses will be determined by the student's faculty committee.

Two foreign languages, normally French and German, are required. As an alternative to the two-language requirement, candidates for the Ph.D. may elect to demonstrate a substantially more advanced proficiency in one of the theoretical foundations of feminism and anti-feminism.

Social Ethics (4) Ethical theory related to politics, economics, law, religion and the family. F

Existentialism (4) E

Phenomenology (4) Prereq: 8 hrs philosophy or consent of instructor. A

4100 Kant (4) Prereq: 8 hrs philosophy or consent of instructor. A

Continental Rationalism (4) Prereq: 8 hrs philosophy or consent of instructor. A

4410 Plato (4) Prereq: 8 hrs philosophy or consent of instructor. A

4420 Aristotle (4) Prereq: 8 hrs philosophy or consent of instructor. A

4430 Philosophy of Language (4) Prereq: 8 hrs philosophy or consent of instructor. A

4610 Philosophical Ideas in Literature (4) Prereq: 8 hrs philosophy or consent of instructor. A

4620 Philosophy of Mind (4) Prereq: 8 hrs philosophy or consent of instructor. A

4630 Philosophy of Language (4) Prereq: 8 hrs philosophy or consent of instructor. A

4720 Philosophy of Natural Science (4) Examination of methods of inquiry and modes of explanation in social sciences. Prereq: 3770 or 2 yrs social science.

5080 Symbolic Logic (4) Nature of logic; epistemological, metaphysical and axiomatic assumptions and implications in various theories of logic. Prereq: 4510 or equivalent.

5090 Symbolic Logic (4) May be repeated.

5101 Foreign Study (1-12) See page 99.

5102 Off-campus Study (1-12) See page 99.

5103 Independent Study (1-12) See page 99.

5110-20-30-40-50-60 Studies in the History of American Philosophy (4, 4, 4, 4, 4, 4) Intensive critical work on major philosophers. W; Sp

5120-Hellenistic or Medieval. 5130-Modern, beginning of the theoretical foundations of feminism and anti-feminism. F, W

5131 Seventeenth- and Eighteenth-century Philosophy (4) F, Sp

5151 Contemporary Philosophy (4) F, Sp

5250 Studies in the History of American Philosophy (4) Intensive, critical work on major philosopher or school.


5355 Orientation to Medical Ethics (4) Survey of ethical theories in application to issues in medical ethics. (Same as Religious Studies in 5355.) F

5365 Applied Ethical Theory (4) Single author, tradi- tion, or topic in ethical theory with special attention to application to issues in health, business, technology, ecology, and other practical fields. (Same as Religious Studies in 5365.) F

5370 Topics in Medical Ethics (4) Prereq: 4370-71 or consent of Medical Ethics Committee.

5375 Clinical Practicum Orientation (4) Medical terminology, history of medical ethics; preparation for UT Center for the Health Science Clinical Practicum. Sp

5410 Philosophy of History (4) Theories of history and historical processes.

5420 Philosophy and Literature (4) Mutual influence of philosophy and literature, possibility of a philosophy of literature, philosophy of criticism.

5430 The Problem of the Self (4) Current studies in sociology, social psychology, and philosophy to amand elucidate traditional philosophical treatments of problem of self.

5460 Philosophy of Mind (4) Relation of mental to physical and role of words in discourse for mental activities such as thinking and feeling.

5510-20 Studies in Epistemology (4, 4) 5510—Modern rationalism; Descartes, Spinoza, Leibniz. 5520—Modern empiricism; Locke, Berkeley, Hume.

5550-60 Philosophy of Science (4, 4) Nature of subject matter and method of sciences. 5560—Natural sciences. 5560—Social Sciences.
A student who enrolls in the Graduate School with the intention of attaining an advanced degree in Physics shall, in general, have completed an undergraduate major in physics or its equivalent. Physics 3210-20, 3710-20-30, 4110-20-30, 4210-20, 4230 or 4240 constitute the minimum course prerequisite to graduate study.

A student who intends to present Physics as a graduate minor shall, in general, have completed an undergraduate minor in Physics or its equivalent. Physics 3210-20, 4210-20 constitute the minimum course work prerequisite to graduate study.

Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy are offered in a number of specialized fields including chemical physics, elementary particle physics, atomic and low temperature physics, health physics, molecular spectroscopy, nuclear physics, plasma physics, solid state physics, theoretical physics, ultrasonics, heavy ion atomic physics, biophysics, and liquid state physics.

Departmental graduate programs providing special opportunities for academic research in areas pertinent to atmospheric and space flight are available at the Space Institute, Tullahoma.

All first-year graduate students are required to take a qualifying examination in undergraduate physics during the fall quarter registration period.

THE MASTER'S PROGRAM

The Physics Department has two Master's degree programs, one in Physics and one in Astronomy.

The thesis program is primarily designed for students intending to go into industrial or governmental laboratories as physicists. The course requirements include 36 quarter hours in such courses as Physics 4510-20-30, 4610-20-30, 5110-20-30, 5210-20-30, 5310-20-30, 5610-20-30 and appropriate courses in related fields. Each candidate must present an acceptable thesis, equivalent to 9 hours of credit, and pass an oral examination on course material and thesis.

The non-thesis program is primarily designed for students intending to teach in colleges or universities on the elementary or intermediate level, or for students specifically intending to work toward a Ph.D. Students seeking an M.S. in Physics by this method must apply to the department's graduate committee for permission to enroll under this program. The requirements for the M.S., under this method, are the satisfactory completion of 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); 9 hours in a minor field (e.g., mathematics); and 9 hours from other courses in physics numbered above 4000 (preferably of advanced laboratory nature). In addition, the candidate must pass a comprehensive examination administered by the committee.

The Physics Department is also participating in the program which leads to the Master of Arts in College Teaching degree. In addition to the requirements for either of the Master's programs described above, the MACT degree in Physics requires 15 more hours of credit, making a total of 60 quarter hours. Nine of these hours are specified as follows: 3 hours in a seminar course dealing with general problems of college teaching; 3 hours in a seminar course dealing with special problems in the teaching of physics; and 3 hours in a course dealing with the history and philosophy of physics. The other 6 hours of selected course work may be elected from any of the physics courses numbered above 5000. During the two-year program leading to the MACT degree, the candidate will be continually engaged in supervised teaching activities.

THE DOCTORAL PROGRAM

All students are expected to take 5210-20-30, 5310-20-30, 5410-20-30, 5510-20-30, 5610-20-30 and 6310. 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 Physics 6810-20 of students specializing in molecular spectra. (The Master's degree is not required.)

A reading knowledge of one foreign language is essential. The student may substitute German or French 3300 with a grade of A or B may be substituted for the corresponding language examination.

The thesis topic will be chosen with reference to one of the fields in which research facilities are available at the Oak Ridge National Laboratory, Oak Ridge, Tennessee.

A program leading to the Ph.D. in chemical physics is conducted jointly with the Chemistry Department, which offers a similar degree. Physics departmental requirements for the degree in chemical physics include the successful completion of Physics 4510, 4610-20-30, 5210-20-30, 5310-20-30, 5410-20-30, 5510-20-30, 5610-20-30, 6110-20-30, and either 6310 or 5720; Chemistry 4160-70, 5430, and any two courses from 5340-50, 6730 or 6810-20.

Astronomy


Physics


3230 Heat and Thermodynamics (3) Concepts of temperature and heat; laws of thermodynamics; applications of laws to simple physical and chemical problems. Prereq: 2320 or 2330 and calculus, 2320-20 or consent of instructor. Sp, Su.


3510-20-30 Physical Measurements (3, 3, 3) Laboratory measurement of some physical quantities. Theory supplied where necessary. Prereq: 2310-
to the function of various parameters. Prereq: 3610-30.

3710-30-30 Vibration and Dynamics (3, 3) 3710—Special vibration and early quantum theory. 3720—Atomic and molecular physics. 3730—Nuclear physics. Prereq: Mathematics 2600 and Physics 2320 for 3710; 2338 or 3710 for 3720.

4000 Foundations of Physics (3) Selected topics from history and philosophy of classical and modern physics. Prereq: 1 yr general physics and consent of instructor. Required of MACT candidates. Sp

4110-30-30 Introduction to Quantum Mechanics (3, 3) Introduction to fundamental principles of quantum mechanics and methods of calculation. Applications to atomic and molecular physics. Prereq: 2330 or equivalent. Mathematics 4550, F, W, or Sp, or W.

4140 Elementary Nuclear Physics (3) General properties of atomic nuclei; nuclear fission, nuclear forces, nuclear models, nuclear reactions, beta-decay, nuclear spin and magnetic moment. Prereq: 4110-30 or 4120. Sp

4160 Physical Acoustics (4) Considerations fundamental to detailed investigation of the propagation of sound. Methods of solution; geometrical acoustics; propagation of acoustic waves in the infrasound and the ultrasonic frequency ranges of frequencies. Prereq: 2320-30, 2330. 3 hrs and 1 lab. Sp

4210-30 Electricity and Magnetism (3, 3, 3) Intermediate level electrostatics; steady and alternating currents; laws of electromagnetism; Maxwell's equations; radiation of electromagnetic waves; refraction and reflection; electromagnetic fields of moving charges. Must be taken in sequence. Prereq: 2320 or 2220 and Mathematics 2830, F, W, or Sp.

4220-40 Modern Optics (4, 4) 4230—Geometrical Optics: Reflection and transmission of light at a dielectric interface; paraxial theory of interfaces, lenses, and mirrors; thick lenses, lens systems, ray tracing; polarization; imagery; laser light. 4240—Physical Optics: Mathematics of wave motion, superposition of waves; interference; Fraunhofer and Fresnel diffraction; Fourier optics. Prereq: 4210 or consent of instructor. 3 hrs and 3 hrs lab. W

4510-30-30 Atomic Physics Laboratory (3, 3, 3) Experiments in: fundamental particle properties, photoelectricity, conduction of electricity through gases, atomic and molecular spectroscopy, x-ray. Prereq: Mathematics 2860 and Physics 2320 for 3710; 2338 or 3710 for 3720. 3 labs.

4540-50 Experimental Nuclear and Radiation Physics (4, 4) Interaction of charged particles and electromagnetic radiation with matter; theory and characteristics of various detectors; statistics of counting, nuclear properties. Experiments illustrate recent techniques for investigating the nucleus and nuclear radiation. Prereq: 2350. 1 hr and 6 hrs lab. F, Su

4580 Principles of Nondestructive Testing (3) Detection and characterization of discontinuities in materials by nondestructive physical measurements. Ultrasonic, electromagnetic, holographic and penetrating radiation techniques are discussed. Prereq: 4110-30 or consent of instructor. (Same as Engineering Science 4580.) W


4710-30 Introduction to Health Physics (3, 3, 3) Radioactivity, interaction of electromagnetic radia- tion with matter, radiation quantities and units, point kernel and extended sources, x-rays and gamma rays, neutron activation, interaction of charged particles with matter, energy absorption, energy deposition, excitation, excitation energy transfer and charge transfer in such field as organic molecular reactivity and organo- molybdenum action. Prereq: 5210-20 or consent of instructor. Sp

5000 Thesis (1-15) E

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

5080 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose research area coincides with interests of student. Open to all graduate students in good standing. Prereq: Consent of department and research director. May be repeated with consent of department. S/NC only. E


5210-30 Advanced Modern Physics (3, 3) Basic principles of wave mechanics; one-electron atom; vector model; atomic and molecular spectroscopy; properties of the electron; properties of the nucleus (spin, magnetic moments, etc.); scattering phenomena; nuclear models and forces; high energy phenomena. Prereq or coreq: 4110-30 or 4140. Differential equations. Must be taken in sequence. F, W.


5720 Physics of Polyatomic Molecules (3) Introduction to electronic structure of molecules and physi- cal processes of luminescence of these molecules; theoretical and experimental aspects of inter- molecular and intramolecular electronic excitation energy transfer and charge transfer in such field as organic molecular reactivity and organo- molybdenum action. Prereq: 5210-20 or consent of instructor. Sp

5910-30 Special Problems (3, 3) Specially assigned theoretical or experimental work on problems not covered in other courses. E

5990 Seminars (1-3) A. Mechanics; B. Radiation; C. Heat and Thermodynamics; D. Electricity and Magnetism; E. Modern Physics. May be repeated with consent of instructor. Maximum 27 hrs. E

6000 Doctoral Research and Dissertation (3-15) E

6110-30 Quantum Mechanics (3, 3, 3) Fundamental principles of quantum mechanics and principal approximation methods. Applications to atomic, molecular, and nuclear physics. Dirac equation, quantum electrodynamics. Prereq: 4130 or 5210; 5310-20-30 or 5410-20-30. Whichever of latter sets of prerequisites is met, the prerequisite is considered corequisite. F, W, Sp.

6210-30 Nuclear Structure (3, 3) General properties of nucleus: two body scattering problems; single and double scattering; properties of nuclear forces; theory of light nuclei; nuclear spectroscopy; special nuclear models; theory of nuclear reactions; the nuclear force. Prereq: 5210-30. F, W, Sp.

6310 Electromagnetic Theory of Light (3) Classical electric theory including theories of the 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 media including reflection, refraction and polarization and also theory of diffraction. Prereq: 5410-20-30. Su

6320 Special Relativity (3) Lorentz transformation; Einstein postulates; relativistic tensors; relativistic electrodynamics. Prereq: 5310-20-30, 5410-20-30, 6310. F

6330 General Relativity (3) Tensor calculus; general theory of relativity; gravitational field equations. Prereq: 5220. W


6430 Advanced Topics in Quantum Theory (3) To meet special needs of students. Possible topics: angular-momentum theory, beta-ray theory, theory of atomic spectra, molecular structure and valence theory, theory of radiation, electric and magnetic susceptibilities, high energy processes, scattering and collision processes, theory of fields. Prereq: 6110-20-30. May be repeated with consent of department.

6500-10 Electrical Conduction in Gases and Plasma Physics (3, 3) Electrical conduction in gases at high and low pressures. Characteristics of spark arc and glow discharge. Collective phenomena in a plasma; plasma oscillation; magnetohydrodynamics. Prerequisite. Physics 3710-20-30 and either 5410-30-30 or Electrical Engineering 5310-20-30. (Same as Electrical Engineering 6500-10.) F

6610 Interaction of Radiation with Gases (3) Interactions of elementary, ionized, or neutral atoms and molecules, oscillator-strength, interaction of charged particles with atoms and molecules; ioniza- tion, excitation, ionization, dissociation, and re- combination, transport and capture; electron swarm and electron beam experiments. Prereq or coreq: 6110-20-30. F
THE MASTER'S PROGRAM

See general requirements on page 19. MASTER'S IN PUBLIC ADMINISTRATION

Specific requirements for graduation include:

1. The completion of 54 quarter hours of approved graduate courses.
2. At least fifty percent of the credit hours must be in approved courses numbered 5000 and above.
3. Demonstration of command of the material covered in course work through a written comprehensive examination which may be followed by an oral examination.

The 54 quarter hours of graduate courses comprise 30 quarter hours of core courses which focus upon general perspectives, analytical skills, and management skills, a recommended internship arranged with a cooperating public agency (6 quarter hours), and 15 quarter hours in an elective specialized track developed by the student with the approval of the coordinator of the M.P.A. program. The specialized track will often contain a mix of courses from political science and one or more outside fields; examples include general government, public health administration, fiscal administration, social services administration, knowledge of criminal justice, urban administration, and environmental and natural resources administration.

Inquiries concerning all programs should be directed to the Department of Political Science, Knoxville, Tennessee 37916.

THE DOCTORAL PROGRAM

Specific requirements for the degree of Doctor of Philosophy in Political Science include:

1. A minimum of 117 quarter hours, following the Bachelor's degree, is required. At least 72 hours shall be in political science. At least 72 hours in political science shall be graduate level hours (i.e. earned in 5000- or 6000-level courses). At least 45 of these graduate level hours shall be at the 6000 level. This figure includes 36 hours of credit for the dissertation.
2. Each Ph.D. candidate must pass an examination in one foreign language. Students specializing in some areas may be required to demonstrate knowledge of a second language or appropriate research tools or both.
3. Admission to candidacy shall be based on a written and oral comprehensive examination which must be passed not later than three quarters before the date on which the degree is granted.
4. The candidate must pass a final oral examination on the doctoral dissertation.
5. Successful completion of the degree also depends on course performance and other evidence of professional interest and conduct.

3545 United States Constitutional Law: Sources of Power and Restraint (4) Analysis of judicial review, constitutional powers of President and Congress, federalism, sources of regulatory authority, and constitutional and statutory rights. Recommended prereq: 2510-20. F.


3555 Minority Group Politics in the United States (4) Content varies from quarter to quarter. May be repeated with consent of department. Maximum 8 hrs. W

3565 Introduction to Public Administrative Organization and Management (4) Organization and decision-making theory, line and staff services, policies of organization, leadership, personnel and fiscal management, administrative responsibility. Recommended prereq: 2510-20. F, W, Sp

3566 Public Administration and the Policymaking Process (4) Public bureaucracy and the policymaking process, their political environments, administrative problems associated with policy making, and interactions. F, W, Sp

3605 Political Change in Developing Areas (4) Characteristics and problems of political changes with primary focus on developing areas. F, Sp

3615-16 Dynamics of Black African Politics (4, 4) F, W

3621 Contemporary China and Japan (4)

3622 Contemporary South and Southeast Asian States (4) Analysis of selected states, with emphasis on problems of development.

3625-26 Latin American Government and Politics (4, 4) F, W

3631-32 Government and Politics of the Soviet Union (4, 4) F, W

3635-36 Politics in Western Democracies (4, 4) Political culture, patterns, and institutions of Western democratic systems. F, Sp, A.

3641 Government and Politics of Middle East and North Africa (4)

3710 State Politics (4) Focus on formal and informal setting of state government; governors, courts, legislatures, and state administrators. Attention will be paid to state government's role in formulating, enacting, and implementing state policy. F

3720 State Government and Policy Making (4) Nature and functions of the institutions of state government; governors, courts, legislatures, and state administrators. Attention will be paid to state government's role in formulating, enacting, and implementing state policy. W

3750 The Urban Polity (4) Analysis of political institutions and processes in metropolitan areas. Sp

3760 Urban Policy Process (4) Analysis of urban problems and policies in metropolitan areas. Sp

3796 Contemporary Problems of Soviet Foreign Policy (4) Sp

3801 Studies in Ancient Political Thought (4) Classical Greek and Roman political thought. F

3802 Studies in Medieval Political Thought (4) From Augustine to Luther: the problems and theories of religion and politics. W or Sp

3803 Studies in Early Modern Political Thought (4) Machiavelli through the Enlightenment. W

3804 Studies in Nineteenth- and Twentieth-century Political Thought (4) Political theories of industrial and technological societies; nineteenth and twentieth century. Sp

3880 American Political Thought (4) Examination of role of selected political ideas, doctrines, and themes in America, emphasizing their development and relationships to diverse political interests. F

4060 Revolution (4) Characteristics, theories, and consequences of revolution, with particular focus on left-wing revolutions and movements. Sp

4110 Law and the Administrative Process (4) Powers of, procedures of, controls over administrators. Sp

4535-36 Political Attitudes, Opinions and Communication (4, 4) Nature, development, formation and distribution of politically relevant attitudes and opinions; role of leadership, persuasion, and communication in opinion-policy process. F, W


4545-46 The Judicial Process (4, 4) Study of courts as components of political systems, and pub-
ic policy formulation through judicial decision making. Recommended for majors: 2510-20, Sp; W.


4575 Special Topics in United States Government and Politics (4) May be repeated with consent of department. Maximum 8 hrs.

4610 Budgetary Process (4) Fiscal planning, budget and expenditure processes in government, their policy and administrative implications. W or Sp.

4620 Public Personnel Administration (3) Development of the merit system in government, career systems, public personnel management functions, organization for personnel management. F or W.

4665-66 Policy Making in Democracies (4, 4) Comparative approach to theory and process of making public policies. F or Sp; W.

4675 Special Topics in Comparative Government and Politics (4) May be repeated with consent of department. Maximum 8 hrs.


4711 International Law (4)

4727 Politics of Inter-American Relations (4) Analysis of selected theoretical and policy issues concerning Latin American countries. Emphasis on American with emphasis upon imperialism, intervention, and the Cuban Revolution, nationalism, foreign assistance, trade and economic integration. Sp, Ar.

4740 Political Parties and Elections (4) Analysis of party systems and electoral process. F, W.

4750 Political Campaigns (4) All aspects of campaign process. F, W.

4815 Contemporary Soviet Marxism-Leninism (4) Soviet applications of Marxist-Leninist theory.

4875 Special Topics in Political Thought (4) May be repeated with consent of department. Maximum 8 hrs.


4975 Prospective in Political Science (4) Selected research for seniors; primarily for majors. May be repeated with consent of department. Maximum 8 hrs.

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required, for the non-thesis student not otherwise registered in a course. A grade of S/NC may be used toward degree or S/NC. May be repeated. S/NC only. E

5101 Foreign Study (1-12) See page 99. E

5102 Off-campus Study (1-12) See page 99. E

5103 Independent Study (1-12) See page 99. E

5110-20 Seminar in Political Theory (3, 3) Selected topics dealing with political problems of less developed countries. F or Sp.


5340-50 Seminar in Latin American Government (3, 3) W

5410-20 Seminar in Public Law (3, 3) Special problems in constitutional and administrative laws. F.

5440-50 Theory and Analysis of U.S. Foreign Policy Processes (4, 4) Theoretical approaches to decision making in foreign policy area and analysis of policy-making process. W.

5510-20 Seminar in International Organization (3, 3) 5510—Introduction to international organizations; political integration at international level. 5520—Special topics. W.

5540 Seminar in Comparative Public Administration (3) Approaches to and methods used in comparative analysis.

5550 Seminar in Administration in Developing Countries (3) W

5600 Public Administration (3) Public administration theory and functions, approaches to public management, contemporary problems in public administration.

5605 Research and Methodology in Public Administration (3) Basic assumptions and techniques of research in public administration; measurement, analysis, and reporting of data. W.

5610-20 Seminar in Organization Theory (3, 3) Appraisal of major theories of organization and their applicability to public sector. F.

5611-21 Seminar in State and Local Administration (3, 3, 3) F

5630 Seminar in Technology and Public Policy (3) Technological change and policy process, government interactions with scientific community, political characteristics of scientific enterprise.

5635-45 Operations Research for Public Administrators (3, 3) Operational research methodology; applications and limitations in public sector; linear programming, transportation and assignment problems, network analysis, PERT, dynamic programming and other methods.

5640-50-60 Seminar in Metropolitan Areas (3, 3, 3) F

5641 Seminar in Contemporary Public Policies (3) Problems in one or more public policy areas from a policy analysis and comparative perspectives. Topic selected by instructor.

5670-80 Seminar in Policy Analysis (3, 3) Role of administrators in policy analysis and decision making with special attention to historical and current issues. Sp.

5710 Seminar in the Politics of Administration (3) Examination of public administration in context of American political system with emphasis upon policy making and political roles of public administrators and agencies. W.

5730 Seminar in Public Budgeting and Fiscal Management (3) Budgetary process, fiscal management, and finance in American government. Sp.

5740 Seminar in Organizational Analysis (3) Organization theory applications in public management; field analysis of public organizations.

5750-55 Seminar in Public Management (3, 3) Selected problems. F, W.

5765-75 Law and the Administrative Process (3, 3) Constitutional position; decisional processes, regulation and management; limitations on governmental action; questions of structure, role, and administrative choice. W.

5770 Practicum in Public Administration (3) Sp.

5785-95 Seminar in Staff Functions (3, 3) Functions of administrative staff personnel serving policy executives, public administrators, legislative bodies, and advisory and community groups in public sector.

5790 Seminar in Public Personnel Management (3) Functions and organization of personnel administration in public service. Sp.

5810 The American Political Process (4) Principal patterns of political behavior linking citizens and political institutions. Sp.


5831-32 The Systematic Study of Politics (3, 3) Scope, methods and procedures of analysis in political science. W.

5840 Ethics, Values, and Morality in Public Administration (3) Moral-ethical value-dilemmas confronting administrators in American political system.

5850 Seminar in Comparative State Politics (3) In-depth readings in comparative state politics focusing on environment of state politics, institutions and policy making.

5910-20 Quantitative Political Analysis (3, 3) Methods and techniques in quantitative political analysis. F, W.

5930 Topics in Quantitative Political Analysis (3) Selected topics in quantitative methods.

6000 Doctoral Research and Dissertation. (3-15) E

6210 Advanced Studies in International Politics (3)

6310 Advanced Studies in Political Theory (4) Repeated into selected topics.

6410 Advanced Studies in International Organizations (3) Research in selected topics.

6440 Advanced Studies in Comparative Politics (3) Research into selected topics. Sp.

6510-20 Advanced Studies in American Constitutional Law (3, 3) Systematic investigation of federal relationships, civil liberties, courts in political settings, judicial institutions, personnel, and public policy content.


6710 Directed Research in Political Science (3) May be repeated with consent of instructor and student's advisor. Maximum 9 hrs. May be taken for letter grade or S/NC.

6810-20 Advanced Studies in the Political Process (3, 3) Open to advanced graduate students upon approval of instructor. F, W.

Psychology

MAJOR DEGREES

Psychology

Professors:

W. H. Calhoun (Head), Ph.D., Ph.D., California (Berkeley); G. M. Burghardt, Ph.D., Ph.D., Chicago; J. F. Byrne,* Ph.D., Ph.D., Harvard; R. C. Cooper,* Ph.D., M.S., Kansas; J. F. Lubar, Ph.D., Ph.D., Syracuse; S. J. Handel, Ph.D., Ph.D., Johns Hopkins; L. Handler, Ph.D., Michigan State; R. P. Lorrain,* Ph.D., Ph.D., Michigan; J. M. Barlow,* Ph.D., Yale; W. G. Morgan, Ph.D., Duke; H. J. Fine, Ph.D., Ph.D., Stanford; D. Lounsbury, Ph.D., Tennessee; J. W. Lounsbury, Ph.D., Ph.D., Yale; N. L. Rasch,* Ph.D., Michigan; F. Samejima, Ph.D., Keio (Japan); R. S. Bok, Ph.D., Pennsylvania; S. Samajdari, Ph.D., Keio (Japan); R. R. Shrader, Ph.D., Tennessee; W. S. Verplanck, Ph.D., Brown; R. G. Watson, Ph.D., Washington; J. A. Wiberley, Ph.D., Syracuse.

Associate Professors:

J. M. Barlow,* Ph.D., Ph.D., Tennessee; E. A. Eliot, M.S.W., Ph.D., Tennessee; D. S. Freeman, Ph.D., Tennessee; H. R. Friedman,* Ph.D., M. G. Johnson, Ph.D., Johns Hopkins; J. Kandilakis,* Ph.D., Tennessee; J. E. Lawler, Ph.D., North Carolina; J. W. Loubs, Ph.D., Michigan State; A. McIntyre, Ph.D., Yale; J. C. Malone, Ph.D., Duke; G. Morgan; Ph.D., Michigan; M. J. O'Connell, Ph.D., Tennessee; R. S. Sandargas, Ph.D., Florida State; D. E. Sutphin, Ph.D., Utah; C. B. Travis, Ph.D., California (Davis).

*Part-time.

**Alumni Distinguished Professor.
and psychological correlates of behavior. Prereq: 1 yr of biology or zoology and 2520. W

4719 Physiological Psychology Laboratory (4) Laboratory studies of nervous system and physiolog- 
cal correlates of behavior. Coreq: 4710. W

4720 Comparative Animal Behavior (4) Methods and 
principles. (Same as Zoology 4720.) F

4729 Comparative Animal Behavior Laboratory (4) 
Laboratory and field studies. Coreq: 4720. (Same as Zoology 4729.) F

4750 Evolution and Ontology of Social Behavior (4) 
Genetic, evolutionary, ecological, and develop-
mental processes as they apply to social organiza-
tion and dynamics of vertebrates. Prereq. Consent of 
instructor.

4830 History and Systems of Psychology (4) 
Pre-
req: 9 hrs of upper division psychology.

4850 Learning Theories (4) Historical and theoreti-
cal development of learning models. Prereq: 3210.

4860 Programmed Learning (3) (Same as Cur-
riculum and Instruction 4860.)

4870 Contemporary Research in Behavior of 
Women (4) Study of interaction of cultural and biologi-
cal factors in determining the behavior of women, with 
emphasis on psychological mechanisms involved. Sp

4880 Afro-American Psychology (4) Review and 
analysis of psychological literature on Afro-
Americans. Prereq. Consent of instructor. (Same as 
Black Studies 4880.)

5000 Thesis (1-15) E

5002 Non-thesis Graduation Completion (3-15) Re-
quired for the non-thesis student not otherwise reg-
eristered during any quarter when such a student uses 
university facilities and/or faculty time before de-
gree is completed. May not be used toward degree 
requirements for the non-thesis student. Sp

5017 Colloquium in Ethology (1) May be repeated. 
Maximum 9 hrs. (Same as Zoology 5017.) S/NC only.

5019 Research Practicum (1-3) Required of all 
first-year students in experimental, physiological, and 
comparative psychology. May be repeated. 
Maximum 9 hrs. S/NC only.

5050 Methods of Research in Applied Psychology 
(3) Techniques and principles for designing and 
conducting psychological research in natural set-
ings.

5070 Seminar in College Teaching (2) Concepts, 
methods, and materials in introduction of psychol-
ogy at college level. Emphasis on research. Re-
quired of all S/NC only. E

5079 Practicum in College Teaching (2) Supervised 
participation in college teaching. S/NC only.

5100 Developmental Psychology (3) Prereq: 3550 
or Educational Psychology 2430. (Same as Educa-
tional Psychology 5100.) F, Sp

5105 Developmental Assessment (3) Techniques for 
assessing development in infants and children. 
Does not include practicum. Prereq: 5100 or equiva-
 lent consent of instructor.

5110 Clinical Aspects of Human Sexuality (3) Na-
ture of sexuality; societal perspectives, personal 
identity, attraction and isolation including 
psychosocial and psychosocial identity and 
models for decisions. Intended for graduate stu-
dents in clinical psychology, social work, and com-
mon and mental health professions. Prereq. Con-
sent of instructor.

5111-12-13 Seminar in Current issues in School 
Psychology (1, 1, 1) Historical, legal, ethical and 
technological issues in practice of school psychol-
gy. Multiple instructors. (Same as Educational 
Psychology 5111-12-13.) S/NC only. F; W; Sp

5140-50-60 Psychoeducational Assessment (3, 3, 3) 
Naturalistic, psychometric, and sociometric as-
sement methods in school learning environments.
Must be taken in sequence. Prereq: Admission to 
School Psychology Program and consent of instruc-
tor. (Same as Educational Psychology 5140-50-60.) 
F; W; Sp

5149-59-69 Practicum in School Psychology (1, 2, 
2) First-year School Psychology Program practicum 
core sequence. Coreq: 5140-50-60. (Same as Educa-
tional Psychology 5149-59-69.) S/NC only. F; W; Sp

5170-80-90 Proseminar in individual and Organiza-
tional Psychology (3, 3, 3) (Same as Management 
5170-80-90.) F; W; Sp

5200 Topics in Developmental Psychology (3) Pre-
req: 3210 or equivalent consent of instructor. May 
be repeated. Maximum 6 hrs.

5210 Readings in Psychology (1) S/NC only. E

5220 Readings in Psychology (2) S/NC only. E

5230 Readings in Psychology (3) S/NC only. E

5240 Readings in Psychology (4) S/NC only. E

5250 Readings in Psychology (5) S/NC only. E

5260 Special Problems in Psychology (1) S/NC only. E

5270 Special Problems in Psychology (2) S/NC only. E

5280 Special Problems in Psychology (3) S/NC only. E

5290 Special Problems in Psychology (4) S/NC only. E

5300 Special Problems in Psychology (5) S/NC only. E

5319 Field Work in School Psychology: Level I (2) 
Supervised on-the-job training in student psychol-
ogy. Limited to students fully admitted to doctoral 
program in school psychology who are assigned to 
program approved field settings. Prereq: 5140-50-60 or 
equivalent. May be repeated. Maximum 6 hrs. (Same 
as Educational Psychology 5319.) S/NC only. F, W, Sp

5325 Behavioral Interventions (3) Principles and 
techniques for planning, implementing, and evaluat-
ing interventions derived from social learning 
theory. Focuses on interventions by people in com-
mon and schools. (Same as Educational Psychology 5325.)

5340 Group Dynamics (3) (Same as Educational 
Psychology 5340.)

5350-60-70 Seminar in Psychology (3, 3, 3) May be 
repeated. Maximum 18 hrs.

5400 Psychophysics and Scaling Methods (3) Pre-
req: One course in statistics.

5420-30-40 Advanced Psychological Statistics (3, 
3, 3) Must be taken in sequence. W; Sp; Su; F

5450 Human Problems in Administration (3) (Same 
as Management 5450.)

5460 Continuing Education in Mental Health (1-4) 
Topics of interest to persons in mental health and 
allied fields. Workshop, seminar, or lecture; topic 
and format to be announced. Prereq: Graduate 
standing or consent of instructor. May be repeated. 
Maximum 9 hrs.

5500 Fundamentals of Psychometrics (4) Basic 
ideas and orientation in psychometrics. All graduate 
students who plan to take one or more courses in 
psychometrics required to take course. Prereq or 
coreq: 4640.

5610 Instrumentation for Psychological Research 
(3)

5520 Theory of Mental Measurement (3) Reliability, 
validity, scaling and equaling, norms, combining 
tests into batteries. Prereq: 1 qtr of graduate-level 
statistics and 5500 or consent of instructor.

5530 Issues in Applied Psychological Measure-
ment (3) Applications of measurement in commu-
nity and organizational research. Prereq: Statistics 
5530-70 or equivalent consent of instructor.

5540 Probability Models in Psychology (4) Introdu-
cation to use of probability models in theory of 
binary test items, differential psychology, comparison of 
different psychometric models and associations of 
parameters, individual choice behavior, and testing of 
psychological hypotheses in human and animal be-
havior. (Same as Educational Psychology 5540.) 
Prereq: 1 qtr mathematics of consent of instructor.

*Part-time.
5550 Advanced Social Psychology (3) Interaction between individual and group, theories of group behavior. Prereq: 3120. May be used for credit in sociology.

5560 Seminar in Social Psychology (3) Prereq: 5550. May be used for credit in sociology. May be repeated. Maximum 6 hrs.

5580 Theories of Personality (3)

5581-82-83 Clinical Psychology I: Human Development and Personality (2, 2, 2) First quarter of program in clinical psychology. Students take 3 2-hr courses concurrently, each course focusing on one of three major contemporary points of view. F

5589 Psychological Techniques Laboratory (2) Basic techniques of psychological appraisal. Restricted to doctoral students in clinical psychology.

5591-92-93 Clinical Psychology I: Patterns of Adaptation (2, 2, 2) Second quarter core of doctoral program in clinical psychology. Students take 3 2-hr courses concurrently, each course focusing on one of three major contemporary points of view. W

5610-90 Psychology of Learning (3, 3) Prereq: 3210 or Educational Psychology 3730. F; W

5613 Learning Modules for Techniques in Professional Psychology (1-4) Set of learning packages; may be repeated. Maximum 15 hrs. (Same as Management Education 6650.)


5641-12-13 Psychotherapy: Elective Concentration Learning Laboratory (2, 2, 2) Typically four psychotherapy concentration areas offered each quarter. Clinical students in core psychotherapy sequence must elect at least one of these in each quarter of sequence. May be repeated. Limited to clinical psychology students enrolled in core psychotherapy sequence or consent of instructor.


5650 Advanced Psychometrics (3, 3) Construction and standardization of psychological tests, questionnaires, and rating scales, theory of errors or measurement, factor and cluster analysis, scaling, equating, and norms development. Prereq: 4560, 5440, and 5500. May be repeated. Maximum 9 hrs.

5680 Neural Basis of Behavior (3) Neuroanatomy; Prereq: M.A. in psychology or equivalent. Offered in alternate years.

5695 Practicum in Program Evaluation (3) Techniques for designing and conducting research to evaluate effectiveness of programs. Prereq: Statistics 2050-60-70 or equivalent and consent of instructor.

5690 Seminar in Motivation and Emotion (3)

5695 Seminar in Measurement and Assessment (2) Seminar for advanced graduate students in psychology or quantitative psychology, to deal with advanced theories, methodologies, and their applications. Prereq: 4640, 5560 or equivalent, and consent of instructor. May be repeated. Maximum 9 hrs.

5700 Community Psychology (3) Psychological aspects of research, evaluation, intervention, and planning in the community. Social, political and environmental factors and systems for primary and secondary prevention, planning of social systems, and relevance of federal policies. Prereq: Consent of instructor.

5713 Learning Modules for Techniques in Professional Psychology (1-4) Set of learning packages; each develops skill in assessment, technology, child psychotherapy, or pathology. Prereq: Consent of instructor. May be repeated. SNC only.

5750 Ethological Psychology (3) Evolutionary and physiological basis of comparative psychology and implications for human behavior. Prereq: Introduction to biology and graduate standing.

5750 General Vertebrate Neuroanatomy (3) Lecture and laboratory dealing with structure and function of central and peripheral nervous system. Prereq: 4710, 4719, or consent of instructor. (Same as Zoology 5760.)

5760 Seminar in Advanced Social Psychology (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5780 Seminar in Psycholinguistic Concepts in Speech Pathology (3) (Same as Speech Pathology 5790.)

5840 Student Apprenticeship (3) (Same as Educational Psychology 5840.)


5850-69-79 Practicum in Psychological Appraisals (2, 2, 2) Ordinarily to be taken concurrently with 5850-60-70.

5890 Counseling Theories and Techniques (3) (Same as Educational Psychology 5980.)

5950-60 Theory and Practice of Consultation (3, 3) Issues in consultation, models of consulting process, and evaluation of consulting techniques. Must be taken in sequence. Coreq: 5959-69 and consent of instructor. (Same as Educational Psychology 5950-60.) W; Sp

5959-69 Practicum in Consultation (2, 2) Coreq: 5950-60. Must be taken in sequence. (Same as Educational Psychology 5959-69.) SNC only. W; Sp

6000 Doctoral Research and Dissertation (1-5) E

6050 Seminar on Methods of Social Research (3) (Same as Sociology 6050.)

6100 Seminar in Community Psychology (3) Evaluation, research, intervention, and systems for delivery of services in communities. Prereq: 5702 and consent of instructor.

6150 Seminar in Program Evaluation (3) Techniques for designing and conducting research to evaluate effectiveness of programs. Prereq: Statistics 2050-60-70 or equivalent and consent of instructor.

6210-20-30 History, Systems, and Theories in Psychology (3, 3, 3) Prereq: M.A. in psychology or equivalent. Must be taken in sequence.

6250-60-70 Seminar in Industrial and Organizational Psychology (3, 3, 3) (Same as Management 6250-60-70.)

6280-90 Factor Analysis (3, 3) Factor analysis; component introduction; latent structure analysis. Prereq: 4640 and 5560.

6310 Seminar in Motivation and Emotion (3)

6319 Field Work in School Psychology: Level II (2) Supervised practice in school psychology. Limited to students fully admitted to doctoral program in School Psychology assigned to program approved field settings. Prereq: 5590-60. May be repeated. Maximum 6 hrs. (Same as Educational Psychology 59319.) SNC only. F, W, Sp

6320 Seminar in Research Methods (3)

6330 Seminar in Learning (3)

6340 Seminar in Developmental Psychology (3)

6350 Seminar in Thinking (3)

6360 Seminar in Sensation and Perception (3)

6370 Seminar in Theoretical Psychology (3)

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


6390 Seminar in Psychotherapy (2) Treatment of current case, focusing upon psychodynamics, psychopathology, and therapeutic techniques employed. Prereq: M.A. in psychology or equivalent.

6395 Seminar in Assesment (3) Seminar for advanced graduate students in clinical psychology, to deal with current research on methods of evaluating the status of individuals seeking clinical aid.

6400 Seminar in Changing Concepts in Clinical Psychology (3) New developments in field in relation to their impact on experimentation and systems of thought. Prereq: M.A. in psychology or equivalent.

6405 Seminar in Psychopathology (3) Prereq: Consent of instructor.

6410-20-30 Psychotherapy (3, 3, 3) Theories and principles of psychotherapy. Prereq: 5580-90. Prereq or coreq: 5640-20-30. W; Sp

6411-12-13-14 Psychotherapy: Elective Concentration Learning Laboratory (2, 2, 2, 2) Typically four psychotherapy concentration areas offered each quarter. Clinical students in core psychotherapy sequence must elect at least one of these in each quarter of sequence. May be repeated. Limited to clinical psychology students enrolled in core psychotherapy sequence or consent of instructor.

6451-23-26 Field Placement in Clinical Psychology Levels 1, 2, 3, 4, (1-6, 1-6, 1-6, 1-6) Supervised clinical experience. Required of and limited to students fully admitted to Ph.D. program in Clinical Psychology. May be repeated. Maximum 8 hrs per course. SNC only. W, Sp, F

6500 Seminar in Psychometrics (3) Seminar for advanced graduate students in psychometrics or quantitative psychology, to deal with advanced theories, methodologies, and their applications. Prereq: 4640, 5560 or equivalent, and consent of instructor. May be repeated. Maximum 9 hrs.

6505 Seminar in Advanced Social Psychology (3) Prereq: Consent of instructor.

6575 Seminar in Mental Health Administration (3) Theory and problems in organization and management of mental health administration.

6595 Assessment of Human Service Organizations (3) Review of theories and methods for diagnosing community-based human service settings. Prereq: 5650. (Same as Educational Psychology 6650.)

6660 Organizational Development in Human Service Settings (3) Review of theoretical and practical approaches to organizational development in human service settings. Didactic material and exercises. Prereq: 6650. Recommended coreq: 6665. (Same as Educational Psychology 6660.)

6669 Practicum in Organizational Development in Human Service Settings (2) Recommended coreq: 6660. Prereq: Consent of instructor. (Same as Educational Psychology 6669.)

6710 Seminar in Integrated Physiology (3)

6720 Seminar in Comparative and Ethological Psychology (3)

6730 Methods of Ethological and Naturalistic Research (3) Current laboratory and field techniques. Prereq: 5710, 5720, or consent of instructor.

6780 Advanced Psycholinguistics (3) Language from psychological and associated points of view; methodological and theoretical problems. Prereq: Consent of instructor.

6900 Field Work in Industrial and Organizational Psychology (1-15) (Same as Management 6900.)

*Note: Psychology 5210-5300, 6310-400, 6419-29-39, 6710-30-30, and/or 6900 may be repeated for credit with the approval of the department.

College of Liberal Arts

Daniel Billen, Dean of the Graduate School

MAJOR

DEGREES

Radiation Biology

Daniel Billen, Director

A graduate major in the field of Radiation Biology is offered through the Institute of Radiation Biology. This is a program crossing both departmental and institutional lines. Included on the Institute staff are certain scientists from the Departments of Radiation Biology.
Biochemistry, Botany, Chemistry, Microbiology, Physics, Zoology; the Memorial Research Center and the Comparative Animal Research Laboratory of The University of Tennessee; the Biology and Environmental Sciences Divisions of the Oak Ridge National Laboratory; and the Medical Division of Oak Ridge Associated Universities.

Formal courses in this program are offered mainly on the Knoxville campus. Thesis research may be carried on at either the University or at one of the Oak Ridge laboratories. Problems selected for thesis research shall involve the interaction of radiations or long-lived fission products and radiometric chemicals with biological systems, at the molecular, cellular, organismal, or ecological level of complexity. Areas of radiation specialization currently include photobiology, environmental, microbial, botanical, and biochemical and biophysical radiobiology.

ADMISSION REQUIREMENTS

The minimum requirements for admission to the Institute are: (1) a Bachelor's degree from an accredited college or university, or (2) a major in either biological science, or chemistry or physics, (3) college mathematics: potential candidates for the Master's program, 9 quarter hours; potential candidates for the doctoral program, differential and integral calculus, (4) for both the M.S. and Ph.D. programs, Graduate Record Examination scores.

THE MASTER'S PROGRAM

Course requirements include: (1) Zoology 5610, (2) Zoology 5620 or 5780, (3) Zoology 5350 or Plant and Soil Science 3610, (4) Chemistry 3810, (5) Biochemistry 4110-20 or 5510-20-30. At least one-half of the student's program must be at the 5000 level. A thesis is required of all students.

THE DOCTORAL PROGRAM

Courses: In addition to those required for the Master's degree, Chemistry 4910-20-30; Physics 3710-20-30 (Chemistry 3930 may be substituted for Physics 3730); Radiation Biology 5620; 5780. Additional course requirements are determined by the student's faculty committee. The student's special field of interest and plans for a career determine these requirements.

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 comprehensive examination will consist of oral and written portions in radiation biology and in allied fields in which the candidate has received training. (3) The student's dissertation committee determines whether or not a foreign language is required for the doctoral degree. (4) The final examination will be an oral examination covering the candidate's dissertation and such other fields as the candidate's faculty committee may specify.

Regular attendance at the weekly Radiation Biology Seminar or an appropriate Departmental Seminar is expected of all students.

5000 Thesis (1-15) E

5300 Graduate Research Participation (3-9) May be repeated. Maximum 12 hrs. E

5610-20 Foundations of Radiation Biology (4, 4) (Same as Zoology 5610-20)

5780 Radiation Physiology (4) (Same as Zoology 5780)

6000 Doctoral Research and Dissertation (3-15) E

6910 Seminar in Radiation Biology (2) (Same as Zoology 6910)

Religious Studies


Associate Professors: W. L. Humphreys, Ph.D. Union; D. E. Linge, Ph.D. Vanderbilt.

Assistant Professors: R. R. Earl, Ph.D. Vanderbilt; J. L. Fitzgerald, Ph.D. Chicago; J. Kim, Ph.D. Chicago.

An M.A. in Philosophy with a concentration in religious studies is available for graduate work in these fields. (Details of this program are available in the office of either department.) Graduate courses in religious studies further provide opportunity for students in a variety of disciplines to pursue work in religious studies as a graduate concentration.

3060-70-80 History of Western Religious Thought and Institutions (3, 3, 3) 3060—First Century to Fifth Century; 3070—Sixth Century to Fifteenth Century. 3080—Sixteenth Century to 1800. (Same as History 3060-70-80.) A

3210 Early Greek Mythology (3) (Same as Classics 3210.)

3220 Early Greek Mythology in the Classical Period (3) (Same as Classics 3220.) W

3220 Roman Mythology (3) (Same as Classics 3220.)

3270 Russian Philosophical and Theological Thought (4) (Same as Philosophy 3270 and Russian 3270.)

3411-12 The Reformation (3, 3) (Same as History 3411-12.)

3460 Religion of Primitive Peoples (3) (Same as Anthropology 3440.)

3650 Philosophy and Religion in India (4) (Same as Philosophy 3650.) W

3660 Buddhist Philosophy and Religion (4) (Same as Philosophy 3660.) W

3671 Religion and Philosophy in China (4) (Same as Philosophy 3671.)

3690 Philosophy of Religion (4) (Same as Philosophy 3690.)

4111-21 Modern Religious Philosophies (4, 4) (Same as Philosophy 4111-21) Examination of the religious implications of major thinkers and movements. 4111—Nicolas of Cusa to Hume. 4121—Kant and the nineteenth century. Prereq: 9 hrs. of philosophy other than logic. (Same as Philosophy 4111-21.)

4210 Topics in Ancient Israelite and Ancient Near Eastern Religions (4) (Same as Philosophy 3660.) W

4310 Jesus and Paul Compared (4) (Same as Religion 4310) Jesus' teaching and activity in the context of first-century Palestinian Judaism: analysis of what the Apostle Paul made of the tradition and the person of Jesus. Recommended prereq: 2610 or 2611.

4370 Theoretical Issues in Medical Ethics (4) (Same as Philosophy 4370.)

4410 American Religious Thought (4) (Same as Religion 4370.)

4450 Topics in American Religion (4) Prereq: One of the following: 3610, 3220, 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. Prereq: Consent of department. May be repeated. Maximum 12 hrs.

4640 Topics in Early Christianity and Hellenistic Religions (4) Selected figures, issues, and institutions. Prereq: Consent of department.

4670 Topics in Eastern Religions (4) Selected figures, issues, and institutions. Prereq: Consent of department. 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 (2-4) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

4940 Sociology of Religion (4) Prereq: Sociology 3610.


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). May be repeated. Maximum 8 hrs. (Same as Sociology 4960.)

5101 Foreign Study (1-12) See page 99.

5102 Off-campus Study (1-12) See page 99.

5103 Independent Study (1-12) See page 99.

5310-20 Topics in Religion and Society (4, 4)

5355 Orientation to Medical Ethics (4) (Same as Philosophy 5355.)

5365 Applied Ethical Theory (4) (Same as philosophy 5365.)

5510-20 Topics in the History of Religion (4, 4)

5710-20 Topics in Religious Thought (4, 4)

Romance Languages

MAJORS

French

MA.

Soviet Studies

Spanish

M.A.

Professors: R. L. Jackson (Head), Ph.D. Ohio State; W. A. Arens (Emeritus), A.M. Texas; P. E. Barrette, Ph.D. California, C. W. Cobb; Ph.D. Tulane; T. B. Irving, Ph.D. Princeton; H. E. Lewald, Ph.D. Minnesota; D. A. Maurino, Ph.D. Columbia; A. M. Vasquez-Begi, Ph.D. Minnesota; A. F. Maybrey, Ph.D. North Carolina, Ph.D. North Carolina.


Assistant Professors: T. R. Aurington, Ph.D. Kentucky, E. J. Campbell, Ph.D. Yale; M. Handlesman, Ph.D. Florida.

The Department of Romance Languages offers two advanced degrees: the Master of Arts (M.A.) in French and Spanish, and the Doctorate of Philosophy (Ph.D.) in Spanish.
Survey from origins to modern period of major Islamic literature, especially Arabic, Persian and Turkish. Readings include The Arabian Nights, The Rubaiyat of Omar Khayyam and Gibran's The Prophet.

5070-80-90 Hispanic-Arabic Literature and Culture (3, 3, 3) (Same as Spanish 5070-80-90). A

5101 Foreign Study (1-12) See page 99. E

5102 Off-campus Study (1-12) See page 99. E

5103 Independent Study (1-12) See page 99. E

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. F; W; Sp: Su

4101-02-03 Introduction to Consecutive and Simultaneous French Translation (3, 3, 3) 4001—Oral translation into English; 4002—Consecutive translation to and from English; 4003—Simultaneous translation to and from English. Training of students with intermediate or advanced knowledge of French for consecutive and simultaneous oral translation from French into English, and vice versa on variety of practical subjects such as business, economics, politics and science. Must be taken in sequence. A

4010 Masterpieces of French Literature in English Translation (3) No foreign language credit. A

4020 Masterpieces of French Drama in English Translation (3) No foreign language credit. A

4110-20-30 French Literature of the Seventeenth Century (3, 3, 3) Prereq: Intermediate French or equivalent. A

4150 Theatrical French (1-3) Performance in one or more French plays. Prereq: Intermediate French or equivalent and consent of instructor. May be repeated with consent of department. A

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. F; W; Sp

4210 Phonetics (3) Prereq: 2130, 2520, or equivalent. F

4220-30 Advanced Grammar (3, 3) Prereq: 2130, 2520, or equivalent. W; Sp

4250 Introduction to Descriptive Linguistics (3) Phonetics and phonology, morphology and syntax. Types of languages, linguistic groups, dialects and dialect geography. Application of descriptive linguistics—field linguistics, dialect study; its practical use in learning languages and in language teaching. Introduction to transformational grammar. Prereq: 9 hrs of upper division English or 9 hrs of upper division courses in a modern or ancient language (exclusive of German and French 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 German, Russian, Spanish and Linguistics 4250.) A

4280 Introduction to Historical and Comparative Linguistics (3) (Same as German, Russian, Spanish and Linguistics 4280.) W

4270 Introduction to Romance Linguistics (3) Development of Classical Latin through Vulgar Latin into the major Romance languages. (Same as Spanish and Linguistics 4270.) Sp

4310-20-30 French Literature of the Eighteenth Century (3, 3, 3) Prereq: Intermediate French or equivalent. A

4350-60-70 Medieval French Literature (3, 3, 3) Medieval works in modern French texts. Prereq: Intermediate French or equivalent. A

4410-20-30 French Civilization (3, 3, 3) Prereq: Intermediate French or equivalent. A

4530-20-30 French Literature of the Nineteenth Century (3, 3, 3) Prereq: Intermediate French or equivalent. A

4640-50-60 French Literature of the Sixteenth Century (3, 3, 3) Prereq: Intermediate French or equivalent. A

4710-20-30 French Literature of the Twentieth Century (3, 3, 3) Prereq: Intermediate French or equivalent. A

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student, 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. E

5011 Techniques in Literary Analysis (3) Required for either Plan A or Plan B of M.A. program. Intensive training with emphasis on theories of color and "correspondances" and their influence on Symbolist writers of the nineteenth century.

5011 Independent Study (1-12) See page 99. E

5012 Off-campus Study (1-12) See page 99. E

5013 Independent Study (1-12) See page 99. E

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 student skills, techniques 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 department.

5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as Italian and Spanish 5151-61-71.) S/N only. A

5210-20-30 French Literature of the Sixteenth Century (3, 3, 3) A


5241 French Theatre of the 18th and 19th Centuries (3) Development of new dramatic forms and evolution of traditional forms in serious and comic theatre of eighteenth and nineteenth century France.

5310-20-30 French Directed Readings (3, 3, 3) E

5350-60-70 The Philosophes (3, 3, 3) Textual analysis of the works of Voltaire, Diderot, Rousseau, and other eighteenth-century writers. A

5410-20-30 The French Novel (3, 3, 3) A

5450-60 Lyric Poetry of the Nineteenth Century (3, 3, 3) Detailed analysis of French poems, plays, and prose works of nineteenth century. 5450—German and English influences on French Romanticism and generation of the poet "le mal du siècle." 5460—Victor Hugo; the Parnassians. A

5470 Baudelaire and the Symbolists (3) Les Fleurs du mal and Petits poèmes en prose with emphasis on theories of color and "correspondances" and their influence on Symbolist school. A

5610-30-30 Trends in Contemporary French Literature (3, 3, 3) A

5650-60 Advanced Syntax and Stylistics (3, 3) Readings and written imitations of modern literary styles in form of compositions, sketches, and original stories. A

5670 Problems in Romance Linguistics (3) Topics vary. May be repeated with consent of department. Prereq: 4270 or equivalent. (Same as Spanish 5670.) A

5710-20-30 Seminar In French Literature (3, 3, 3) Topics vary. May be repeated with consent of department. Su

5910 Literary Criticism: The Foundations of Romance Criticism (3) (Same as Spanish 5910.) A
Italian
3310-20-30 Civilization and Culture (3, 3, 3) Prereq: Intermediate Italian or equivalent. A
3330-20-30 Italian Literature in English Translation (3-4, 3-4-3) 3330—Sicilian School, the Florentine School, Dante, Petrarch, Boccaccio, Machiavelli, Ariosto. Prereq: 3340. From the Baroque through nineteenth century, commedia dell'arte, Vico, Leopardi. 3330—Twentieth century, Carducci, Pirandello, Quasimodo, D'Annunzio, Croce, Moravia. No change in credit hours after add deadline. Option of 4 hrs credit must present appropriate amount of extra work above that required for 3 hrs. A
3510-20 Aspects of Italian Literature (4, 4) Prereq: Intermediate Italian or equivalent. Recommended for literature majors. F, W
4010-20 Italian Drama in English Translation (3-4, 3-4-3) 4010—La commedia dell'arte and major works of Machiavelli, Metastasio, Alfieri, Goldoni. 4020—Twentieth-century theatre: operatic drama, the Grottesso, Pirandello, De Filippo, Frail. No change in credit hours after add deadline. Option of 4 hrs credit must present appropriate amount of extra work above that required for 3 hrs. A
4050-50-70 Dante and Medieval Culture (3, 3, 3) Topics vary and may be repeated with consent of department. A
4210 Phonetics (3) Prereq: 3130, 3520 or equivalent. A
4230 Boccaccio (3) Prereq: 3130, 3520 or equivalent. A
4240-30-40 Introduction to Comparative Linguistics (3) (Same as French, German, Russian, Linguistics 4260.) A
4250 Introduction to Historical and Comparative Linguistics (3) (Same as French, German, Russian, and Linguistics 4260.) W
4270 Introduction to Romance Linguistics (3) (Same as French and Linguistics 4270.) Sp
4310 Italian Civilizazation (3) Prereq: Intermediate Spanish or equivalent. F
4410 Spanish Civilization (3, 3, 3) Prereq: Intermediate Spanish or equivalent. W, Sp
4530 The Modern Novel (3) Prereq: Intermediate Italian or equivalent. A
4540 The Modern Theatre (3) Prereq: Intermediate Italian or equivalent. A
4610 Contemporary Theatre (3) Prereq: Intermediate Italian or equivalent. A
4620 Contemporary Poetry (3) Prereq: Intermediate Italian or equivalent. A
4630 Contemporary Prose (3) Prereq: Intermediate Italian or equivalent. A
4760 Italian Folklore (3) Folk arts, music, traditions, rituals and lore of Italy from Middle Ages to present. (Same as Modern European Studies 4760.) Sp
5011 Techniques in Literary Analysis (2) Intensive course in explication de texte. A
5012 Foreign Study (1-12) See page 99, E
5013 Directed Readings (3, 3) Topics vary and may be repeated with consent of instructor. F
5014 Independent Study (1-12) See page 99, E
5101 Bibliography and Methods of Research (1, 1) (Same as French and Spanish 5151-61-71.) S/N only. A
5108-20-30 Seminar in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of department. A
5109-20-30 Seminar in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of department. A
5110-20-30 Old Spanish (3, 3, 3) Medieval Spanish literature and language. A
5121 College Teaching of Romance Languages (3) Seminars in preparation 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 Asis-
Sociology

MAJOR

Sociology

DEGREES

M.A., M.A.C.T., Ph.D.

Professors:

D. W. Poirer (Head), Ph.D. North Carolina; J. A. Black, Ph.D. Iowa; D. J. Champion, Ph.D. Purdue; L. Ebersole, Ph.D. Pennsylvania; S. Wallace, Ph.D. Minnesota.

Associate Professors:

D. M. Betz, Ph.D. Michigan State; D. Clelland, Ph.D. Michigan State; D. Haddo, Ph.D. Massachusetts; T. C. Hood, Ph.D. Duke; R. G. Perrin, Ph.D. British Columbia; N. Shover, Ph.D. Illinois.

Assistant Professors:


For a full statement of departmental requirements, students are referred to the Departmental Graduate Manual.

The MASTER'S PROGRAM

The department offers both a thesis and non-thesis option for a Master's degree. For information concerning the Master's degree with thesis, see the General Requirements on page 19. Those interested in the non-thesis option should obtain details from the department.

THE DOCTORAL PROGRAM

General requirements for the degree of Doctor of Philosophy are described on page 21. Additional specific requirements for the degree of Doctor of Philosophy in Sociology include:

1. A minimum of 108 credit hours following the Bachelor's degree, exclusive of credits for the Master's thesis, is required. Of this number, 36 hours shall be allocated to doctoral research and dissertation. A maximum of 12 hours credit outside the major may be taken in related fields, with the approval of the student's committee.

2. An introductory comprehensive examination covering sociological theory, research methodology, and social processes in sociology must be passed prior to admission to candidacy. This examination must be passed not later than one academic year before the date on which the degree is granted.

3. No later than one month before granting of the degree, the candidate will be required to pass an oral examination on the doctoral dissertation. At the time of the oral examination, the candidate will be expected to show a thorough knowledge of sociological theory and methodology related to the research.

410 History of Ideas (4) General treatment of sociological thought from 1700 to the present, with an emphasis on the development of sociological thought in the United States.

4110 Topics in Social Psychology (4) Same as Psychology 4120.

4120 Topics in Social Psychology (4) Same as Psychology 4120.

4130 Sociology of Punishment and Corrections (4) Traces development of correctional movement, develops a critical sociological perspective on contemporary correctional programs, and provides overview of evaluative research in corrections.

4150 Theory of Attitudes and Values (4) Organization, functions and measurement of attitudes and values, approaches to attitude change, and relationship to attitudes, values and behavior.

4340 Criminology (4)

4330 Urban Ecology (4) Examination of public, private, collective, and individual space. Classical school of ecology, its neoclassical revisers, social area analysis, and cognitive symbolic ecology emphasized.

4410 Educational Sociology (3) Same as Curriculum and Instruction 4410.

4530 Community Organization (4) Structure, function, linkages, change and development and important community studies are reviewed and discussed. Emphasis on sociological analysis, not on the implementation of change.

4540 Social and Religious Change (4) Critical review of historical and contemporary theories and methods employed in study of social change. Attention given to both macro and micro group change. (Same as Religious Studies 4540) A

4560 Formal Organization (4) Analysis of bureaucratization process, division of labor, delegation of authority, and communication under a system of rationality.

4820 American Minority Groups (4) Minority groups and social structure in American society; analysis of intergroup 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) A

4960 Tradition, Change and Modernity in Asia (4) (Same as Religious Studies 4960)

5000 Thesis (1-15) E

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

5010 Professional Seminar (1) Limited to sociology graduate teaching assistants or graduate assistants. May be repeated. Maximum 4 hrs. S/NC only. W, Sp

5040 Methodological Issues in Social Research (3)

5050 Seminar in Political Sociology (3) Political system from societal, organizational, and group perspectives.

5060 Seminar in Social Research (3, 3) Directed readings and research projects. E

5125 Seminar in Environmental Sociology (3)

5200 Seminar in Collective Behavior and Social Movements (3)

5210 Social Theory (3) F

5220 Social Control (3)

5230 Seminar in Sociology of Medicine (3)

5251 Historical Demography (3) Family reconstitution, aggregate analysis, strategies for examining data, and information on population. Research findings on historical patterns of change in fertility, mortality, migration and different types of family structures.

5310 Seminar in Methods of Sociological Research (3) Major methodological issues in sociology, scaling techniques: reliability, validity, sampling, and qualitative methods.

5320-30 Social Statistics (3, 3) General survey of parametric and nonparametric procedures in analysis of sociological data; assumptions underlying procedures; advantages, disadvantages, and special applications. Must be taken in sequence. F, W

5420-30 Social Theory (3, 3) W, Sp

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) Relationship between formal sociological models and substantive theories of mental illness. Historical development of theoretical and methodological perspectives related to mental illness, and their relationship to current research in mental disorder. Review of major studies.

5590 Social Differentiation and Stratification (3) 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 individual and society; technology and occupations; unequal rewards and occupations; social organization and occupations.

5620 Seminar in Occupations (3) Continuation from material in Sociology 5610; interface between occupations and settings in which they are performed.

5630 Seminar in Occupations (3) Research participation, directed projects on subjects developed in Sociology 5620. Prereg: 5610 or 5620.

5640 Theories of Social Psychology (3) Current and classical theoretical perspective in social psychology. 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) Critical assessment, through reading and actual research, of contemporary theoretical orientations to study of small groups. Research designed to test selected theoretical problems. May be repeated.

5730 Seminar in Research Problems in Inter-group Relations (3) Research techniques and problems as encountered in race and intergroup relations are explored; actual field research projects are performed.

5810 Seminar in Race and Culture (3) Critical examination of theoretical and conceptual approaches in study of intergroup relations.

5910 Urban and Regional Sociology (3)

5920 Seminar in Social Attitudes (3)

5940 Delinquency and the Social Structure (3) Critical assessment of contemporary theories of delinquency, research findings related to them, and their implications for formal strategies of control and rehabilitation.

5960 Demographic Techniques (3) Life, table, standard rates, and survey techniques of population analysis.

5970 The Sociology of Development and Modernization (3) Comparative approach to institutional and organizational correlates of modernization. Relations between urbanization, industrialization, and modernization.

6000 Doctoral Research and Dissertation (3-15) E

6040 Experimental Research (3)

6050 Seminar on Methods of Social Research (3) Experimental research projects. (Same as Psychology 6050.)

6070 Field Research (3)

6080 Reading in Social Psychology (3) Directed
Speech and Theatre

4170-80-90 Film History and Theory (3, 3, 3) Analysis of cinematic forms and styles. 4170—Narration.
4180—Exposition and persuasion. 4190—
4575-60-70 Studies in Rhetoric (3, 3, 3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. F
5750-60-70 Studies in Rhetoric (3, 3, 3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. F

5911 Directing the Forensic Program (4) Philosophy and methods of directing cocurricular and extracurricular forensic activities in high schools and colleges; competitive and noncompetitive approaches to directing debate, oral interpretation and public speaking events. (Same as Curriculum and Instruction 5911). Sp

Speech and Theatre

5000 Thesis (1-15) E
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during the quarter. May be used toward degree requirements. May be repeated. SINC only. E
5110 Introduction to Graduate Research in Speech and Theatre (3) F
5120 Directed Reading and Research (3) May be repeated. Maximum 9 hrs. E
5160 Theory and Technique in Oral Interpretation (4) Literary, psychological, communicative, and aesthetic approaches to performance; production, adaptation, and oral presentation of literature. May be repeated. Maximum 8 hrs. W, Sp

Theatre

3121-22 Advanced Acting (4, 4) Historical styles of acting. 3121—Renaissance. 3122—seventeenth and eighteenth centuries. Prereq: Consent of instructor.
3151 Theatre Practicum: Production (1-4) Supervised work on productional productions. Available for credit only to theatre majors or with consent of department. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E
3152 Theatre Practicum: Production (1-4) Supervised work on departmental productions. Available for credit only to theatre majors or with consent of department. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E
3153 Theatre Practicum: Production (1-4) Supervised work on departmental productions. Available for credit only to theatre majors or with consent of department. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E
3214-15 Technical Theatre (4, 4) Special techniques in scenery and property construction; stage management; problems in basic technical theatre practice. Prereq: 2211-21, W, Sp
3221-22 Introduction to Scene Design (4, 4) Mechanics of stage lighting; elementary theory; prob-
lems in basic lighting practice. Prereq: 2211-21 and consent of instructor. Must be taken in sequence.
3451-52 Play Directing (4, 4) Must be taken in se-
quence. Prereq: 2211.
3511-12 Introduction to Costume Design (4, 4) Cos-
tume as an expression of character on stage; the application of costume history to specific design projects. Prereq: 2231 or consent of instructor.
4133-34 Special Problems in Acting (3, 3) Advanced exercises in voice and movement; preparation of major role under performance conditions. Prereq: 3121-22 and consent of instructor. F, W
4151 Theatre Practicum: Performance (1-4) Con-
tinuation of 3151. Available for credit only to theatre majors. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E
4152 Theatre Practicum: Production (1-4) Continu-
ation of 3152. Available for credit only to theatre majors. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E
4153 Summer Repertory Productions (4) Continua-
tion of 3153S. Available only to members of summer company by consent of instructor. Su
4214-15 Advanced Technical Theatre (4, 4) Ad-
vanced technical theatre management; advanced scenery and property execution; special problems in technical theatre. Prereq: 3151-52 and consent of instructor. Minimum 8 hrs. E
4241-42 Advanced Scene Design (4, 4) 4241—
Descriptive drawing as an approach to three dimen-
sional design; theatrical graphic standards and preparation of painter's elevations. Prereq: 2311-22 and consent of instructor. W, Sp
4541-42 Advanced Theatre Costume Design (4, 4) Advanced problems in costume design and con-
struction; pattern drafting; draping. Prereq: 3511 or 3512. F, Sp
4751-52 Dramatic Theory and Criticism (3, 3) 4751—Theatre aesthetics. 4752—Dramatic theory. W, Sp
4951-52 Playwriting (4, 4) Prereq: Consent of in-
structor. F, W
5011-12-13 Projects in Lieu of Thesis (3, 3, 3) Availa-
ble to Theatre M.F.A. students only.
5250 Seminar in Playwriting (3) Sp
5310 Studies in European Theatre History (3) May be repeated. Maximum 9 hrs. F, W
5320 Studies in American Theatre History (3) May be repeated. Maximum 9 hrs. F, W
5620 Projects in Lighting Design (3) May be re-
peated. Maximum 9 hrs. E
5630 Projects in Play Directing (3) May be repeated. Maximum 9 hrs. E
5640 Projects in Scene Design (3) May be repeated. Maximum 9 hrs. E
5650 Projects in Costume Design (3) Problems of play interpretation and theatrical costume design. Prereq: 2311-22 and consent of instructor. W, Sp
5670-71-72-73-74-75 Master Class in Acting (5, 5, 5, 5, 5, 5) Available to Theatre M.F.A. students only.
5680-81-82 Design and Technical Theatre Seminar (1-6, 1-6, 1-6) Available to Theatre M.F.A. students only. May be repeated. Maximum 6 hrs.
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, two years including 12 quarter or 8 semester hours of general inorganic; (4) mathematics, 9 quarter or 6 semester hours including differential and integral calculus; (5) physics, 12 quarter or 8 semester hours; (6) Graduate Record Examination scores (Verbal, Qualitative 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.

A course in biostatistics is required of all candidates for an advanced degree in Zoology.

All aspirants for advanced degrees in Zoology must exhibit competency in six areas of zoology as determined by a qualifying examination. Students must take this examination during the fall quarter of the first year and may repeat this examination in the following fall quarter if unsatisfactory scores are received. Competency must be exhibited within this two-year period for a student to continue in the program.

Preparation for thesis or dissertation: During the first year a written examination and a special research problem in each of two faculty members' laboratories will determine the student's preparation for thesis or dissertation study.

THE DOCTORAL PROGRAM

Special requirements in Zoology are as follows: (1) course requirements shall be determined by the candidate's faculty committee; (2) the comprehensive examination will be an oral and written examination in zoology and in allied fields in which the candidate has had training; (3) the candidate for the Ph.D. degree must possess a reading knowledge of at least one foreign language in which there exists a sizeable amount of literature relevant to the major field of study. The student has the option of demonstrating a reading knowledge of this foreign language by (a) passing the official reading exam 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 comprehensive 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.

3050 Comparative Vertebrate Embryology (5) Developmental morphology of selected vertebrates. 2 hrs and 3 labs. F, Sp

3060 Comparative Vertebrate Anatomy (5) Physiological and anatomy of organ systems. Dogfish shark and cat primarily used in laboratory. 3 hrs and 2 labs.


3110 General Entomology (5) Introduction to insects; basic structure, development, behavior; classification of insect orders and representative families; interpretation and use of keys. Prereq: Biology 3130 or consent of instructor. 3 hrs and 2 labs. F

3150 Invertebrate Zoology (5) Biology of invertebrates; keys for families, classification, ecology, behavior. Prereq: Biology 3130, 3 hrs and 2 labs. W

3220 Physiology of Reproduction (3) (Same as Animal Science 3220), F, Sp

3230 Histology (4) Study of animal tissues. Prereq: Biology 3120, 2 hrs and 2 labs. F, Sp

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. Sp

4007, 4010-4017 Minicourse in Zoology (2 hrs each) Selected, advanced topics in zoology, concentrated in time and subject matter. Consult departmental listing for actual topics offered. Prereq: As posted. May be repeated. E

4050 Developmental Biology (4) Experimental morphogenesis, fertilization, cellular interactions, hormonal effects and related topics with examples drawn primarily from invertebrates and vertebrates. Prereq: 3030, 2 hrs and 2 labs. F, W

4120 Undergraduate Research Participation (2) Experience in active research projects under supervision of staff members. Prereq: Consent of instructor. E

4140 Practicum in Zoology (1-3) Participation in practical application of zoology in community institutions, government organizations and industry. Approximately 5 hrs involvement per week. Prereq: Biology 3110, 3120, 3130 and senior standing. F, W, Sp

4190 Mammalogy (4) Classification, evolution, distribution, reproduction, populations, and behavior. 2 hrs and 2 lab or field periods. F

4200 Ichthyology (5) Classification, collection and identification, distribution, life histories, and economic importance of fishes. Prereq: Biology 3130 or consent of instructor. 2 hrs and 2 lab or field periods. F

4210 Cell Physiology (5) Development of modern concepts in cell physiology from point of view of information and control which examines kinetics and integration of cellular activities. Prereq: Cell biology, or any physiology, and organic chemistry. Recommended prereq: Biochemistry, 3 hrs and 1 lab. Sp

4240 Animal Ecology (4) Environmental factors determining distribution and numbers of animating species. Trapspecific relations; problems and methods. Prereq: Biology 3130, 2 hrs and 2 labs. F

4250 Comparative Animal Physiology I (3) Environmental physiology. Survey of physiological mechanisms enabling animals to survive in diverse physical environments. Prereq: Biology 3120-30 and 2 yrs chemistry. W

4260 Comparative Animal Physiology Laboratory I (1) Coreq. 4250. W

4260 Comparative Animal Physiology II (3) Sensory, effector and integrative physiology. Prereq. 3080. Sp

4290 Comparative Animal Physiology Laboratory II (1) Prereq. 4260 and consent of instructor. Coreq. 4260. Sp

4270 Immunology (3) (Same as Microbiology 4270.) F

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: 3080 or equivalent. W

4290 Herpetology (4) Classification, distribution, life histories, ecology, and identification of snakes, lizards, amphibians and reptiles, primarily of local species. 2 hrs and 2 labs or field periods. Sp

4300 Ornithology (4) Morphology, physiology, behavior, reproduction, populations, evolution, field identification. 2 hrs and 2 labs or field periods.

4320 Microtechnique (4) Prereq. 3320 recommended. 2 hrs and 2 labs.

4330 General Cytology (4) Study of cellular organisms at the light and electron microscope levels and the functioning of these organisms. Prereq: Biology 3130. Sp

4359 General Genetic Laboratory (2) Mainly Drosophila experiments designed to illustrate basic principles of inheritance. Prereq: Biology 3110. W

4380 Organic Evolution (3) Modern concepts of evolution. Prereq: Biology 3110. F

4390 Human Genetics (3) Principles and problems of inheritance in humans. Prereq. Biology 2110. F

4410 General Parasitology (4) Morphology, taxonomy and ecology of parasitic worms and protozoa, with emphasis on host-parasite relationships. 3 hrs and 1 lab. Prereq: Biology 3130 or consent of instructor. F

4430 Medical Entomology (4) Distinctive morphological and physiological features of medically important arthropods; control of arthropods that parasitize human or serve as vectors of human pathogens. Recommended prereqs: Entomology and Plant Pathology 3210 or Biology 3130.

4450 Protozoology (4) Morphology, taxonomy, and physiology of protozoa in relation to fundamental biological concepts. 2 hrs and 2 labs. Recommended prereq. Biology 3120.

4660 Introduction to Aquatic Ecology (4) Physiochemical nature of inland waters. Biotic communities are described, interrelationships explored. Prereq: Chemistry 1110-20-30, Biology 3130, 2 hrs and 2 labs. F

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.) F

4720 Comparative Animal Behavior Laboratory (4) Laboratory and field studies. Coreq. 4720. (Same as Psychology 4725.) F

4810-20-30 Insect Morphology and Taxonomy (4, 4) 4810—Internal morphology of both generalized and specialized forms. 4820—Taxonomy of major orders. 4830—Taxonomy of minor orders and immature forms. Prereq for 4820-30: 3110 or consent of instructor. 2 hrs and 2 labs. W, F, Sp

4940 Physiology of Exercise (4) Functions of body in muscular work; physiological aspects of fatigue, training, and physical fitness. Prereq: 2920-30 or 3080. 3 hrs and 1 lab. F, Sp

5000 Thesis (1-15) E

5017 Colloquium in Ethology (1) (Same as Psychology 5017) E

5079 Zooplenkton Ecology (4) Secondary productivity in aquatic systems. Prereq: 4460 or equivalent. Sp

5880 Graduate Research Participation (3) Advanced research techniques studied under supervision of staff research director whose research area coincides with interests of student. Open to all graduate students in good standing. Prereq: Consent of department and research director. May be repeated with consent of department. S/N only. E

5110-20-30 Special Problems (2, 2, 2) E

5150 Zoological Bibliography (1) Methods of locating and using zoological literature, bibliographies, and abstracts, and of preparing bibliographies and scientific papers.

5180 Fresh Water Invertebrate Zoology (4) Ecology and taxonomy of fresh water invertebrates exclusive of insects. Laboratory and field study. Prereq. 3150.

5210 Plant Parasitic Nematodes (4) (Same as Entomology and Plant Pathology 5210.) E


5270 Advanced Neuromuscular Physiology (5) Cellular and molecular aspects of phenomena as-
sociated with conduction of excitation and muscu-
lar contraction. Prereq: 4250. 3 hrs and 2 labs.

5380 Insect Physiology (4) Functions and interrela-
tionships of systems relative to metabolism, growth, coordination, movement, and reproduction. Prereq: 4110, 1 yr general chemistry or consent of instructor. 2 hrs and 2 labs. W, A

5290 Quaternary Problems (4) (Same as Geology 5290 and Botany 5290.)

5310-20 Seminar in the Teaching of College Zoology (2, 2) Current concepts and principles in teach-
ing of zoology; modern techniques and instrumen-
tation. Supervised application of teaching principles and methods. Must be taken in sequence. Prereq: Consent of instructor. S/JNC only.

5330 Biometry (3) Statistical methods used in analysis of quantitative biological data. Prereq: 1 qtr statistics or consent of instructor. F

5360 Isotopic Methods and Techniques: Lecture (2) Theory of isotopic decay, measurement of isotopic decay by liquid scintillation counting, single and double isotope counting, applications using Cerenkov radiation, radioimmunooassay, synthesis of metabolic intermediates, experimental de-
sign and data analysis. Coreq: 5389. Prereq: Upper division laboratory course in either physiology, biochemistry, microbiology, or consent of instruc-
tor. F

5389 Isotopic Methods and Techniques: Laboratory (4) Use of liquid scintillation counter, optimization of counting parameters for single and double isotope counting, quenching and correction, measure-
ment of Cerenkov Radiation, procedures for measuring blood volume, settle uptake into cells, radioimmunooassay of steroid hormones, hormone synthesis, synthesis of metabolic intermediates and other topics. Coreq: 5380. Prereq: Graduate stand-
ing and one upper division laboratory course in either biochemistry, physiology, microbiology or consent of instructor. Chemistry 3810 highly rec-
ommended. F

5410 Advanced Parasitology (4) Life cycles, tech-
niques of collection, preservation, and identification of parasitic worms and protozoa. Prereq: Consent of instructor.

5430 Advanced Medical Entomology (3) Prereq: 4330.

5510-20 Advanced Animal Physiology (5, 5) Primar-
ily mammalian physiology; 5510—membrane neuron, central nervous system, muscle, cardiovas-
cular system, and control mechanisms; 5520—
respiratory, renal, gastrointestinal, and reproduc-
tive physiology; acid-base mechanisms, and metabolism. Should be taken in sequence if both courses are taken. Prereq: General undergraduate anatomy and physiology and Biochemistry 4110 or equivalent or consent of instructor. Biochemistry 4120 also recommended. (Same as Animal Science 5510-20.) 4 hrs and 1 lab. W, Sp

5550 Advanced Ornithology (4) Classification, dis-
tribution, and anatomy of birds. Prereq: 4300.

5570 Animal Populations (3) Characteristics and methods of study of animal populations.

5610-20 Foundations of Radiation Biology (4, 4) Physical, chemical, and biological mechanisms in-
volved in actions of different kinds of radiations on living cell and its components. Recommended pre-
req: 1 yr biological science, general physics; biochemistry, calculus. (Same as Radiation Biology 5610-20.) 3 hrs and 1 lab.

5630 Methods of Experimentation with Laboratory Mammals (3) Designed to give competence in han-
dling research mammals. Techniques of anesthesia, drug administration, radiography and surgery. Prereq: 4550, or 4410, or consent of instructor.

5660 Physiology of Development (3) Chemical as-
psects of growth, morphogenesis, and cyto-
differentiation. Recommended prereq: Biochemis-
try 4110-20. F

5670 Cellular Immunology (4) Laboratory course with emphasis on immunological phenomena at cellu-
lar level. Preparation and use of immunofluores-
cent reagents, macrophage migration inhibition, skin allograft reactions, diffusion chamber cultures, and antibody formation at cellular level. 4 hrs and 2 labs.

5740 Physiological Ecology of Animals (2) Adaptive physiological responses of animals to natural changes in or extremes of physical and biotic envi-
ronment. Emphasis on terrestrial vertebrates. Term paper including review of assigned topic with em-
phasis on development of special aspect. 1 2-hr lec. Su

5760 General Vertebrate Neuroanatomy (3) (Same as Psychology 5760.)

5780 Radiation Physiology (4) Effects of different kinds of radiations on functions of cells, tissues, and organ systems of animals. Recommended prereq: 5610. (Same as Radiation Biology 5670.)

5790 Transport of Ions Across Epithelia (4) Oper-
tional principles and methods needed to study elec-
trical and kinetic properties of epithelia and electrically excitable tissues. Quantitative methods of measuring ion fluxes and flux ratios. Prereq: Two upper-division physiology courses, graduate stand-
ing, or consent of instructor. Recommended prereq: Chemistry 3810.

5820 Methods of Taxonomy (4) Classification of animals; rules of nomenclature; problems in prior-
ty; preparation of keys, descriptions, and figures. Prereq: Consent of instructor.

5840 Aquatic Insects (4) Taxonomy and biology of aquatic insects, emphasis on immature forms. 2 hrs and 2 labs. Sp

5860 Geographic Distribution of Animals (4) Distri-
bution patterns of vertebrate and invertebrate ani-
mals in all major habitats. Prereq: Consent of in-
structor.

5870 Insect Synecology (4) Ecology of insect com-
munities.

6000 Doctoral Research and Dissertation (3-15) E

6110 Seminar in Cellular Biology (2) Prereq: Con-
sent of Instructor. May be repeated. Maximum 6 hrs. Sp

6140 Seminar in Immunobiology (2) Prereq: Con-
sent of instructor. May be repeated. Maximum 6 hrs.

6210 Seminar in Physiology (2) Prereq: Two physi-
ology courses or consent of instructor. May be re-
peated. Maximum 6 hrs.

6310 Seminar in Cytology (2) Prereq: 4310. May be re-
peated. Maximum 6 hrs. W

6350 Seminar in Developmental Biology (2) Internal regu-
lation in differentiating cell. Prereq: 3050, 4050; Biochemistry 4110-20. W

6410 Seminar in Parasitology (2) Prereq: 5410. May be re-
peated. Maximum 6 hrs.

6510 Seminar in Genetics (2) Prereq: General genet-
ics. May be repeated. Maximum 6 hrs. Sp

6610 Seminar in Ornithology (2) Prereq: 4300. May be re-
peated. Maximum 6 hrs.

6650 Seminar in Aquatic Biology (2) Prereq: Any 2 of
4200, 4660-70, Botany 5061, or consent of instructor. Prereq: May be repeated. Maximum 6 hrs. F, W, Sp

6710 Seminar in Ecology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. W

6810 Seminar in Entomology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. Sp

6910 Seminar in Radiation Biology (2) Prereq: 5610. Coreq: 5620. May be repeated. Maximum 6 hrs. (Same as Radiation Biology 6910.)
The major campus of the College of Medicine is located in Memphis, Tennessee. The College, however, is a statewide organization with other units in Chattanooga, Jackson, and Knoxville.

In addition to Department of Medical Biology faculty listed here, the Knoxville Unit has other College of Medicine faculty and students in undergraduate and graduate medical education.

The College of Medicine traces its origin to the establishment of the Medical Department of the University of Nashville in 1851. Later, through a merger of four medical schools, it became The University of Tennessee College of Medicine and moved to Memphis in 1911.

Department of Medical Biology/Memorial Research Center

Professors:
- R. D. Lange (Chairperson and Director), M.D.
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke
- W. R. Farkas, Ph.D. Duke

Associate Professors:
- J. P. Chen, Ph.D.
- J. E. Fuhr, Ph.D.
- J. E. Fuhr, Ph.D.
- J. E. Fuhr, Ph.D.
- J. E. Fuhr, Ph.D.
- J. E. Fuhr, Ph.D.
- J. E. Fuhr, Ph.D.
- J. E. Fuhr, Ph.D.

Assistant Professors:
- E. L. Fuson, Ph.D.
- E. L. Fuson, Ph.D.
- E. L. Fuson, Ph.D.
- E. L. Fuson, Ph.D.
- E. L. Fuson, Ph.D.
- E. L. Fuson, Ph.D.

The Department of Medical Biology of The University of Tennessee College of Medicine-Knoxville Unit was formed from the faculty of The University of Tennessee Memorial Research Center and Hospital in 1978. The Research Center was established in 1978. Its faculty has education, research, and service interests in cancer, blood diseases, birth defects and clinical genetics, and biochemistry of disease. Courses in these areas are offered to students at the graduate and undergraduate levels. Elective courses are also available to students in the College of Medicine by special arrangement.

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

Courses

4210 Introduction to the Study of Cancer (3) Lectures, classroom discussion, and case reports surveying the major topics of oncology. Prereq: Biology 3110-20 or consent of instructor.

4310 Introduction to Hematology (4) Pathophysiology of blood and blood forming systems. Lectures, class discussions and demonstrations. Prereq: Upper division biology background to include histology and/or general anatomy.

4430 Clinical Genetics (3) Human genetic disorders, case presentations. Prereq: General biology and general genetics background or consent of instructor.

5080 Graduate Research Participation (3) Advanced research techniques studied while conducting individual biomedical research projects under supervision of faculty. Prereq: Consent of instructor. Open to all graduate students. May be repeated with consent. Maximum 9 hrs. S/NC only.

5220 Special Topics in Cancer (1-3) Special topics in oncology. Prereq: 4210 and consent of instructor. May be repeated. Maximum 9 hrs.

5320 Special Topics in Hematology (1-3) Special topics in clinical hematology. Prereq: 4310 and consent of instructor. May be repeated. Maximum 9 hrs.

5420 Special Topics in Metabolic Disease (1-3) Biochemical and physiological basis of selected diseases of humans and animals. Clinical-pathological correlations. Prereq: 5410 and consent of instructor. May be repeated. Maximum 9 hrs.

5430 Metabolism of Drugs (2) Drug mechanisms of action: membrane transport, enzyme reactions, drug receptors, ionization, stereoisomerism and metabolic pathways. For students interested in biochemical pharmacology. Prereq: Biochemistry 4110-20.
The College of Nursing offers a five-quarter program of study leading to the Master of Science in Nursing degree. The general purpose of the program is to prepare at the graduate level nurses who are qualified to function as practitioners, clinicians, educators, and administrators in all segments of the health care delivery system.

Upon successful completion of the program, graduates will be able to:
1. Provide advanced high quality, comprehensive nursing care to individuals and groups in a variety of settings;
2. Collaborate with other health professionals in systematic implementation and evaluation of health care delivery to large groups in agency and community settings;
3. Utilize appropriate advanced teaching, administrative and clinical practice skills in the discharge of one's professional responsibilities;
4. Utilize appropriate research findings in the implementation and evaluation of nursing care;
5. Participate in clinical research activities by means of data collection, tabulation, and analysis, and by generating research topics for referral to nurse researchers.

GENERAL REQUIREMENTS

1. Meet requirements for admission to the Graduate School.
2. Hold a Bachelor's degree in Nursing. If the Bachelor's degree is not in Nursing, the applicant must demonstrate successful completion of the equivalent of an upper division major in Nursing.
3. If the number of qualified applicants exceeds the number that can be accommodated, preference will be given to applicants:
   a. whose undergraduate GPA is 3.0 or higher;
   b. who have had at least two years of full-time clinical practice experience following completion of a baccalaureate nursing program;
   c. who are Tennessee residents;
   d. who are currently employed in underserved health service areas and who can demonstrate their commitment to return to those areas following completion of the program; or
   e. who are currently employed as nurse educators in programs preparing registered nurses; or
   f. who are currently employed as directors of nursing service.
4. Ordinarily one year of full-time clinical practice experience should be completed prior to applying for admission to the program.

DEGREE REQUIREMENTS

1. Students must complete 60 quarter hours of graduate level course work with a cumulative GPA of 3.0 or better.
2. The 60 credit hours must include the following components:
   a. Core requirement: 23 hrs
   b. Clinical concentration option: 20 hrs
   c. Functional concentration option: 11 hrs
   Total: 60 hrs
3. A Master's thesis is not required, but those students who wish to complete a thesis as a part of their program may substitute the thesis for the 9 elective hours.
4. Those students who do not choose the thesis option must successfully complete a comprehensive final examination.
5. Students may choose either primary care nursing, secondary/tertiary care nursing or community mental health nursing as their clinical concentration option. Students selecting the primary care nursing option must complete 5450, 5460, and 5550. Students selecting the secondary/tertiary care nursing option must complete 5120-30 or (5140-50) and 5310. Students selecting the community health nursing option must complete 5410, 5480, 5490, 5500 and 5510.
6. The core requirement that must be completed by all students regardless of clinical option includes the following courses: 5010, 5020, 5030, 5070, 5210, 5680 and a graduate level statistics course that must be approved in advance by the student's faculty advisor.
7. Students may select a functional concentration option in teaching, management or advanced clinical practice. Students selecting the teaching option must complete 6 hours of graduate level courses in education and 5630. Students selecting the management option must complete 6 hours of graduate level courses in administration and 5730. Students selecting the advanced clinical practice functional option must complete 5560 and 5660 if their clinical option is primary care, 5320 and 5340 if their clinical option is secondary care or 5520 and 5540 if their clinical option is community mental health. All courses taken in other colleges must be approved in advance by the student's faculty advisor.

REQUIREMENTS FOR SECOND MASTER'S DEGREE

1. Students must complete 60 hours at the graduate level (with a cumulative GPA of 3.0) unless they already have Master's or doctoral degrees. For the latter up to 15 hours may be applied to the second Master's degree, with approval of the student's committee, Dean of the College, Dean for Graduate Studies and/or Vice Chancellor for Graduate Studies and Research.

Any hours so applied would be from courses in the first degree program that are directly relevant to the second. Hours from the first program to be applied to the second shall have been earned within the time limits (six years) established for the second.

Reduction of hour requirements, when appropriate, will not be used to reduce the residency requirements of the second Master's degree.

2. The 45 to 60 hours must include the following components:
Courses

4240 Nursing in Acute Care Settings (5) Theory and clinical practice related to care of hospitalized children and adults who require acute care in hospital settings. Open only to MSN candidates lacking undergraduate major in nursing; others with consent of instructor. Prereq: Completion of 2000 and 3000 level nursing courses. 3 hrs and 2 labs. Su

4260 Community Mental Health Nursing (5) Theory and clinical practice related to care of clients whose primary actual or potential health problem is psychosocial or developmental; strong family and community orientation with emphasis on mental health care for children. Open only to MSN candidates lacking undergraduate major in nursing; others with consent of instructor. Prereq: Completion of 2000 and 3000 level nursing courses and 4200; Coreq: 4210. 3 hrs and 2 labs. Sp

4280 Nursing the Child Bearing Family (5) Theory and clinical practice related to care of clients and their families in varying stages of childbearing and child rearing, normal and abnormal states. Open only to MSN candidates lacking undergraduate major in nursing; others with consent of instructor. Prereq: All required 2000 and 3000 level nursing courses. 3 hrs and 2 labs. Sp

4330 Nursing in the Specialties (2-4) Application of principles from behavioral, physical, social and nursing sciences to solution of nursing problems. Exploration of nursing intervention needed to maintain or restore health and function of clients experiencing acute episodes and related crises. Prereq: Completion of selected physiological and/or behavioral deviations. Specific topics to be determined by faculty and student. Prereq: All required 2000 and 3000 level nursing courses and 4200; Coreq: 4210. 3 hrs and 2 labs. Sp

4350 Oncology Nursing (3) In-depth exploration of the cancer problem, medical and nursing intervention. Relates cellular kinetics to theories of carcinogenesis and metastasis, and examines treatment modalities and nursing intervention employed in the treatment of cancer. Prereq: Consent of instructor. Prereq: 5020 and 5030. 4 hrs and 2 labs.

4360 Primary Care Nursing (3) Exploration of role of pediatric clinical nurse specialist in assisting adults and their families to optimal health; application of advanced nursing, physiological, developmental, and psychosocial theories to delivery of health and nursing care to adults and their families who are experiencing acute and chronic illness episodes and related crises. Prereq: Completion of 2000 and 3000 level nursing courses. 3 hrs and 3 labs. Su

5103 Independent Study in Nursing (1-4) In-depth exploration of a nursing topic of special interest to the student. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs. E

5120 Secondary/Tertiary Nursing of Adults I (6) Role of clinical nurse specialist in assisting adults and their families to optimal health; application of advanced nursing, physiological, developmental, and psychosocial theories to delivery of health and nursing care to adults and their families who are experiencing acute and chronic illness episodes and related crises. Prereq: Completion of 2000 and 3000 level nursing courses. 3 hrs and 3 labs. Su

5130 Secondary/Tertiary Nursing of Adults II (6) Continuation of 5120 with further exploration of role of clinical nurse specialists; application of theories and concepts to delivery of health care to adults with emphasis on analysis and utilization of nursing and health related research findings in delivery of health and nursing care. Prereq: 5020, 5120. Prereq or coreq: 5120. 3 hrs and 3 labs.

5140 Secondary/Tertiary Nursing of Children I (6) Exploration of role of pediatric clinical nurse specialist in assisting children and their families to optimal health; application of advanced nursing, physiological, developmental and psychosocial theories and techniques useful in assisting children and their families who are experiencing acute illness episodes and related crises. Prereq: Completion of 2000 and 3000 level nursing courses. 4 hrs and 2 labs. Sp

5150 Secondary/Tertiary Nursing of Children II (6) Continuation of 5140 with emphasis on role of pediatric clinical nurse specialist in group and community health assessment and in client-staff education programs; exploration and utilization of community resources available to children and their families. Prereq: 5140 and 5010. Prereq or coreq: 5140. 3 hrs and 3 labs.

5170 Readings in Applied Physiology (3) Carefully planned library study of selected topics in physiology and pathophysiology related to various body systems. Prereq: Consent of instructor. Prereq: 4230. 3 hrs and 1 lab.

5210 Applied Nursing Research (4) Utilization of research process to identify and investigate common nursing problems; critical assessment of nursing research methods and literature; development and critique of nursing research proposals. Prereq: Completion of 2000 and 3000 level nursing courses and 4200; Coreq: 4210. 4 hrs and 3 labs.

5300 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter where 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/C only. E

5010 Applied and Pathophysiology (5) Advanced physiological theories and principles related to normal and abnormal function with particular emphasis on those processes which, when altered, are most commonly encountered in acute and chronic disease states. Prereq: 3210-20 or 4010 or consent of instructor. Su, F, Sp

5020 Current Health Issues (2) Weekly seminar dealing with current social, political, cultural, and community issues, concerns, and actions that have direct or indirect implications for nursing and health care. Prereq: Consent of instructor. Prereq: 5010, 5030, 5070. 4 hrs and 2 labs.

5400 Family Centered Primary Care Nursing I (6) Primary care nursing and health care management of individuals and families with acute and chronic illness episodes and related crises. Prereq: 5020, 5120, 5140 or coreq: 5020, 5450. Prereq or coreq: 5120. 4 hrs and 2 labs.

5480 Community Mental Health Nursing: Individual (3) Application of nursing process within systems framework, to therapeutic intervention with individuals experiencing mental health problems; study of psychopharmacological issues; analysis of special clinical problems. Prereq: 5010, 5050, 5070, 2 hrs and 1 lab.

5490 Community Mental Health Nursing: Family (3) Application of nursing process, utilizing communication and therapeutic intervention, with families experiencing mental health problems; current models of family education. Prereq: 5020, 5480. Prereq or coreq: 5490. 2 hrs and 1 lab.

5520 Community Mental Health Nursing Field Work I (3) Clinical practicum in a community setting providing opportunities to apply mental health nursing knowledge in planned interactions with individuals and groups at primary, secondary and/or tertiary care levels. Community and mental health systems assessment. Prereq: 5510, 5410, 5520. 3 hrs and 3 labs.

5540 Community Mental Health Nursing Seminar I (3) Community mental health clinical specialist. Coreq: 5520. 3 hrs and 1 lab.

5590 Community Mental Health Nursing Field Work II (3) Clinical practicum for graduate student choosing functional concentration of advanced clinical practice. Objectives identified by student; specific learning and practice needs. Prereq: 5510 and 5530.

5640 Community Mental Health Nursing Seminar II (2) Identification of issues and problems involved in delivery of community mental health nursing care; further analysis and exploration of theories and concepts included in 5680 as they affect role of nurse as community mental health clinical specialist. Coreq: 5520. Prereq: 5580.

5650 Primary Care Nursing Field Work I (3) Placement in selected off-campus primary health care delivery site for purposes of applying newly acquired knowledge and developing clinical skills necessary to function as a nurse practitioner. Prereq: 5050, 5240, 5260. F

5660 Primary Care Nursing Field Work II (3) Continuation of 5650 with further emphasis on acquisition of specific knowledge and skills related to function more autonomously. Prereq: 5550. F

5670 Primary Care Nursing Seminar (3) Analysis and application of curricular and teaching methodologies, field placement with supervised role opportunities to provide both classroom and clinical instruction to undergraduate nursing students. Prereq: 6 hrs approved education courses or consent of instructor. 2 hrs and 3 labs. F, Sp

5680 Primary Care Nursing Seminar (3) Theories of leadership, motivation, power, conflict, authority, change and decision making and their application to advanced clinical nursing practice. Examination and analysis of role of nurse as health care provider.
and client—family advocate. Prereq or coreq: 5310 or 5550 or 5510.

5730 Management Strategies and Practicum (5) Analysis and application of managerial and supervisory theories and strategies; field placement in nursing service facility with supervised practice in nursing service administration. Prereq: 6 hrs approved management courses or consent of instructor. 2 hrs and 3 labs. Sp

5770 Special Topics (3) In-depth study of selected nursing topics, problems, or issues not covered in other courses. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
Graduate School of Biomedical Sciences

W. E. Barnett, Director
R. J. Preston, Associate Director

MAJOR

Biomedical Sciences

DEGREES

M.S., Ph.D.

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

The program of study, which incorporates a high faculty-to-student ratio, is based on intensive graduate courses supplemented by tutorial instruction, participation in a wide variety of seminars, and a heavy emphasis on communication skills, research training and independent study. The program encourages students to pursue graduate studies to the limits of their abilities. The School is not departmentalized, and, apart from certain basic requirements, each student's curriculum is planned to meet individual needs, with the aim of giving: (1) strength in the basic sciences; (2) perception of the biomedical sciences as a whole; and (3) experience and training in a chosen specialty.

The research areas available for Master's thesis and Ph.D. dissertation work are biochemistry, biophysics, carcinogenesis, genetics, and cellular, developmental and mammalian biology. Included are such subjects as immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation and environmental biology, virology, developmental biology, experimental pathology, microbial and mammalian genetics, mutagenesis, and problems of aging.

ADMISSION REQUIREMENTS

A Bachelor's degree or its equivalent is required. Students with M.S., D.V.M., or M.D. degrees are also encouraged to apply. Completed applications, Graduate Record Examination scores and letters of reference should be sent to the address below. The student will need previous training in biology, calculus, physics, and organic and physical chemistry. However, a course in physical chemistry is offered by the School in order to meet this requirement. t is recommended that deficiencies in meeting entrance requirements should be eliminated prior to entrance.

Requests for application forms, information on admission, financial support, and housing should be sent to:
Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences,
Biology Division, ORNL, Box Y, Oak Ridge, Tennessee 37830.

THE DOCTORAL PROGRAM

Requirements for the Ph.D. degree are:
1. Satisfactory (B grade or better) completion of the following core courses or their equivalent: Biochemistry (5110-20); Biophysics (5140); Genetics (5160); Molecular Genetics (5170); Cell Biology (5180-90); Mammalian Physiology (5200); and Statistics for Biologists (5740).
2. Three quarters of Biomedical Sciences Laboratory (5310-20-30-40).
3. Participation in at least one of the seminars during each quarter of residence after the first year is strongly recommended.
4. Satisfactory completion of formal advanced courses in the areas of the student's interests. The number and nature of the required advanced courses will vary depending upon the student's background and area of specialization.
5. Pass both written and oral comprehensive examinations.
6. A dissertation reporting the results of original and significant scientific research. A minimum of 36 quarter hours of course 6000 is required.
7. A final oral examination on the dissertation.

8. A formal seminar presentation of the dissertation research.

SPECIAL MASTER OF SCIENCE DEGREE PROGRAM

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

Requirements for the M.S. degree are:
1. Graduate credit or a proficiency in the following core courses: Biochemistry (5110-20); Cell Biology I (5180); Cell Biology II (5190); plus any three of the following four courses: Biophysics (5140); Genetics (5160); Molecular Genetics (5170); and Mammalian Physiology (5200). Additional credits may be obtained (6 to 15 credit hours) with electives.

The student will need previous training in biology, calculus, physics, organic and physical chemistry.
2. Forty-five credit hours of approved graduate courses including a minimum of 9 quarter hours for thesis (maximum 18 quarter hours of credit for course 5000).
3. For admission to candidacy: Completion of any required prerequisite courses and one quarter of graduate course work 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 approved faculty members upon admission to candidacy.
5. A thesis reporting results of original and significant scientific research.
6. Pass a final oral (or oral and written) examination as determined by the student's committee.

Full-Time Faculty

Professors: D. Billen, Ph.D. Tennessee; D. E. Olins, Ph.D. Rockefeller.
Associate Professor: F. H. Gaertner, Ph.D. Purdue.
Assistant Professor: N. W. Revis, Ph.D. Glasgow (Scotland).
### Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>Thesis (1-15) E</td>
<td></td>
</tr>
<tr>
<td>5070-80</td>
<td>Physical Chemistry (3, 3) Thermodynamics, phase equilibria; chemical equilibrium, electromotive force, surface chemistry, electrolyte solutions, kinetics, conductance, viscosity, diffusion.</td>
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</tr>
<tr>
<td>5110-20</td>
<td>Biochemistry (3) Chemistry of carbohydrates, lipids, proteins, nucleic acids, and coenzymes; enzyme mechanisms of intermediary metabolism and photosynthesis; biosynthesis of amino acids, purines, pyrimidines, lipids, and macromolecules.</td>
<td>15</td>
</tr>
<tr>
<td>5140</td>
<td>Biophysics (3) Energy levels and excited states of large molecules; optical instrumentation; adaptations to system perturbations; properties of macromolecular solutions, solution behavior, inter- and intramolecular forces; physical principles of microscopy.</td>
<td>0-10</td>
</tr>
<tr>
<td>5150</td>
<td>General Genetics (3) Mendelian genetics, mitosis, meiosis, Transmission genetics, mapping, and linkage.</td>
<td>0-15</td>
</tr>
<tr>
<td>5160</td>
<td>Advanced Genetics (3) Genetics of phage, bacteria, and eucaryotes. Mapping, linkage, mutagenesis, cytoplasmic inheritance. Mechanisms of recombination, chromosome structure and replication.</td>
<td>0-15</td>
</tr>
<tr>
<td>5170</td>
<td>Molecular Genetics (3) Molecular biology of genetic processes. Gene regulation; coding; protein synthesis; suppression of missense and nonsense mutations; mutagen mechanisms; complementation; recombination.</td>
<td>0-30</td>
</tr>
<tr>
<td>5180</td>
<td>Cell Biology I (3) Structure and composition of major nuclear and cytoplasmic organelles of eucaryotic cells. Pertinent instruments and techniques; chromosome analysis; some structure; nuclear RNA metabolism; nucleoli and ribosome biogenesis; survey of specialized cells. Structure and transcription and translation in bacteria.</td>
<td>Coreq: 5110</td>
</tr>
<tr>
<td>5190</td>
<td>Cell Biology II (3) Comparative biochemical approach to cell structure and function. Membrane systems and metabolism; development and function of mitochondria, chloroplasts, peroxisomes and other organelles as related to metabolism and regulation; higher organisms, eucaryotic cell; cycle.</td>
<td>5110, 5180. Coreq: 5120</td>
</tr>
<tr>
<td>5200</td>
<td>Mammalian Physiology (4) Mammalian organ systems and their functions. Nervous, muscular, endocrine, digestive, respiratory, circulatory, reproductive, and excretory systems; interrelationships of these systems and fundamental importance of interactions in contemporary biological research.</td>
<td>0-15</td>
</tr>
<tr>
<td>5230</td>
<td>Biochemical Concepts in Medical Sciences (3) Biochemical mechanisms involved in physiological conditions and pathological processes of human body. Functions of organ systems, biochemical pharmacology; hormone actions; neurobiochemistry. Current biochemical advances in basic and clinical medicine.</td>
<td>5200, 5110-20</td>
</tr>
<tr>
<td>5210-20-30-40</td>
<td>Biomedical Sciences Laboratory (3, 3, 3) To acquaint students with both approaches and technologies in various areas of modern biology.</td>
<td>0-40</td>
</tr>
<tr>
<td>5220</td>
<td>Enzyme Regulation and Kinetics (3) Kinetics of catalysis, inhibition by product, substrate and deadend inhibitors; stimulation and inhibition of allosteric enzymes, biochemical feedback regulation; role of subunits in enzyme regulation; multifunctional enzymes.</td>
<td>5110-20</td>
</tr>
<tr>
<td>5240</td>
<td>Biochemistry of Lipids (3) Biochemistry of lipids and their functions in membranes, enzyme expression, and metabolism. Lipid biochemistry of mammals; comparative aspects, particularly lipid pathways in bacteria and yeast.</td>
<td>0-20</td>
</tr>
<tr>
<td>5251</td>
<td>Molecular Biology in RNA (3) RNA synthesis and metabolism in prokaryotes, eucaryotes, and their viruses.</td>
<td>5110-20 or consent of instructor</td>
</tr>
<tr>
<td>5252</td>
<td>Molecular Biology of DNA (3) DNA replication, repair, and recombination. Recent advances in mechanisms at molecular level using biochemical and genetic techniques.</td>
<td>5110-20 or consent of instructor</td>
</tr>
<tr>
<td>5270</td>
<td>Biomedical Sciences Seminar (1) Critical analyses of current journal publications in selected area of modern biology. Written evaluation of papers and weekly oral presentations by each student. Required of all first-year students.</td>
<td>5110-20-30-40</td>
</tr>
<tr>
<td>5280-30</td>
<td>Biomedical Sciences Laboratory (3, 3) Special advanced research project covering area not related to dissertation research. Topics chosen with consent of instructor. May be repeated.</td>
<td>0-60</td>
</tr>
<tr>
<td>5290-30</td>
<td>Biomedical Sciences Seminar (1) Special advanced research project covering area not related to dissertation research. Topics chosen with consent of instructor. May be repeated.</td>
<td>0-30</td>
</tr>
<tr>
<td>5300</td>
<td>Graduate Research Participation (3, 6) Selected advanced research project covering area not related to dissertation research. Topics chosen with consent of instructor. May be repeated.</td>
<td>0-90</td>
</tr>
<tr>
<td>5310-20</td>
<td>Doctoral Research and Dissertation (3-15) Original papers presenting new and lasting concepts in genetics.</td>
<td>5170</td>
</tr>
<tr>
<td>5320</td>
<td>History and Epidemiology of Cancer (3) History of viral oncolysis, descriptive catalog of tumor viruses. Biology of viral oncolysis, molecular and biochemical properties and behavior of tumor viruses; replication cycle; transformation; genetics; natural history. RNA tumor viruses; endogenous and exogenous virus genetics; induction; transformation; natural history.</td>
<td>0-15</td>
</tr>
<tr>
<td>5330</td>
<td>Cancer and Chemical Carcinogenesis (3) History and epidemiological considerations. Nature</td>
<td>0-15</td>
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and metabolism of chemical carcinogens. Radiation and site-specific carcinogenesis.

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) Basic mechanisms in chemical and radiation mutagenesis and dosimetry in variety of systems including bacteria, fungi, Drosophila, and mice.

6400 Membrane Biology (3) Transport kinetics, membrane biogenesis and turnover, endocytosis and exocytosis, receptor regulation, hormone-membrane biogenesis interactions. Prereq: 5110-20 and 5180-90 or consent of instructor.

6410 Techniques in Cell Biology (3) Application to specific research problems, kind of data they yield, and cautions in data interpretation. Laboratory demonstrations may be arranged where appropriate. Prereq: 5180-90 or consent of instructor.

6450 Immunology (3) Structured lectures in modern immunology and emphasis on concepts and mechanisms at the cellular level. Topics: T-B cell interaction, soluble mediators, tolerance, surveillance, transportation genetics, immunoglobulin structure. Selected laboratory exercises. Prereq: 5180-90 or consent of instructor.

6510 Advanced Topics in Biomedical Sciences (3, 3, 3, 3) Current and future research developments. Topics listed under Special Topics Courses, can be taken either as tutorials or as literature survey courses requiring substantial student participation. May be repeated.

6600 Mammalian Genetics (3) Orderly presentation of known genetics variants affecting each organ system of experimental mammals, especially laboratory mouse. Prereq: 5160.

6610 Mammalian Biochemical Genetics (3) Combined biochemical and genetic approaches to problems of immunology, globin synthesis, and control of enzyme synthesis. Prereq: 5110-20 and 5160 or consent of instructor.

6650 Microbial Genetics (3) Basic phenomena in microbial genetics: transduction, transformation, conjugation, and mutation. Genetics of bacteriophage. Prereq: 5160 or consent of instructor.

6750 Regulation of Intermediary Metabolism (3) Pathways involved in intermediary metabolism. Steady-state processes, "nonequilibrium" reactions, first enzymes, feedback inhibition, isozymes, multienzyme systems and compartmentation, covalent modification, positive and negative control, catabolite, repression, autoregulation, stringent control, attenuation, hormonal control, other selected topics. Prereq: 5110-20 or consent of instructor.
Graduate School of Library and Information Science

Ann E. Prentice, Director

MAJOR DEGREE
Library Science M.S.L.S.

The Graduate School of Library and Information Science provides a library education program leading to the preparation of librarians for work in all types of libraries. The programs of study of this School include the graduate curriculum leading to the degree of Master of Science in Library Science.

MASTER OF SCIENCE IN LIBRARY SCIENCE

The goal of the program is to prepare graduates to function effectively in libraries and information centers. The program is designed to:

1. Enable students to examine critically the role and function of libraries and information centers in our society, and to define and redefine that role as the needs of society demand;
2. Enable students to understand and use the concepts and procedures related to the selection, acquisition, organization, and dissemination of knowledge;
3. Enable students to understand and apply the principles of management to the library and information center;
4. Enable students to assume individual and collective responsibility for the well-being and development of their profession and of professional service;
5. Enable students to make informed assessments and decisions regarding various career opportunities in libraries and information centers.

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, 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, special libraries and information centers as well as a variety of library and information related activities.

The SREB Academic Common Market applies to applicants from Arkansas, Georgia, West Virginia, and Virginia.

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, and should provide three letters of recommendation (obtained from the Graduate School of Library and Information Science) should be returned to the Director of the School.

FINANCIAL ASSISTANCE OPPORTUNITIES

Employment with the University of Tennessee Libraries may provide a work-study opportunity for selected students who wish to obtain experience in academic librarianship while pursuing the degree. Such students usually work at least 20 hours each week and thus extend the period required for the degree up to two years.

Similar opportunities exist with some 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, Ph.D. Case Western Reserve.

Associate Professors:

Assistant Professors:
J. M. Pemberton, Ph.D. Tennessee; G. M. Sinkankas, Ph.D. Pittsburgh; M. S. Stephenson, M.L.S. North Texas State.

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 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 (6) Acquisitions, cataloging and maintenance of library collections.
4330 Introduction to Reference Materials (3) Basic information sources and services for all libraries.
4750 Utilization of Instructional Media (3) (Same as Curriculum and Instruction 4750 and Vocational-Technical Education 4750)
5000 Thesis (1-15) E
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student...
5110-20-30 Problems in Library Science (3, 3, 3)
May be repeated with consent of school.

5140 Research Methods in Library Science (3)
Research methods applicable to librarianship. Process and conduct of research; 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) English and non-English literature and bibliographical sources in education, economics, political science, history, geography, anthropology, psychology, and sociology; organization of collections for optimum use. Prereq: 5200.

5220 Sources and Services for the Natural Sciences (3) English and non-English literature and bibliographical sources in mathematics, physics, astronomy, chemistry, geology, biology and medicine; organization of collections for optimum use. Prereq: 5200.

5230 Sources and Services for the Humanities (3) English and non-English literature and bibliographical sources in literature and language, fine arts, music, philosophy and religion; organization of collections for optimum use. Prereq: 5200.

5240 Organization of Library Collections II (3) Construction and maintenance of library catalog as retrieval instrument; indexing and subject analysis theory, comparative classification with emphasis on Library of Congress system, and problems in reclassification. Prereq: 4270.


5260 Government Publications II (3) Acquisition, organization and utilization of publications of foreign governments and international organizations such as United Nations, UNESCO, and others.

5270 Legal Bibliography (3) Introduction to literature of Anglo-American jurisprudence. Use of reports, statutes, administrative regulations and decisions, treaties, periodicals, and indexes as bibliographic tools.

5300 Library Management (3) Management and organization concepts applicable to libraries and librarians.

5310 Multitype Systems and Networks (3) Organization, structure, governance, planning, evaluation, and services in state, regional, national, and international networking of information.

5330 Academic Libraries (3) Persistent and current problems. Topics vary depending upon needs and interests of group.

5350 School Libraries (3) Persistent and current problems. Topics vary depending upon needs and interests of group. Prereq: 4150 or consent of instructor.

5360 Special Libraries and Information Centers (3) Development and present status, scope and objectives, administration and organizational problems, acquisition, organization, and use of information.

5370 The Library in the Community (3) Public library as social agency; role in education and communication systems of community.

5380 Seminar in Library and Information Science (3) Advanced study of varied topics. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5400 Library Facilities (3) Problems inherent in planning and construction of library quarters; interrelationship of staff, materials, and user space requirements.


5510 Multimedia Resources of Libraries (3) Selection, acquisition, processing, storing, and servicing nonbook materials, with special attention to films, recordings, microforms, photo-copying.

5520 History of Books and Printing (3) Development of alphabet and writing; early writing materials; book in manuscript; history and technique of printing; book illustration and binding; standards of modern fine printing.

5530 Contemporary Publishing (3) Creation, production, marketing, and distribution of materials acquired by libraries, with special attention to various types of publishers.

5540 Special Collections—Archives and Rare Books (3) Problems involved in acquisition, organization, housing, preservation and utilization of rare books and archival materials.

5550 Records Management for Information Professionals (3) Functional elements and objectives of records management within organizations, emphasizing control of creation, distribution, retention, storage, retrieval, protection, and disposition regardless of medium. Prereq: 4330, 4270, or consent of instructor.

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 Narration (3) Fundamental principles of art storytelling; 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. Fifteenth 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 Advanced Production of Audiovisual Software (3) (Same as Curriculum and Instruction 5691.)

5700 Automation of Library Processes (3) Analysis of 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) Content and method of information science; application of research findings to general library practice.

5720 Information Systems Analysis and Design (3) Elements in 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 performance of systems to arrive at generalizations with respect to theory, design and operation of information retrieval systems.

5999 Practicum (6 or 9 or 12) Opportunity to translate library theory into practice under guidance of qualified librarians. Prereq: Completion of 21-hr core curriculum plus approval of director.
The Graduate School of Planning offers a two-year graduate course leading to a degree of Master of Science in Planning with concentrations in land use, transportation, environmental, regional, administrative, health, and historic preservation planning. The purpose of study is the education of professional planners, competent to handle positions of increasing technical and administrative responsibility. Graduates are candidates for professional service in regional, city, county, and metropolitan area planning agencies; in local, state, and federal agencies concerned with physical, economic and administrative planning; in private businesses and organizations dealing with urban problems; and in private consulting practices.

The curriculum is organized on a basis of six quarters, or 72 credit hours, and provides the student with core courses in planning theory, methods and techniques, and also takes advantage of offerings at The University of Tennessee in related fields such as government, economics, geography, civil engineering, and sociology.

The course of study ordinarily requires two years with an optional work internship during the summer between the two years. Planning courses as well as related courses will be offered during the summer period. This is to serve the needs of those planners now in the field who wish to acquire their professional degree but who can spare only the minimum amount of time from their jobs because of financial or family considerations.

Entering students follow a program of courses which provides education in the basic elements of planning. These include studies in theory, history, analytical methods, and legislation, as well as related courses in government, geography, sociology, and economics. Students are permitted to pursue particular interests through the choice of electives approved by The Graduate School.

DEGREE REQUIREMENTS

Each student will be required to complete a minimum of 72 hours credit. The following courses are the required core curriculum for the M.S.P. degree: 5040, 5045, 5100, 5110, 5130, 5180, 5230, 5270, 5280, 5340, 5435, 5440, 5465, 5500, Sociology 5320 or Statistics 5211. Waivers can be made by the faculty where competence is demonstrated. Each student will be required to demonstrate competence in individual research. This may take either of two forms. Plan I—Complete a thesis for 9 hours credit. Plan II—Complete a major study with acceptable documentation. In order to be eligible for the major study the student must have earned a grade of B+ or higher in Research Methods II, have a 3.5 cumulative grade point at the time of approval of the major study proposal, and have completed at least 24 hours of graduate study. The student meeting these criteria may present a proposal for a major study which will include at least 9 hours of elective course work in an area of concentration. The proposal shall justify the area of study, the approach to the study, and the method of final documentation. Approval of the documentation, which must include written documentation, is a prerequisite for graduation.

Students in the Graduate School of Planning are given a comprehensive written examination after approximately four quarters of course work. In addition to testing the knowledge of the student, the information thus obtained is 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:
- Ph.D. Missouri; A. Loebl.
- Ph.D. North Carolina; E. Bowen, M.A. George Washington.
- M.C.P. Harvard; J. A. Spencer, M.C.P. Ohio State.
- M.P. Michigan State; W. L. Shoupe, M.C.P. Harvard; J. A. Spencer, M.C.P. Ohio State.
- Associate Professor: G. E. Bowen, M.A. George Washington.

Assistant Professors:
- E. Cole, M.S.P. Tennessee; P. Fisher, Ph.D. Florida State; M. Kersey, B.L.A. Georgia; A. Loeb, Ph.D. Missouri; J. G. Stoiroff, M.J.P. Hunter.

Ph.D. Kansas; M. Kersey, B.L.A. Georgia; A. Loeb, Ph.D. Missouri; J. G. Stoiroff, M.J.P. Hunter.
Courses

4100 Survey of Planning (3) History of city development and of planning with special attention to the U.S. experience in urban and other levels of planning. State of the art, the process, the comprehensive plan, implementation devices. Planning issues in society. Not for credit for M.S.P. degree. F

5000 Thesis (1-15) E

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

5005 The Planning Process (3) Identification and examination of generic aspects of planning process and planning techniques applied in variety of settings. Not for credit for M.S.P. degree. F, Su

5040 Communications for Planners I (1) Introduction to basic communications, interpersonal and oral communications, graphic presentations, audiovisual equipment. F, Su

5045 Communications for Planners II (1) Graphic communications in planning. Use and application of computer graphics, models and presentation graphics. Prereq: 5040. W

5050 Communication for Planners III (1) Audiovisual equipment, programmed communication and photography used in planning. Prereq: 5045. Sp

5100 Theory of Planning (3) Analysis of nature and objectives of planning process; role of planner and planning function in public decision-making. Prereq: 5110. W

5110 Introduction to Planning (3) History of planning, familiarization with operations of contemporary planning, concept of systems, current trends and issues. Relationship between planning and sociology in which it occurs. Designed for GSP students. F, Su

5130 Planning Research Methods I (2) Research techniques in subject areas associated with city and regional planning. Research tools, data collection and analysis as basis for planning and decision-making. F, Su

5135 Planning Research Methods II (3) Application of rigorous investigation techniques in solving planning problems, including statistical analysis and mathematical models. Urban and regional information systems as resource and tool in problem identification and solution. Prereq: 5130. W

5145 Library Research for Planning (1) Survey of publications of interest to planners, including resources and research techniques. Use of facilities and collections of UTK Library. F, W

5160 Planning Seminar (3) (Same as Environmental Engineering 5160). F

5170 Planning for Historic Preservation (3) Planning for preservation, restoration and conservation of historic buildings, areas and sites as related to comprehensive planning process. National, state, and local government roles in preservation, designation of sites, legislative needs, financing and administrative organization. F

5180 Planning Analysis and Forecasting (3) Methods of quantitative analysis and modeling in urban and regional studies. Population, employment, and economic base studies with emphasis on forecasting techniques. Prereq: 5130. W

5230 Urban and Site Design (3) Principles of design of residential subdivisions and some components of physical community such as shopping centers, institutional complexes, central business districts. Problems of reviewing alternative designs against each other or written regulations. Extensive laboratory experience. E

5235 Urban and Site Design II (3-6) Prereq: 5230. W

5270 Planning and Transportation (3) (Same as Civil Engineering 5270). W

5300 Regional Planning (3) Making planning process operative in intergovernmental context. Theories of regions and analysis of metro planning, area planning, regional planning by states, single-purpose agency planning, and TMA. Prereq: 5100.

5310 State Planning (3) Evolution of planning function in state government, with emphasis on institutional environment in which planning occurs. Context and scope of state planning, and relationships with other branches and levels of government. Prereq: 5100.

5340 Implementation (3) Policy formulation, information systems, taxation, capital improvement programming, and other aspects of plan implementation. Programming public actions to affect development. Prereq: 5440. Su, F

5360 New Towns (2) Historical development of planned new towns and implications for national urbanization policy in United States; process by which new towns are created, from establishment of objectives to administration of development process and provision of public services; organizational alternatives for new town planning, development and management in context of past experience and future objectives. Prereq: 5110 and consent of instructor.

5380 Housing (3) Nature and demand for housing in U.S. and abroad with emphasis on U.S. experience. Private market processes and public influences. Problems of change in housing supply, impact of new technology, and governmental programs to improve supply and quality of housing. Coreq: 5110 or consent of instructor.

5390 Futures (3) Alternative futures and their implications for future living patterns and community planning. Techniques of futures research.

5410-20-30 Special Topics in Planning (1-3, 1-3, 1-3) Lecture, group discussion, and individual research and study on specialized topics in planning not covered in depth in other courses. May be repeated. Prereq: Consent of instructor. E

5435 Planning and Government (3) Governmental context within which planning occurs. Policy making as public process. Planning structures, powers, and policies. F

5440 Planning and Land Use Controls (4) Legal basis for planning and guiding community development. Exercise of police power and eminent domain. Development and administration of zoning, subdivision controls, and related devices. Prereq: 5435. Sp

5455 Urban Revitalization (3) Goals, principles and strategies for restoring and revitalizing cities. Review and analysis of historic, current, and proposed public and private programs aimed at urban revitalization. Physical building and restoration activities as related to financial and administrative requirements. Relationship between construction oriented activities and economic and social development programs is emphasized. Prereq: 5110 or consent of instructor.

5460 Planning Administration (2) Planning agency management, program development, and agency finance. Prereq: 5435.

5465 Planning and Property Development (3) Processes of urban physical growth and change with emphasis on functioning of private sector real estate development and its relationship to planning. Partnership roles of public and private sectors in urban development and redevelopment. Prereq: 5440.

5500 Synthesis (9) Problem-oriented experience to integrate knowledge from previous courses. Interrelationships stressed; student required to use judgment in evaluation and creation of plans and policies addressed to real world situations. Extensive laboratory experience. Prereq: Required planning courses or consent of faculty. F, W

5670 Social Planning (2-3) Theory, philosophy and implications of programs for planning social change. Consideration of major social planning issues in diverse fields of service; aging, corrections, education, health, social services. Prereq: Consent of instructor. (Same as Social Work 5670).
Graduate School of Social Work

Ben P. Granger, Dean
Betty J. Cleckley, Associate Dean
Ronald K. Green, Director, Continuing Social Work Education
David P. Fauth, Director, Nashville Branch
Roger M. Nooe, Director, Knoxville Branch
Kate Mullins, Director, Memphis Branch

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 School of Social Work has as its primary objective the education and training of persons for leadership in the social welfare profession and the social work practice community. Leadership roles include positions in social welfare administration, social planning and policy development, and positions as treatment team leaders, supervisors, consultants, and expert practitioners.

Central to professional leadership are a commitment to the values and goals of the profession and a developed capacity for self-awareness and self-discipline. The experience of a graduate professional education builds commitment, and the School's program guides students into independent, analytical thought and prepares them to use their skills and knowledge to effective purpose.

The School of Social Work recognizes and enjoys the challenge of cultural pluralism in society and encourages applications for admission from minority group members. Through the planned inclusion of significant and pertinent racial and ethnic content in the curriculum, the School provides students with the educational background needed to take creative roles in the social work profession's efforts toward the elimination of racism and such other social ills as poverty, crime, neglect, and social injustice.

A special bulletin describing the facilities, admission, fees, and degree requirements is obtainable from The School of Social Work, 2014 Lake Avenue, Knoxville, Tennessee 37916.

AREAS OF PROFESSIONAL PRACTICE

Specializations within the School's curriculum prepare students for social work careers in such practice fields as criminal and juvenile justice systems; family and child welfare services in public and voluntary agencies; group services in neighborhood and community centers; health services; mental retardation; public welfare services; mental health services; manpower training programs; governmental and voluntary human services planning agencies; rehabilitation services; school social work; and social gerontology.

THE PROFESSIONAL CURRICULUM

The School of Social Work's curriculum is designed to provide the student with the basic components of professional competence through a progression of course work and supervised practice experience. Students may elect a thesis or non-thesis option. The two-year, six-quarter program includes a core curriculum, a specialization in one of two areas—social work treatment or social welfare administration and planning—and concurrent field practice.

The Core Curriculum

The core curriculum is offered during the first two quarters of the first year and is required of all students. It is a 30-quarter-hour sequence of five basic courses. As the initial phase of the School's educational program, the core curriculum contributes to the process of socialization and professional identification, and presents students with a comprehensive and broad knowledge base from which to operate in the future as practitioners and administrators.

Credit Hours

Fall Quarter, First Year
5070 Social Work Research I 3

Winter Quarter, First Year
5110 Social Welfare Policy and Services I 3
5210 Human Behavior and Social Environment I 3
5410 Social Work Practice I 3
5910 Field Practice 3

TOTAL QUARTER HOURS 15

Spring Quarter, First Year
5120 Social Welfare Policy and Services II 3
5220 Human Behavior and Social Environment II 3
5420 Social Work Practice II 3
5920 Field Practice 4

TOTAL QUARTER HOURS 15

The Specialization

The curriculum outlined below for the spring quarter, first year, and for the second year shows typical programs for students after they have completed the core curriculum. A student may earn 9 hours of elective credit through completion of a Master's thesis.

Spring Quarter, First Year
5930 Field Practice 4
Specialization Courses and Electives 10
TOTAL QUARTER HOURS 14

Fall Quarter, Second Year
Specialization Courses and Electives 12

Winter Quarter, Second Year
5940 Field Practice 8
Specialization Courses or Electives 2 or 3
TOTAL QUARTER HOURS 10 or 11

Spring Quarter, Second Year
5950 Field Practice 8
One Elective 2 or 3
TOTAL QUARTER HOURS 12 or 13

AREAS OF SPECIALIZATION

Social Work Treatment

Social work treatment deals with those individual, family, and group methods utilized to enhance the social functioning of individuals and effectively ameliorate problems of social dysfunction. The specialization attempts to develop a thorough
Field Practice
Field practice is a critical component of the student's first- and second-year program. Because the School of Social Work cooperates with a wide range of social agencies, students are provided with field placement opportunities in the principal cities in Tennessee and areas immediately adjacent to the State, the School is able to provide field placements in a variety of social work practice areas. The faculty works closely with the placement agency and the field instructor to assure that the student has a quality field practice experience which meets the objectives of the core curriculum and the specialization.

The first-year curriculum is on a concurrent class and field plan, with students engaged in classroom study two or three days per week and in field practice the remainder of the week. First-year agency placements are selected to provide the student with practice experiences related to the core curriculum content and beginning specialization. Within the placement, each student's experiences are planned and designed according to the educational needs.

In the second year, students are engaged full time in classroom courses during the fall quarter. The winter and spring quarter plans consists of a block field placement of four days per week and at least one concurrent classroom course each quarter. Second-year placements are selected according to the student's area of specialization, individual career interests, and educational needs. The student actively participates with the field practice coordinator and the specialization committee in the selection of the second-year field placements. The second-year field practice experience focuses on the integration of social work knowledge and values, and emphasizes the acquisition and development of full practice skills.

Students are responsible for meeting the requirements of their placement agencies in terms of office hours and workload coverage. This responsibility takes precedence over scheduled University breaks and may result in variations in holidays and office hours for the student.

DEGREE REQUIREMENTS
1. Satisfactory completion of the curriculum.
2. All courses taken as part of the degree programs, whether taken with the School of Social Work or elsewhere, must be acceptable for graduate credit, relevant to social work and to the student's career objectives, and have the approval of the student's faculty advisor.
3. Achievement of a B average on all work presented for the Master's degree.
4. Completion of each required course at a satisfactory level (a grade of C or above). Graduate courses may not be repeated to raise a grade.
5. Students who elect a thesis must pass an oral examination conducted by a faculty committee.
6. Students who elect a non-thesis option must pass a written comprehensive examination.
7. Credits to be counted toward the degree must be earned within six years from the beginning date of course applied toward the degree, except in cases where permission to update courses has been granted.
8. The minimum number of credit hours required for a degree shall be 78 hours including a maximum of 36 S/CN hours.
9. Performance at a satisfactory level in field practice, which is designed to teach professional practice skills.

ADMISSION REQUIREMENTS
Admission to the professional curriculum is based on the following requirements:
1. A Bachelor's degree from an accredited college or university with some preparation in the social sciences. At least three-fourths of the applicant's undergraduate work should be in the social sciences, humanities, physical sciences, and other liberal arts subjects. Those with other academic backgrounds may request consultation regarding ways in which they might be admitted.
2. A grade point average of 2.5 on a 4.0 scale, with those falling below the average to be admitted on supplemental evidence of ability to perform at a satisfactory level.
3. Personal qualifications acceptable for entrance into the professional practice of social work.
4. Preference is given to applicants with a B average in undergraduate work and substantial preparation in the social sciences. Applications should be filed no later than March 1 for the year in which admission is desired.

THE ADMISSIONS PROCESS
Individuals who wish to be considered for admission should obtain the required application materials from the Office of Admissions, UT School of Social Work, 2014 Lake Avenue, Knoxville, TN 37916, telephone (615) 974-3175. Beginning students are admitted only in the fall quarter. The Admissions Office begins processing applications after October 1 for the following fall quarter. Applications for first-year admission should be filed as early as possible. A minimum of six weeks should be allowed for consideration of the application.

Students intending to apply for financial aid are encouraged to apply for admission to the School as early as possible. By doing so, students should be able to meet financial aid application deadlines, many of which are April 1 for September funding.

To apply for admission, applicants should forward the completed Graduate School Application and payment of a nonrefundable $10 application fee to the Graduate School Office, The University of Tennessee, Knoxville. The university of Tennessee's two official transcripts of all undergraduate, graduate, and extension work (except work taken at The University of Tennessee, Knoxville) should be sent to the Graduate School Office immediately after filing the Graduate School Application.

The completed University of Tennessee School of Social Work Application and three reference forms should be returned to the Admissions Office of the School of Social Work.

If a personal interview is required by the School, the applicant will be contacted by a representative of the School and arrangements will be made concerning a time and place. Applicants who wish to may also request a personal interview with a faculty member.

ACCELERATED PROGRAM
The University of Tennessee School of Social Work has a special accelerated program which enables eligible candidates to complete the M.S.S.W. degree in four quarters. 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 of full-time practice in the field of social work.
3. Pass a qualifying examination administered by the School of Social Work faculty in early spring.

The accelerated programs begin either in the Memphis Branch in March or in the Nashville Branch in June with an intensive ten-week term from which students proceed in the fall into the regular second-year curriculum. Application for admission to the accelerated program is through the regular admission process. Applications should be filed not later than December 31 for the Memphis program and not later than January 31 for the Nashville program.

PART-TIME STUDENTS
Courses in the regular curriculum of the School are open to persons who meet the admission requirements for full-time study and who are planning to complete the work for the degree within the next two or three years. Application should be made to the School in the regular way, but the applicant should inform the Director of Admissions of the wish to begin part-time study on a planned basis.

TRANSFER CREDITS
Courses completed in another accredited school of social work are usually accepted for The University of Tennessee School of Social Work degree requirement providing the applicants meet the admission requirements of the Graduate School and The University of Tennessee School of Social Work, and if previous courses are equivalent to required or elective courses offered here. The University of Tennessee School of Social Work allows a maximum of 45 credit hours of graduate course work taken at another accredited institution to be transferred into the student's Master's program. Such work must have been taken for graduate resident credit and passed with a B or better. In addition, it must be part of an otherwise
Graduate School of Social Work

satisfactory graduate program (B average) and be approved by the branch director and the dean. This course work must be completed within the six-year period prior to the receipt of the degree. In addition, SNC credit earned for the field practicum is also acceptable.

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.

Faculty

**Professors:**
- M. H. Block, M.S.S.W.
- R. C. Bonovich, D.S.W.
- G. W. Fryer, Ed.D.
- B. P. Granger, Ph.D.
- D. K. Mullins, Ph.D.
- G. Mclaman, M.S.S.W.
- B. E. Orchard, M.S.S.W. (Emeritus)
- S. W. Spencer, M.S. (Emeritus).

**Associate Professors:**
- G. W. Ayers, D.S.W.
- L. M. Beasley, D.S.W.
- B. E. Bissett, Ph.D.
- D. R. Falcon, Ph.D.
- P. P. Faux, Ph.D.
- A. J. Fisch, Ph.D.
- E. J. Fried, Ph.D.
- D. P. Kurtz, Ph.D.
- E. K. Marshall, Ph.D.
- P. Hess, M.A.
- K. Hirayama, M.S.W.
- P. A. Knighton, Ph.D.
- C. F. Lowry, Ph.D.
- A. M. M. Harkleroad, M.S.S.W.
- W. D. Harrison, Ph.D.
- I. C. Faust, Jr., M.S.S.W.
- H. J. Hess, M.A.
- P. J. Haynes, Ph.D.
- A. J. Hirayama, M.S.W.
- P. J. Janikovc, M.S.S.W.
- D. C. Johnston, M.S.W.
- M. A. Knighton, Ph.D.
- C. F. Lowry, M.S.W.
- I. C. Faust, Jr., M.S.S.W.
- P. P. Poppel, Ph.D.
- M. P. Strong, M.S.W.
- H. P. Tate, M.S.S.W.
- C. S. Wilkes, Ph.D.

**Instructors:**
- R. C. Bonovich, D.S.W.
- H. E. Coyne, Jr., Ph.D.
- I. C. Faust, Jr., M.S.S.W.
- A. Ford, M.S.W.
- A. A. C. Hains, Ph.D.
- M. M. Harkleroad, M.S.S.W.
- D. W. Harrison, Ph.D.
- K. Haynes, Ph.D.
- H. J. Hess, M.A.
- P. Hess, M.A.
- K. Hirayama, M.S.W.
- M. J. Janikovc, M.S.S.W.
- D. C. Johnston, M.S.W.
- M. A. Knighton, Ph.D.
- C. F. Lowry, M.S.W.
- L. Michael, M.S.W.
- P. R. Poppel, Ph.D.
- P. M. Strong, M.S.W.
- H. P. Tate, M.S.S.W.
- C. S. Wilkes, Ph.D.

**Graduate Students:**
- P. R. Popple, Ph.D.
- M. P. Strong, M.S.W.
- H. P. Tate, M.S.S.W.
- C. S. Wilkes, Ph.D.

Courses

5000 Thesis (1-15) E
- 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.

5070 Social Work Research I (3) Research methodology as applied to problems in the social welfare field. Prereq: Completion of core only. E
- May be repeated.

5080 Social Work Research II (3) Continuation of Social Work Research I. W
- May be repeated.

5081 Research Advanced research course. Topics include sociopolitical and organizational context of the social work role, development of research methods and utilization of research findings. Prereq: Completion of core or consent of instructor. Sp

5082 Practicum in Social Work Research (3) Supervised practicum in research methods and tools to social welfare program. Prereq: May be taken by faculty, students, or social welfare agency or organization. Prereq: 5070-80 and consent of faculty member conducting investigation. SNC only. Sp

5083 Directed Readings in Research (2-4) May be repeated with approval of instructor. Maximum 4 hrs. F, W, Sp

5090 Special Problems in Social Work (2-3) Individual study or research on problems of special significance to student's program, under supervision of major professor. May be repeated. F, W, Sp

5110 Social Welfare Policy and Services (1) Interests of social welfare policy development of contemporary social policy at local, state, national, and international levels of organization. Contributions of social work professionals can make to formal policies and practices. Micro- and macro-level social change is affected, and through which aggregate social welfare services are proposed, authorized, financed, analyzed, and evaluated. Policy must be focused on beginning skill development. F

5120 Social Welfare Policy and Services II (3) Examination of theories of complex organizations applied to social service delivery settings. Transformation of collective social welfare resources into divisible and indivisible social welfare benefits through organized institutional action of professional nature. W

5130 Social Policy Analysis (2-3) "Policy science" techniques are considered for appropriateness in assessing social policy and programs. Determination of social policies through substantive knowledge about social problem or condition and interrelationships among problem definition, social policy, and program development. Prereq: Completion of core or consent of instructor. Sp

5181 Social Welfare Seminar (2-3) Problem area or field of practice seminar focusing on substantive knowledge about social problem or condition and interrelationships among problem definition, social policy, and program development. Prereq: Completion of core or consent of instructor. Sp

5210-20 Human Behavior and Social Environment I and II (3, 3) Examination of theories pertaining to individual, family, and small group within context of their interaction in social roles and processes. Behaviors of these systems conceptualized along functional-dysfunctional and normal-deviant continuum. Organization of system, development, and system dynamics. Open system approach used to understand interrelationship of biological, psychological, and social variables with emphasis on implications of culture and ethnicity. F, W

5290 Special Accelerated Program in Social Work (19) Ten-week program provides beginning students intensive academic and field practice experience that qualifies them to enter second year of graduate study upon completion of this program. SNC only.

5310 Human Behavior and Social Environment (3, 3) Explores the nature of the human being and its environment and the role of the social worker in helping individuals, families, and groups to develop and maintain health and well-being. Prereq: Second-year status. May be repeated. Max 9 hrs.

5311 Imaginative Perspectviews on the Human Condition (2-3) Introduces students to the social work perspective of human beings as they are perceived, the limits and possibilities of human existence, and the nature of human experience in general. Prereq: Second-year status. May be repeated. Max 9 hrs.

5312 Psychopathology and Social Deviance (2-3) Theories of recent research and research in the social work discipline. Theories of psychological and social variance. Characteristic of clients responsive to social work intervention. Combines class-lecture, methodology and skills development fundamental to social work intervention. Combines class-lecture, methodology and skills development fundamental to social work intervention. Combines class-lecture, methodology and skills development fundamental to social work intervention. W

5313 Deviant Behavior of Children and Youth (2-3) Deviant behavior and conduct disorders in children and youth, etiology, symptomatology, and range of social services and treatment modalities. Prereq: Completion of core or consent of instructor. F

5314 Comparative Theories of Personality (2-3) Those personality theories that are most relevant for social work practice with individuals, groups, and families. Prereq: Completion of core or consent of instructor. W

5315 Human Sexual Problems (2-3) Desensitization and resensitization of personal and social attitudes toward sexual behavior, clinical problems and approaches to make social workers better able to deal with patients with sexual problems. Prereq: Completion of core or consent of instructor.

5316 Mental Health and Employment (2-3) Work as major life task and value, attitudes toward work, patterns of employment and unemployment. Case concepts of mental health and the role of social work in mental health. Prereq: Completion of core or consent of instructor.

5317 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. W

5320 Social Work Practice II (3) Assessment, planning, methodology and skills development fundamental to social work intervention. Combines classroom skills and laboratory experiences. W

5340 Family Therapy in Social Work Practice (2-3) Application of practice theory to assist in acquisition of skills in family therapy. Prereq: Completion of core or consent of instructor.

5341 Transactional Analysis (2-3) Philosophy, theory, and therapeutic technique of transactional analysis. Lectures, discussion, and experiential methods facilitate acquisition of knowledge and skills to use transactional analysis as treatment modality. Prereq: Completion of core or consent of instructor.

5342 Short-term Treatment (2-3) Theory and practice of short-term treatment focusing on nature of methods, characteristics of clients responsive to this approach, and design of programs providing short-term treatment services. Specific techniques of assessment and treatment applied to practice with individuals and families. Prereq: Completion of core or consent of instructor. W

5433 Seminar on Behavior Therapy (2-3) Behavior modification methodology applied to clinical assessment, planning, and intervention. Principles and techniques of treatment interventions, skill in evaluating data on effectiveness of treatment interventions. Prereq: Completion of core or consent of instructor. May be repeated. Maximum 6 hrs. Sp

5444 Social Work Practicum with the Poor (2-3) Problems, issues, and dilemmas of practice in social services with poor and attributes of service-delivery systems which make that practice possible. Prereq: Completion of core or consent of instructor.

5460 Social Work Practice with Individuals and Families (3) Social work, social casework, social service work as a method of social work practice and as part of interpersonal relationship. Prereq: Completion of core or consent of instructor.

5470 Contemporary Treatment Modalities: Individual and Family (2-3) Well-established and developing treatment modalities in essential characteristics of case concepts, differential treatment interventions, and in evaluating data on effectiveness of treatment interventions. Prereq: Completion of core or consent of instructor.

5480 Special Topics in Social Work Practice (2-3) Advanced study of specific special topics in social work practice. Prereq: Completion of core or consent of instructor. May be repeated. Maximum 9 hrs. F, W, Sp

5560 Social Work Practice with Groups (3) Development of knowledge and skill in use of group methods in social work practice; organization and functioning of group, structuring group tasks and experiences, understanding and-enhancing group functioning, enabling problem-solving effectiveness, facilitating change and development of individual and group effectiveness. Prereq: Completion of core or consent of instructor.

5581 Interpersonal Skill Development (2-3) Training group employed to enhance interpersonal competence in application of human relations skills in social work practice. Prereq: Completion of core or consent of instructor.

5570 Comparative Methods of Group Treatment (2-3) Comparative analysis and critical review of theory and methodology of some of major group treatment approaches and modalities. Promotes leadership, techniques and procedures, and research. Prereq: Completion of core or consent of instructor.
5601 Social Work in Rural Communities (2-3) Characteristics of rural populations and rural community and regional analysis of rural social services and delivery systems. Development of social work generalist concept and occupational function in rural areas. Prereq: Completion of core or consent of instructor. W

5661 Community Organization (2-3) Using behavioral and social science knowledge about communities and organizations to assist in development of programs to meet human needs. Prereq: Completion of core or consent of instructor. W

5670 Social Planning (2-3) (Same as Planning 5670.) F

5671 Planning and Management of Change in Social Welfare (2-3) Theories and models of change such as planned change, conflict, and evolutionary change in relation to organizational change, community improvement, locality development, and economic development related to social welfare services. Prereq: Completion of core or consent of instructor.

5701 Administration in Social Work (2-3) Introduction to administrative practice as it relates to social work purpose and values and development of administrative principles that make possible effective provision of welfare services.

5702 Organizational Design of Social Welfare Agencies (2-3) Critical problems of adapting organizational structure and operational patterns to new tasks, objectives, and mandates. Planning and design techniques for new programs and for modification of existing programs for appropriate deployment of resources and personnel for maximum effectiveness and efficiency. Integration of theory and experience for development of administrative skills for coping with variety of situations. Prereq: Second-year administration or community organization students, or consent of instructor; 5761 or equivalent.

5741 Supervision in Social Work (2-3) Dual roles of supervisor in various settings, and supervision distinctions from consultation. Responsibility and accountability to client system, supervisee, and executive, problems of middle management position of supervisor. Differences and similarities in supervision of varying levels of personnel. Goals, tasks, techniques, and processes in individual and group supervision and field instruction. Prereq: Second-year status or consent of instructor.

5742 Consultation in Social Work (2-3) Consultation roles, relationships, and behaviors required of consultant. Consultation as distinguished from supervision, administration, and direct practice. Types of consultation in relation to various settings and levels of responsibility. Processes and practices of consultation and dilemmas and pitfalls of consultant's position. Prereq: Second-year status or consent of instructor.

5743 Management of Human Resources in Social Welfare (2-3) Personnel function in administration of human services programs and agencies. 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. W

5744 Education and Training in Social Welfare (2-3) Philosophies and practices of teaching and learning related to adults in social work and social welfare. Distinctions between teaching and learning, training and education; unique aspects of adult learning; measurement issues; models and styles of education. Prereq: Completion of core or consent of instructor. W

5745 Professional Leadership in Social Work (2-3) Leadership in social welfare. Theories of leadership; complexity of leadership; function, effectiveness, and satisfaction of leaders; leadership styles, values, motivation and morale; and leadership development. Prereq: Outline of analysis of social rural programming. Prereq: Completion of core or consent of instructor. W

5761 Social Welfare Administration and Planning (3) Topics significant to managerial-planner role such as decision making, budgeting, planning, and