

Assistant Professors: D. A. Hendricks, Ph.D., Alabama; W. L. Russell, Jr., Ed.D., Homestead; A. M. Virginia; C. A. Washburn, Ph.D., Maryland; P. D. Wiley, Ed.D., Houston; S. J. Wynn, M.S., Tennessee.

Graduate programs are designed to improve scholarship and educational accomplishment in a number of areas related 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, and 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, elementary education, English education, foreign language education, instructional media, 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 48.

For further information, write the Department of Curriculum and Instruction.
5262 Teaching Science in the Elementary School (3) Critical examination of literature and current trends in content. Prereq: Consent of instructor.

5283 Problems and Materials in Teaching Elementary Science (3) Analysis of new and innovative science program materials; methods of divergent and convergent evaluation in instructional program. Prereq: 3720 or equivalent, or consent of instructor.

5284 Seminar in Teaching Elementary Science (3) Analysis of current curricular issues. Prereq: 5280 or 5281, at least one year teaching experience; or consent of instructor.

5290 Teaching of Mathematics in the Elementary School (3) Trends in methods, materials, and content. Not available for credit to persons completing recent elementary mathematics course. Prereq: Consent of instructor. F, Su

5291 Programs and Materials in Elementary School Language Arts (3) Programs and special instructional materials in language arts. Prereq: 3260 or equivalent, or consent of instructor.

5292 Seminar in Research and Theory in Teaching Mathematics in the Elementary School (3) Examination of research and theory and their application to teaching of mathematics. Prereq: 3350 or equivalent, consent of instructor, and 1 yr of teaching experience. Su

5301 Developmental Reading in the Elementary and Middle School (3) Methods and materials, basic approaches, examination of reading skills, development of functional relationships with other curricular areas. Not available for credit to persons with recent course in reading education. Prereq: Consent of instructor.

5302 Psychology of Reading (3) The reading act, related approaches to assessing and correcting language and reading problems, role of reading in child's overall intellectual development. Prereq: Undergraduate reading course or consent of instructor.

5303 Methods and Materials for Teaching Critical Reading (3) Instructional techniques, methods, and materials for development of higher level comprehension skills, concepts, and attitudes for creative (or productive) and critical (or evaluative) reading. Prereq: Course in reading education or consent of instructor.

5304 Programs and Materials for Reading Instruction (3) Design and development of instructional reading materials for learning disabled, selected, and/or gifted students. Prereq: Course in reading instruction or consent of instructor.

5305 Trends and Issues in Teaching Reading (3) Differentiation of issues and trends through analysis of past, present, and future programs, materials, and developments. Prereq: Graduate course in reading education or consent of instructor.

5308 Teaching Reading to the Linguistically Different Learner (3) Language characteristics and special reading problems pertaining to linguistically different learner. Prereq: Course in reading education or consent of instructor.

5307 Assessment and Correction of Classroom Language Arts Difficulties (3) Classroom approaches to assessing and correcting language arts (other than reading) difficulties. Prereq: One graduate level course in elementary school language arts or consent of instructor.

5350 Curriculum Development and Evaluation (3) Examination of alternative approaches to improve current practice. Prereq: 5580 or consent of instructor.

5350 Curriculum Development at the Local Level (3-0) Systematic approach to planning and development of curriculum at local school or system level. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

5355 Mathematics Laboratories in Elementary Schools (3-0) Facilities and equipment for teaching mathematics; dealing with activity-oriented mathematics laboratory materials and pedagogical strategies. Theoretical and practical considerations of development and materials for laboratory. Prereq: Consent of instructor. Sp, Su

5379 Diagnosis and Correction of Classroom Reading Problems (3) Methods, concepts, strategies, and materials. A student who has completed 4280 may not enroll without consent of instructor. Prereq: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 6 hrs.

5380 Practicum in Diagnosis of Reading Problems (3) Application of principles of learning and teaching methodology in working with elementary and/or secondary school students preparing for classroom teaching. Prereq: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 6 hrs.

5381 Practicum in Remediation of Reading Problems (3) Theoretical and practical applications of specific reading diagnostic instruments; testing of elementary and/or secondary school students on one-to-one or small group basis. Prereq: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 6 hrs.

5382 Developmental Reading Practicum (3) Diagnosing and planning instruction for elementary and/or secondary school students in reading; emphasis on techniques, problems, and insights in our society. Prereq: Consent of instructor.

5400 Problems in Improvement of Instruction (1-3) Special conferences, workshops, and inservice programs. Prereq: Minimum 9 hrs. S/NC only.

5410 The High School Curriculum (3) Characteristics of programs of local, regional, and national significance. Prereq: 5580 and 5909 or consent of instructor.

5510 Education in Cultural Perspective (3) Evaluation of trends in programs of local, regional, and national significance. Prereq: Consent of instructor.

5511 Non-Western Education: Anthropological Approaches (3) Prereq: Anthropology 5510.

5570 The Junior High and Middle School Curriculum (3) Course design and pattern of interaction with other curricular areas. Prereq: Consent of instructor.

5690 Design of Instructional Media (3) Design and development of instructional materials and media, role as identified by student in various educational roles. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5692 Evaluation of Instructional Media (3) Evaluating and recycling media prototypes to meet needs and objectives of learners. Prereq: 5691 or consent of instructor.

5693 Administering Instructional Media Programs (3) Duties, functions, and responsibilities of persons involved in preparing materials and media programs developing and administering media program in various organizational and learning settings. Prereq: 5691, 5692, or consent of instructor.

5694 Utilization of Educational Television and Radio (3) Use of noncommercial educational TV and radio in schools and colleges. Prereq: Consent of instructor.

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

5696 Practicum Experience in Instructional Media (3) Practicum experience in professional media role as identified by student in various organizational and learning settings. Prereq: Consent of instructor.

5697 Application of Instructional Media (3) Media theory and research, newer media and technology, application of media in instructional settings. Prereq: Consent of instructor.

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

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

5790 Career Development: Workshop (1-6) (Same as Anthropology 5799).

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

5810 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. Prereq: Consent of instructor.

5820 Seminar in the Teaching of Mathematics (3) Current methods and materials for grades 7-12 for experienced teachers. Prereq: 1 year teaching experience (mathematics grades 7-12) or consent of instructor. Sp

5825 Teaching Mathematics in the Middle and Junior High School (3) Problems related to teaching mathematics in middle and junior high schools. Understanding structure of mathematical concepts, strategies, and materials for teaching. Problems suitable for individualized instruction, mathematical laboratories, and independent study. Opportunities for individual projects. Prereq: 3350 or 3751-52 or equivalent.

5830 Seminar in Mathematics Education (3) Current curricular issues. Emphasis on individual student projects and investigation.
5160-90-200 Educational Specialist Research and Thesis (3, 3, 3) P/NP only; E

5220 Philosophy and Theory in Educational Administration (3) Philosophical and theoretical foundations of educational administration, programs, and institutions, within the framework of American culture. F, Sp, Su

5230 Seminar in the Behavioral Sciences in Educational Administration (3) Key behavioral science concepts and their application in administration such as semantics, communication, leadership, change processes, organizations and organizational behavior, motivation and morale, role theory. Sp, Su

5290 The Politics of Education (3) Special emphasis on leadership structures, operational beliefs, and communication of ideas with regard to community decisions concerning education. F, Sp, Su

5310 School Administration and Civil Rights Issues (3) To help school administrators meet responsibilities and resolve problems stemming from civil rights legislation pertaining to race, sex, and the handicapped. A

5420 District Level Administration (3) Role of central administrative team, and relationships, behaviors, and competencies to develop an effective school organization. F

5430 Building Level Administration (2) For beginning school principals and administrators, and for those operating in rural elementary, secondary, or consolidated schools. W, Su

5440 Introduction to Law, Finance, and Business Management at the Building Level (3) Orientation for beginning principals for basic foundations of the American legal system; how case law affects daily building level operations; building level methods of fiscal and logistical support measures. Sp, Su

5450 Organization of the School Program (3) For principals and supervisors; conceptual and technical skills in organizing school program including curriculum, instruction, student grouping, staff, schedules, and space. F, Su

5460 Personnel Administration: Local School (3) Planning personnel needs; job analysis; recruitment; selection; placement; orientation of new staff; fair employment and dismissal; and contract administration for both professional and supporting staff. F, Su, Sp

5470 Introduction to School Facility Planning (3) For school administrators: facility planning; skills in building planning, use and evaluation. F, Su

5480 Instructional Supervision—Local School (3) Developing a concept of supervision; instructional help, support, and service for teachers; supervision of curriculum; staff development; and staff evaluation. F, Sp, Su

5530 Introduction to Educational Planning (3) Processes for improving decision-making function through both quantitative and qualitative planning techniques. Relating educational policy analysis to educational planning. W, Su


5550 Research for Educational Administrators (3) Descriptive, experimental, and quasiexperimental designs to help student without quantitative background to read and understand technical literature. Primarily for nonthesis option students. Should be taken early in M.S. or Ed.S. program. W, Su

5560 Seminar in Communication Skills for Educational Administrators (3) Identification, development and improvement of interpersonal and group related communication skills. F, Sp, Su

5711 Problems in Educational Administration and Supervision: School Operation (3) May be repeated. E

5712 Problems in Educational Administration and Supervision: Higher Education (2) May be repeated. E

5713 Problems in Educational Administration and Supervision: State School Administration (3) May be repeated. E

5714 Problems in Educational Administration and Supervision: Preparation Programs (3) May be repeated. E

5715 Problems in Educational Administration and Supervision: Community Education (3) Independent study of administrative problems. May be repeated. E

5751 Problems in Educational Administration and Supervision: Theory (3) May be repeated. E

5752 Problems in Educational Administration and Supervision: Finance (3) May be repeated. E

5753 Problems in Educational Administration and Supervision: Transportation (3) May be repeated. E

5754 Problems in Educational Administration and Supervision: Business Management (3) May be repeated. E

5755 Problems in Educational Administration and Supervision: Personnel (3) May be repeated. E

5756 Problems in Educational Administration and Supervision: School Law (3) May be repeated. E

5757 Problems in Educational Administration and Supervision: Organization and Structure (3) May be repeated. E

5758 Problems in Educational Administration and Supervision: School Law (3) May be repeated. E

5759 Problems in Educational Administration and Supervision: Supervision (3) May be repeated. E

5770 Maintenance of School Plants (3) Skills in operating school custodial and maintenance programs. W

5810 Survey Research Methods (3) Overview of descriptive studies, data collection, analysis, and interpretation for survey studies and school surveys, strategies for descriptive research in education. F, Su

5850-60-70 Independent Study in Educational Administration (3, 3, 3) Prerequisite: Consent of instructor. E

5890 Decision Making and Decision Theory in Educational Organizations (3) Theoretical constructs undergirding executive decision theory problem-solving activities for preservice and practicing administrators. Executive decision making at several administrative levels in complex educational organizations. S/NC only. A

5900 Special Topics (3) May be repeated. E

5910-20-30 Problems in Lieu of Thesis (3, 3, 3) S/NC only. E

5950 Elementary Administrators Seminar (3) For in-service training of elementary school administrators. Developments, problems, programs, and trends of elementary schools and management skills of elementary school administrators. Prerequisite: 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. Developments, problems, programs, and trends of middle schools and management skills of middle school administrators. Prerequisite: 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 of 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. E

6000 Doctoral Research and Dissertation (3-15) P/NP only. 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 repeated at discretion of student's committee. Opportunity for doctoral students and advanced graduate students to gain experience in performance of critical tasks of educational administration under supervision of practitioner and university representatives. E

6110 Administrator Update (3) Current topics of concern to practicing school administrators, selected over half 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, Su

6220 Programs for the Professional Preparation of Educational Administrators and Supervisors (3) A

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

6380 Instructional Supervision—School District (3) Definition and analysis of instructional supervision at the school district 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 Relations (3) The local unit of school administration, school district and its governing body, board of education or school board. Sp

6440 School Business Management (3) Emphasizes superintendent team 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.

6460 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. Sp, 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. A

6540 Contemporary Economics and Educational Finance (3) Contemporary educational finance policies and their influence on educational service and program, national economy, welfare of individuals, and welfare of the nation. F, Su

6550 State-Federal Relations in Education (3) Purposes and functions of federal/regional/states/local educational agencies, organizational control and political variables. Major education laws, rule and regulation-making process, grants and contracts as inter-level policy instruments. F, Su

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. A

6580 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, Su

6870 Advanced Study in School Facility Planning (3) In-depth research and development of educational specifications and techniques of leadership in creation of quality educational facilities. W

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. Sp

6983 Specialized Seminar: State School Administration (3) E

6984 Specialized Seminar: Preparation Programs (3) E

6990 Specialized Doctoral Seminar in Politics of Education (1) Required three consecutive quarters. Prereq: 5290, 5610 or equivalent or consent of instructor. W

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 organization and leadership research in education and related disciplines; implications for further research; application of existing theory and research to known educational settings. Prereq: Consent of instructor. A

6998 Specialized Seminar: School Law (3) E

6999 Specialized Seminar: Supervision (3) Sp

Ph.D. Ohio State; H. S. Saudargas, Ph.D. Florida; K. K. Swander, Ph.D. Florida.

Assistant Professors:

Graduate programs (thesis or non-thesis option) lead to the Master of Science degree with a major in Educational Psychology with concentration areas in educational psychology, in school psychology, and in community agency counseling; the M.S. degree in Guidance has concentrations in elementary or secondary guidance; the Specialist in Education and the Doctor of Education degree with concentrations in educational psychology, school psychology, and counselor education. Professional emphases within the above programs are offered in applied behavioral analysis, positive mental health. Application of mental health criteria to a study of one's self based on a battery of personality assessment instruments.

4110 Psychology of Sex Role Development (3) Examination, from both a theoretical and research base, of factors which contribute to sex role development and definition in society and role of education in these changes. For student with minimal background in behavioral sciences. F, Sp, Su

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

4320 Self-Management for Personal and Professional Development (3) Applications in career, social, emotional, and physical development. Theoretical and experiential activities. Prereq: Introduction course in psychology or consent of instructor. Letter grade or S/NC.

4350-60-70 Special Topics and Problems (1-6, 1-6, 1-6) May be repeated. S/NC or letter grade.

4440 General Evaluation Procedures for Public Schools (3) Prereq: 2430 or equivalent. 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 3610 or consent of instructor. W, Su

4860 Psychology of the Disadvantaged Child (3) Significant behavioral differences and causes for appropriate intervention approaches.
5310 Diagnostic and Corrective Teaching (3) Application of psychology of people of Appalachian region through examination of history, culture, and role of education. W, Su


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

5000 Theory (1-15) P/NP only. E

5022 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

5040 Guidance and Pupil Personnel Services in Elementary Education (3) (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 groups in counseling, psychological and parent education. F, Su

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

5099 Field Work (1-6) Practical experience in Departmentally approved field placement. Supervision by field and University personnel. Program prerequisites to field work 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 and group counseling. Prereq: Psychology 5100. F, W, Su

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: social context in which various theories were developed and current theories and research focusing on women and/or sex differences. Prereq: 4130 or basic course in personality theory. E

5111 Seminar in Current Issues in School Psychology (3) (Same as Psychology 5111). S/NC only.

5120 Seminar in Blasphemy Counseling (3) Feminist psychology, bias-free education, and counseling. Prereq: 4110 and 5110 or consent of instructor. May be repeated. Maximum 6 hrs. S/NC only.

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

5149-59-69 Practicum 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) P/NP only. 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 texts as reported in journals. Prereq: 5210 or consent of instructor. W, Su

5310 Diagnostic and Corrective Teaching (3) Application of psychology of learning to instruction and problem-solving situations that student encounters in classroom. Prereq: Course in general psychology. May be taken for undergraduate credit by undergraduates admitted to teacher education or consent of instructor. Minimum 6 hrs. S/NC only.

5319 Field Work in School Psychology: Level I (3) (Same as Psychology 5319.) S/NC only.

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

5330 Theory and Research in Human Learning (3) Contemporary learning theory; current 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. Maximum 6 hrs. S/NC only. 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

5356 The College Student (3) nature, characteristics, and needs. E

5720 Evaluation In Education (3) Techniques and instruments for identifying and appraising social values, the thinking processes, social adjustment, emotional development, and achievement in educational and vocational areas. E

5750 Career Development: Theory and Research (3) F, Su

5755 Career Development: Program Development, Implementation and Evaluation (3) Career development and preoccupational programs and projects, K-adult with emphasis on development, implementation, and evaluation. Prereq: 5760 or equivalent, or consent of instructor. Sp

5790 Career Development: Workshop (1-6) Designed for in-service training of school personnel. Developments, programs, and trends related to career development. May be repeated. Maximum 6 hrs. (Same as Counseling and Instruction 5760 and Special Education 5760.)

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.) W

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

5880 Career Development: Occupational and Educational Resources (3) Gathering, interpreting, and using occupational, social, occupational, and community information in the guidance program; sources, types of materials, and occupational filling 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 school, community, business, and/or industry. May be taken concurrently or separately: 5789, 5785, 5790, 5800, and/or consent of instructor. May be repeated. Maximum 6 hrs. E

5890 Counseling Theories and Techniques (3) Presentation, demonstration, and application of techniques open to students interested in 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) S/NC only.

5940 Counselling 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. W, Sp

5941-44-45 Practicum In Guidance, Counseling, and Personnel Services (3, 3, 3) Supervised practice in the use of counseling tools and techniques. Minimum: 90 clock hours each quarter. Prereq: 5890 and consent of instructor. E

5944-45-46 Teaching Practicum (3, 3, 3) Prereq: Acceptance in doctoral program and consent of instructor. May be repeated. Maximum 6 hrs for each course. E

5950 Counseling Supervision (3) May be repeated with consent of advisor. Prereq: 5890, 5940, 6810, 6941. S/NC only. E
Vocational Rehabilitation Counseling
Special Education
MAJORS
Special Education
O. Welch, Ed.D. Tennessee; George Peabody; W. Mulkey, Ph.D. Florida State; S. M. Benner, Ed.D. Columbia; K. H. Kopp, Ph.D. Virginia; F. V. Essery (Emeritus), Ph.D. Michigan; Associate Professors: Mississippi State


Instructors: M. Griffin, M.S. Tennessee; N. E. Tedder, M.S. Tennessee; S. M. Liss, M.S. Tennessee; K. M. Warden, M.S. Tennessee.

Lecturers: R. D. Avans, M.S. Tennessee; Z. H. Brody, M.A. Tennessee; M. M. Brindley, Ph.D. California; O. E. Reece, B.S. Memphis State.

The Department of Special Education and Rehabilitation provides competency-based programs and experiences to prepare regular, special education personnel to work with exceptional persons: children and adults. Specialized courses may be distributed over the several areas of exceptionality: deafness, blindness, learning disabilities, and emotional disturbance. Facilities are available for continuous observation and participation in direct relationships with handicapped children and adults who are hospitalized, homebound, or in residential schools, special classes, or regular classes.

Course sequences may be planned in specialized areas to include (1) hearing impaired; (2) gifted; (3) learning disabilities; (4) mentally retarded; (5) multiple disabilities; (6) socially or emotionally maladjusted; (7) rehabilitation counselor education; (8) disability evaluation education; (9) general special education and rehabilitation.

Prerequisites to the Master of Science degree in Special Education with an emphasis in one of the specialized areas.

Under the sponsorship of the Office of Special Education and Rehabilitative Services (S.S.A.), a specialized institute for the preparation of professionals to adapt their skills toward services to hearing impaired and deaf people is provided. For further information write the department head.

EDUCATION OF THE HEARING IMPAIRED


520 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 Emotional Implications of Language Deficiency (3) Readings, discussion, and projects on impact of language deficiency on educational programming for children with language deficiencies. Prereq: 4101 or consent of instructor. W, Su.


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) Philosophy and rationale underlying teaching and guidance of mentally retarded; methods and materials in special and regular classes. Prereq or coreq: 4110. E.

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


4822 Student Teaching of the Edubably Retarded (3) Observation and supervised practicum. S/NC only. E.

5111 Psychology of Mental Retardation (3) Intellectual functioning, psychological theories and learning interrelations and theoretical and educational implications emphasized. Prereq: 4110. 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. E.


5157 Multiple Disabilities (3) Nature of brain-injured child; skills for identifying educational, physical, and emotional characteristics; special educational techniques. F.

5160 Education of Children with Crippling and Special Health Conditions (3) Medical and educational characteristics; appropriate educational modifications and associated services. Prereq or coreq: 3533 or consent of instructor.

5480 Educational Problems of the Cerebral Palsied Child (3) Nature of cerebral palsied child. Physical, social, and educational needs of cerebral palsied; evaluation techniques. F.

4921 Student Teaching in Crippling and Special Health Conditions (3-15) Observation and supervised practicum in home, hospital, and classroom. S/NC only. E.

EDUCATION OF THE EMOTIONALLY DISTURBED

4610 Nature and Characteristics of Learning and Behavior Disorders (3) Forms of academic and socially disturbing behavior, degrees of severity, possible causes, and relationships to each other. Relationships with respect to personality characteristics and development factors interpreted through behavioral and psychodynamic theory as well as practical situations in which learning and behavior disorders may occur. E.
4620 Education of the Emotionally Disturbed Child (3) Managing behaviors, models for instruction, teaching techniques and materials, and teacher-pupil family interpersonal relationships as basis for academic achievement for the pupil. Prereq: 4610. W, Su

4630 Practicum in Residential Settings Serving Children with Disturbing Behavior (3) Practicum in residential staff setting that involves observing and recording disturbing behaviors. Initiating behavior changes regarding academic and social behaviors. To perform in a residential setting that involves observing and recording disturbing behaviors, interacting with children in a residential classroom setting, and to take part in discussion and evaluation of relevant academic and social behavior problems. Prereq: 4610 and 4620 or consent of instructor. A

4640 Practicum in Public School Systems Serving Children with Learning and Behavior Problems (3) Academic tutoring in a teacher aide capacity within regular classrooms. Participate in individualizing instruction for learning disabled and behavior problem children within 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 (3-9) Tutoring and classroom observation and teaching of emotionally disturbed individual. Prereq: coreq. 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; case finding, intake, diagnosis, physical rehabilitation, community resources; counseling, referral, follow-up; relation to programs of allied agencies, rehabilitation teams, and programs in hospitals, institutions, community agencies, and service groups. Attention to specialization in disability categories such as mentally ill, mentally retarded, and blind. F

5115 Case Load Management in Rehabilitation (3) Techniques and procedures involved in management of caseloads in state rehabilitation agencies and public/private rehabilitation facilities; analyses of appropriate industrial management models related to rehabilitation programs; and simulated experience in work planning, decision making, and case selection. W

5120 Psychosocial Aspects of Disability (3) Medical aspects and psychological impact of major disabling handicaps; issues including implications of family and community. Sp

5121 Job Development and Placement in Rehabilitation (3) Identifying work for handicapped persons: utilization of occupational resource materials and techniques including field experiences for analyzing jobs, procedures necessary for helping a handicapped individual successfully adjust to a work environment and assessment of future trends within labor market. Su

5130-40 Seminar in Rehabilitation (3, 3) Seminar in various topics related to vocational rehabilitation. 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 lines of communication essential to maintenance of vocational evaluation program. Effective supervisory, referral, recording, budgeting, and staff development practices. Prereq: 5141, 5145, 5146, or consent of instructor. F

5145-46-47 Practicum in Rehabilitation (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

5150-60 Internship in Rehabilitation (9, 9) Internships in rehabilitation field experience with handicapped individuals. Prereq: 5141 and 5142 or consent of instructor. A

5170 Systematic Human Relations Training (3) Active listening, observing verbal and nonverbal behavior, empathetic understanding, and communicating with handicapped individuals. F

5180 Approaches to Rehabilitation Counseling (3) Approaches and techniques used in individual and 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

DISABILITY EVALUATION EDUCATION

5700 Evaluation and Mobilization of Community Resources (3) Vocational evaluation: resource utilization and administration of appropriate rehabilitation services. Prereq: 5710-20 or 5730-40. F

5710 Medical Aspects of Disability I (3) Etiology, clinical signs, symptoms and diagnostic procedures related to musculoskeletal, neurological, circulatory, and respiratory diseases/disorders. Effect on structure and function of human body. Restorative measures to eliminate or minimize resulting handicaps. F

5720 Medical Aspects of Disability II (3) Etiology, signs and symptoms of diseases 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 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) Relationship of work to physical, social, psychological, and economic development of disabled individual. Process and techniques of vocational evaluation, work adjustment services in rehabilitation. F

5750 Principles and Problems of Disability Evaluation (3) Individual identification and analysis of principles and problems of disability evaluation process or structures; emphasis on problems of disability evaluation process or structures, and innovation, exploration of alternatives, and sharing experience within group. Prereq: 5700 or consent of instructor. W

5760 Seminar: Functional Capacity Assessment (3) Criterias 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. Su

5770-71 Current Problems in Disability Claims Evaluation (1-3, 1-3) Current problems in process, content, or administration of disability claims evaluation or program and exploration of alternative solutions. May be repeated with consent of instructor. S/NC only. A

SCHOOL SPEECH AND HEARING THERAPY

4030 Professional Aspects of Speech/Language Programming in Schools (3) Organization and administration of school programs. Other settings, hospitals, institutions, private practice, professional certification levels, legislation, careers.

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

4310 Stuttering (3) (Same as Audiology and Speech Pathology 4310.)

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

4330 Clinical Practice in Speech Pathology I (1-6) (Same as Audiology and Speech Pathology 4330.) S/NC only.

4340 Clinical Practice in Speech Pathology II (1-6) (Same as Audiology and Speech Pathology 4340.) S/NC only.

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.)

4930 Aural Rehabilitation: Speechreading and Auditory Training (3) (Same as Audiology and Speech Pathology 4930.)

4940 Introduction to the Verbo-Tonal System (4) (Same as Audiology and Speech Pathology 4940.)

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

5360 Cerebral Palsy (3) (Same as Audiology and Speech Pathology 5360.)

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) Curriculum adjustments and materials; home visits for parents' cooperation in medical care and special needs. A

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

4923 Student Teaching of the Partially Seeing (3) Observation and supervised practicum in special and regular classes. A

GENERAL COURSES

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

College of Education/Special Education
5400 Assessment and Remediation of Learning Disabilities (3) Identification and remediation of learning problems of children: neurological and medical origins of cognitive, affective, and psychomotor skills; formal diagnostic testing; and materials emphasizing cognitive development. (Offered in combination with a pre-service teaching instruction program with a descriptive teaching approach to learning disabilities.) Su


5402 The Exceptional Child in the Regular Classroom (3) Adoption, modification, delivery, and maintenance of instructional activities for exceptional children within the regular classroom. Learning and academic considerations stressed. Prereq: 5401 or consent of instructor. A

5403 Resource Teachers for the Handicapped (3) To help students acquire the skill to maintain a team of handicapped children in regular public education environments; job descriptions and expectations, interpersonal relations with adults, use and interpretation of test results, and adaptation of teaching methodology. (Offered in cooperation with Educational Psychology 5120.) A

5410 Instructional Media for the Handicapped: Definition, Selection, and Evaluation of Prototypical Curriculum Materials (6) Perception, communication and learning theories; media design and advanced production techniques; evaluation procedures. Emphasis on planning and producing prototype media materials specifically designed to meet needs of handicapped learners. Enrollment limited to persons holding major responsibilities for media in program for handicapped or similar setting. (For Summer Media Institute only.) A

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

5550-60-70 Problems in the Education of Exceptional Children (3, 3, 3) E

5555-65-75 Special Topics (1-3, 1-3, 1-3) S/N or letter grade.

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


5790 Career Development: Workshop (1-6) (Same as Educational Psychology 5790) A

5830 Seminar: Issues and Theories in the Education of the Exceptional Child (3) Current trends in education of exceptional child, application of philosophical approaches to education, analysis of current theories of integration as applied to exceptional child. Current research concerning education and/or rehabilitation of exceptional persons. Prereq: Curriculum and Instruction 5810 or Educational Psychology 5210 and consent of instructor. A

5910-20-30 Problems in Lieu of Thesis (3, 3, 3) S/N only.

5970 Juvenile Delinquency and the School (3) Responsibilities of school in studying sources of maladjustment; school function in community programs for children's welfare; curricular adjustments; directed study of socially maladjusted children, environment, and programs for meeting needs. A

Vocational-Technical Education

MAJORS

Agricultural Education DEGREES

Business Education M.S., M.A.

Distributeive Education M.S., M.A.

Industrial Education M.S., M.A.

Vocational-Technical Education Ed.D., Ph.D.

Education M.S., Ed.S., Ed.D.


THE MASTER'S PROGRAM

The M.S. degree with a major in Vocational-Technical Education is available with concentrations in agricultural education, business and office education, distributive education, general vocational-technical education, home economics education, industrial education, and technical education. Requirements are:

Concentration

Electives

Thesis Option

Problems in Lieu of Thesis Option

Course Option

Total 45-51 hrs

All course work must be approved by the student's committee. Each vocational service area (agricultural education, business education, distributive education, industrial education and vocational-technical education) offers similar programs leading to the Master's degree. Both thesis and non-thesis options are available. Details regarding the Master's programs of each of the service areas may be obtained from the coordinators of the service areas. The MACT is available in the business education area.

THE SPECIALIST PROGRAM

The Ed.S. degree program, which is a thesis or non-thesis program, is a cooperative undertaking involving all vocational service areas. Options are available in agricultural, business, distributive, home economics, and industrial education, and in general vocational-technical education.

THE DOCTORAL PROGRAM

The comprehensive Ed. D. program in Vocational-Technical Education is designed to provide for achieving professional objectives, developing needed competencies, and gaining desirable experiences and understanding of vocational-technical areas. The Vocational-Technical Education doctoral curriculum consists of the following: professional education core, 9 hours; service area, 18 hours; vocational-technical education, 18-27 hours; cognate fields, 9-18 hours; research techniques, 15 hours (consult advisor for details); and dissertation, 36 hours. A minimum of 120 hours above the baccalaureate is required.

The Doctor of Philosophy degree with a major in Education includes options and emphases as listed on page 48.

General

4010 Development and Utilization of Advisory Committees (3) Draft advisory committees, selection, organization, implementation, and utilization.

4750 Utilization of Instructional Media (3) (Same as Curriculum and Instruction 4750 and Library and Information Science 4750.)

5000 Thesis (1-15) P/NP 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/N only. E

5005 Problems in Lieu of Thesis (3) May be repeated. S/N only.

5101 History and Organization of Vocational-Technical Education (3) Vocational and technical education in public schools through analysis of social forces, legislation, and organization models.

5109 Professional Education (3) Professional education is required for students seeking positions in professional education core, 9 hours; service area, 18 hours; vocational-technical education, 18-27 hours; cognate fields, 9-18 hours; research techniques, 15 hours (consult advisor for details); and dissertation, 36 hours. A minimum of 120 hours above the baccalaureate is required.

6001 Professional Education (3) Professional education is required for students seeking positions in professional education core, 9 hours; service area, 18 hours; vocational-technical education, 18-27 hours; cognate fields, 9-18 hours; research techniques, 15 hours (consult advisor for details); and dissertation, 36 hours. A minimum of 120 hours above the baccalaureate is required.

6770 Course Work Approved by Graduate Committee (1-9) S/N only.

6771 Student must meet the service area entrance requirements for the concentration selected. General vocational-technical education requires 6 hrs Vocational-Technical Education 5015 and 5010.

6772 hrs course work approved by graduate committee in area of emphasis outside of area of concentration.

5020 Placement, Follow-up and Evaluation Procedures in Occupational Education (3) Methods and procedures in establishing placement programs, curriculum revision.

5030 Organization and Operation of Area Vocational-Technical Schools (3) Area vocational-technical school concept; administration and supervision of vocational and technical education programs in area schools.

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

5050 Supervision of Vocational-Technical Education (3) Program planning, coordination, instruction. Roles and functions of supervisors.

5055 Vocational School Administration and Management (3)

5070 Competency Based Vocational Education (3) Introductory, comparative, and practical approaches.

5080 Continuing Education in Vocational-Technical Education (3) Importance, objectives, historical development, psychological and sociological formulations, methods and techniques, research, evaluation.

5100 Occupational Program Development for Disadvantaged Persons (3) Academic, socioeconomic, cultural and/or other handicaps that prevent individuals from succeeding in regular vocational education programs.

5110 Principles and Objectives of Vocational-Technical Education (3) Fundamental principles and curricular objectives.

5130-31-32 Problems in Vocational-Technical Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

5140 Individual Study in Vocational-Technical Education (1-3) Must be approved by supervisor, instructor and service area coordinator or department head. Approval form must be filed in office of department head. May be repeated. Maximum 12 hrs.

5150 Microcomputer Operations and Educational Applications (3) Operating procedures and program-tracing techniques. Hands-on experience in operating common microcomputers, writing, debugging, and running educational programs. Prereq: Teaching, administrative, or related experience in schools or special consent of instructor.

5155 Software Design for Microcomputers in Education (3) Advanced BASIC software design: operating System-CMP, TRSDOS and DSI, sequential and random I/O, analysis and operation of commercial educational programs, and teacher-designed programs. Prereq: 5150.

5180-90-200 Educational Specialist Research and Thesis (3, 3, 3) Selection, analysis, and completion of problem necessitating original investigation, beneficial to investigator and vocational-technical field. P/NP only.

6000 Doctoral Research and Dissertation (3-15) P/NP only. E

6010 Curriculum Planning in Vocational-Technical Education (3) Prereq: Curriculum and Instruction 5410 or equivalent.

6020 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.

6030 Evaluation of Vocational-Technical Education Programs (3)

6040 Seminar in Vocational-Technical Education (1) Participation in 3 consecutive quarters during residency. S/N/C only.

6050 Administration of Vocational-Technical Education (3) Administrative principles and relationship to vocational and technical training.

6111-12-13 Internship in Vocational and Technical Education (3, 3, 3) Field experiences in selected areas of vocational and technical education. S/NC only.

Agricultural Education

4230-31-32 Problems in Agribusiness Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

4240-41-42 Seminar in Agricultural Education (1, 1, 1) Prereq: 4350 or consent of department head.

5210 Supervision of Student Teaching in Agricultural Education (3)

5220 Teaching Agricultural Mechanization in Vocational Agriculture (3) Prereq: 4350.

5230-31-32 Special Problems in Agricultural Education (3, 3, 3) May be repeated. Maximum 18 hrs.

5240 Current Literature in Agricultural Education (1-3) May be repeated. Maximum 6 hrs.

5250-51 Agricultural Education in Off-Farm Agricultural Occupations (3, 3) Developing occupational experience programs; course planning, teaching procedures. Prereq: 4350.

5260 Agricultural Education for First-Year Teachers (3) Adjustment to situation in which employed; group meetings in selected centers, and visits by instructor. Prereq: 4350.

5270 Adult Education in Agriculture (3)

5280 Supervised Occupational Experience in Agriculture (3) Prereq: 4350.

Business Education

5305 Methods and Materials for VOE Programs (3) Development of instructional aids, recent developments and research, individualized instruction, occupational clusters.

5306 Organization and Management of VOE Programs (3) Developing office occupations, guidelines in cooperatives, laboratory, and model office programs. Physical facilities, instructional aids, related instructional activities (clubs), enrollment, instructor and advisory committees.

5307 Measurement in Business Education (3) Evaluative methods and tools for all courses in business education and related areas of study in secondary and postsecondary business education.


5309 Evaluation of Research in Business Education (3) Prereq: Curriculum and Instruction 5610 or equivalent.

5310 Graduate Seminar in Business Education (3) Review of techniques for research and preparation of proposal for thesis or problem project.

5311-12 Special Topics in Business Education (1, 1)

5313-14-15 Practicum in Business Education (2, 2, 2)

5320 Improvement of Instruction in Basic Business Courses (3) Issues, research findings, methods, and materials for improved instruction at both secondary and postsecondary levels.

5330 Improvement of Instruction in Typewriting and Clerical Programs (3) Research, principles of learning, issues and materials.

5340 Improvement of Instruction in Shorthand/Secretarial Science (3) Principles of learning, issues, research findings, and materials on secondary and postsecondary levels.

5350 Improvement of Instruction in Accounting and Data Processing Programs (3)

5360 Improvement of Instruction in Business Communications and Word Processing (3) Basics of and strategies for teaching written communications. Word processing and oral communications.

5380-85 Problems and Projects in Business Education (3, 3) Required in the non-thesis option. S/N/C only.

5390 Problems in Business Education (1-9) Variable topics. May be repeated. Maximum 9 hrs.

6300-10-20 Current Issues in Business Education (3, 3, 3)

6330-40-50 Advanced Studies in Business Education (3, 3, 3)

6380 Higher Education for Business (3)

Distributive Education

4430-31-32 Problems in Distributive Education (1-3, 1-3, 1-3) Research problems in teaching and coordinating distributive education programs. May be repeated.

4440 Supervised Distributive Experience (3) Minimum 200 hours experience for each 3 credit hours in approved distributive business; concurrent analytical project. May be repeated. Maximum 9 hrs.

4450 Areas of Distribution (3) Marketing, product or service technology, social skills, basic skills, and distribution as they affect distributive education curriculum in secondary and postsecondary programs.

4460 Organization and Operation of Distributive Education Programs (3) Background and development needs, federal and state legislation; curriculum implications; establishing, evaluating, reporting, and improving programs.

4470 Methods and Materials in Distributive Education (3) Prereq: 4460 or consent of instructor.

4480 Coordinating Techniques in Distributive Education (3) Selecting training agencies; job analysis; selecting and briefing training supervisors; advisory committees; adult and other community services. Prereq: 4460, 4470.

5410 Administration and Supervision of Distributive Education (3) Operation of distributive education program and work of city or county supervisor. Understanding and appreciating problems from high school principal's and department head's point of view. Trends in distributive education; community surveys; state plans; teacher-coordinator qualifications, changing curriculum.

5416-26-36 Problems in Distributive Education: Retailing (3, 3, 3)

5420 Organizing and Teaching Adult Distributive Education (3) Planning, organizing, promoting, teaching, and evaluating continuing education programs in distributive education; utilizing trade associations, employment agencies, business groups, and advisory committees in implementation.

5430-31-32 Special Problems in Distributive Education (3, 3, 3) Individual research, conferences, and/or workshops in teaching and supervising high school, postsecondary, and adult programs.

Home Economics Education

5510 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 school—day school, adults, home experience, and Future Homemakers of America.

5515 Evaluation in Home Economics Education (3) Purpose of evaluation in development of home economics programs; techniques employed in evaluation. Techniques for determining progress of students; individual problems of evaluation.

tion (1-3, 1-3, 1-3) May be repeated. Maximum 3 hrs per course.

5540 Curriculum Development and Implementation in Family Relationships Instruction (3) Content for teaching family relationships. Selected materials and methods of instruction; awareness of teaching curriculum objectives in family relationships.

5545 Wage-Earning Programs in Home Economics (3) Planning, establishing, and implementing wage-earning programs in home economics.

5550 Advanced Methods of Teaching Homemaking Classes for Adults (3)

5555 Supervision of Home Economics in the Public Schools (3) For teachers with successful experience in vocational home economics preparing for supervisory positions in vocational education. Program planning, organization, and administration. Field contacts with urban and rural programs.

5570-75 Seminar in Home Economics Education (3, 3) Research literature and techniques. Prereq: Consent of Instructor.

5580 Teaching Home Economics in College (3) Methods, organization, and evaluation.

5581 The Problem Method of Teaching Home Economics (3) Underlying philosophy; skills and techniques. Observation and discussion.

5582 Furthering Good Human Relationships in the Classroom (3) Relationships between problems in human relations, basic needs of individuals, techniques of interpersonal relations and social values in developing more effective teacher education programs.

Industrial Education

3830 History and Philosophy of Industrial Education (3)

3840-41-42 Part-Time Programs in Cooperative Industrial Training (3, 3, 3) Principles of organization, methods, and materials.

3850 Shop Organization and Management (3)

3860-61 Materials and Methods for Teachers of Shop and Related Subjects (3, 3)

3870 School Shop Safety (3)

4620 Special Topics in Drafting (3) Industrial practices in specialized areas of drafting selected for the individual student. Prereq: 6 hrs drafting.


4670 Manufacturing Processes (3) The manufacturing processes of industry and their relationship to careers. Prereq: 2620, 2641, 2660, 3851; or consent of instructor.

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

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

4820 Foremanship Training by the Conference Method (1)

4830-31 Job Analysis (3, 3) Principles, practice, instructional methods.

4850-51 Curriculum Building in Trade and Industrial Subjects (3, 3) Course material in trade and industrial subjects; results of job analysis, checking sheets and individual job sheets in both trade and related subjects. Prereq or coreq: 4830.

4880-81-82 Seminar in Industrial Education (3, 3, 3) Educational innovations, current events, problems, and mechanics associated with the field of industrial education.

4885 Organization and Development of Vocational-Industrial Clubs of America (VICA) (3) To give industrial education teacher experiences and understanding of organization and operation of VICA. Prereq: Undergraduate degree and 3 yrs teaching experience when taken for graduate credit.

4890-91-95 New Developments in Industrial Education (3, 3, 3) Developments, pressing problems, and recent trends in field of industrial education presented by a coordinating instructor in conjunction with knowledgeable resource personnel.

5810-11-12 Administration and Supervision of Industrial Education (3, 3, 3) Principles of vocational education; relationships with general education and trade and labor organizations; administrating and supervising schools and classes under federal vocational education acts.

5830-31-32 Special Problems in Industrial Education (3, 3, 3)

5840 Methods of Research in Industrial Education (3)

5850 Improving Teachers in Service (3) Problems of coordination in part-time and apprentice training programs.

5860 Advisory Committees and Apprentice Training (3)

5880 Advanced Methods of Teaching Skills and Technical Information (3) Proper selection and effective application of contemporary methods and techniques in teaching of specialized skills and technical related information.


5895 New Developments in Industrial Technical Education (3) Prereq: B.S. in Industrial Education and teaching experience.

School of Health, Physical Education, and Recreation

Madge M. Phillips, Director

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

The MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: Physical Education, Recreation, Safety Education and Service, and School Health Education. Forty-five quarter hours are required for the M.S. Approximately 30 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 Physical Education and the Doctor of Education in Physical Education. See further description under Health Education and Physical Education.

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 potential 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 48.

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, 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 should be addressed to: The School of Health, Physical Education, and Recreation, The University of Tennessee, Knoxville, Tennessee 37996-2700.

Departments of Instruction

Division of Health and Safety

MAJORS

Health Education

Safety Education and Service

School Health Education

DEGREES

Ed.D., Ph.D.

M.S., Ed.S.

M.S.
5350 Civil and Defense Education (3) Civil and defense problems: tornadoes, floods, fires, mass civil disorders, and nuclear and personnel attack by alien countries. E
5720-30-40 Graduate Workshop in Safety (3-6, 3-6) Deals with specific safety problems. Special safety problems in a concentrated period of time. Su
5870-80-90 Current Issues in Safety Education (1, 1, 1) E
6010-20-30 Internship and Research in Safety (3, 3, 3) Allows the student opportunities for engaging in field experience so that a significant problem in that experience will be identified, researched, and reported on in acceptable form. E

School Health
3000 Foundation of Health Science (3) Personal and contemporary health problems, i.e., mood modifying products, consumer health, international health, personal health practices, reciprocal relationships involving humane, disease, and environment. E
3210 First Aid and Emergency Care (4) Theory and practice, medical self-help. Leads to Red Cross Certification in Advanced First Aid and Emergency Care. (Applicant must be at least 18 years of age for certification.)
3410 School Health Instruction (3) Selection of health content in the school curriculum. E
3420 School Health Services (3) Development, maintenance, and protection of health of students, including examination, screening, special services, communicable disease control, 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 responsibility in promoting healthful living and the place of existing media and agencies in program. Not open to health and physical education majors. E
3610 Methods in Elementary Health Instruction (3) Preparation and presentation of health topics. Teaching method emphasized and student participation stressed. Required for elementary teachers. Prereq: 3510 or Public Health 1110 or Nutrition 1230. E
3820 The Teaching of Sex Education (3) Trends, content, methods, and materials in sex education. F, W, Sp
3850 Methods in Secondary Health Instruction (3) Preparation and presentation of health topics. Teaching method emphasized and student participation stressed.
4120 Alcoholism and Alcohol Education (3) Emphasis on factors which make alcoholism serious health problem. Instructional/educational and intervention programs.
4130 Suicide and Suicide Intervention (3) Emphasis on factors which make suicide a serious health problem. Instructional/educational and intervention programs.
4140 Death, Dying and Bereavement (3) Theories of death and dying and other programs to mitigate trauma of death and dying.
4410 Consumer Health and Safety Education (3) Major consumer health and safety problems; selecting, purchasing, and financing of safety and medical services. (Same as Public Health 4410.)
4411 Instructor's Advanced First Aid and Emergency Care (3) Satisfactory completion qualifies one for American National Red Cross Certification as Advanced First Aid for Emergency Care Instructor. (Applicant must be at least 21 years of age for certification.) Prereq: 3210 or valid Advanced First Aid and Emergency Care Certificate.
4412 Cardiopulmonary Resuscitation (3) Theory and skills to implement basic cardiac life support following cardiac arrest due to heart attack, drowning, electrocution, suffocation, poisoning, drug intoxication, vehicular and other accidents. Educational and preventive aspects of controlling cardiovascular disease.
4420 Drug Abuse Education (3) Problems and suppressed causes, phases, and factors on society and methods of drug abuse education.
4430 Women's Health (3) Factors influencing women's health and women as consumers of nation's health service delivery systems. E
5000 Thesis (1-15) P/NP only. E
5003 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/NC only. E
5010 Problems and Practices in School Health (3) Comprehensive study and analysis of the principles, systems, and trends of and in school health. F
5020 Teaching of Sex Education and Human Sexuality (3) Analysis and explanation of theory, methods and materials for planning, organizing and teaching sex education and human sexuality in schools and other community settings. Sp
5510 Curriculum Construction in School Health Instruction (3) Analysis of school health instruction programs in elementary and secondary schools. Planning and construction of health curricula to meet needs, interests, and abilities of pupils. W
5520 Evaluation in School Health Instruction (3) Principles of objective tests construction; place of behavioral and attitudinal scales, check list, questionnaires, surveys, and inventories in evaluation of health instruction. Includes criticism of several commercial prepared tests and construction and standardization of test. W
5530 School Health Program Surveys (3) Techniques and standards used in surveying total school health program; relative contribution of health instruction, health services, and healthful environment as each contributes to well being of individual students. Survey of existing school health program. Sp
5560 School Health Administration and Supervision (3) Analysis of various types of administrative control; budgetary problems; education-public health dihlemma; responsibilities of school health personnel. Resource materials include case studies of on-going school health personnel. Resource materials include case studies of on-going school health programs. Sp
5630-40 Workshop in School Health Education (3, 3) Designed for graduate students, inservice teachers, and other health professionals. Emphasis in any workshop to be placed on one critical health issue. Su
5720-30-40 Graduate Workshop in Health Education (3-6, 3-6, 3-6) Deals with specific health problems. Designed especially to explore special health problems in a concentrated period of time. Su
5810-20-30 Problems in School Health Education (1-3, 1-3, 1-3) Individual identification and study of
current issues in school health education. Extensive reading and critical analysis of literature. E

6000 Doctoral Research and Dissertation (3-15) P/NP only. E

6030 Critical Analysis of Writing and Research in Health Education (3) F

6050-60 Seminar In Health Education (3, 3) W, Sp

6210 Health Aspects of Gerontology (3) Biologica,l psychological, and sociological aspects of aging related to health of individual. (Same as Public Health 8210.)

6220 Seminar on the Nation's Health (3) Comprehensive overview of status of America's health. (Same as Public Health 8220.)

6230 International Health (3) Status of health in countries throughout world. (Same as Public Health 8230.)

### Division of Physical Education

#### MAJOR DEGREES

**Physical Education**

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

**Professors:**
- J. E. Acker, M.D. Tennessee; G. F. Brady (Emiratus), Ph.D. Iowa; D. D. Frank, Ph.D. Illinois; E. T. Hovell, Ph.D. Wisconsin; A. J. Kochar, Ph.D. Michigan; N. E. Lay, Ph.D. Florida State; W. P. Liennoch, Ph.D. Iowa; M. M. Phillips, Ph.D. Iowa; H. B. Watten (Emiratus), Ph.D. Michigan; H. G. Welch, Ph.D. Florida.

**Associate Professors:**
- P. A. Beitel, Ed.D. North Carolina (Greensboro);
- R. Croyser, M.F.A. Southern Methodist; R. E. Jones (Chairperson), Ph.D. Toledo; B. J. Mead, Ph.D. Purdue; W. J. Morgan, Ph.D. Minnesota; C. A. Wislberg, Ph.D. Michigan.

**Assistant Professors:**
- P. A. Borovick, M.S. Tennessee; C. Fox, M.F.A. Southern Methodist; J. L. Lewis, Ed.D. Tennessee; M. G. McClusken, Ed.D. North Carolina (Greensboro); B. L. Morgenegg, Ed.D. Teacher's College, Columbia;

The Physical Education Division offers the following degree programs:

- Master of Science degree in Physical Education (thesis and non-thesis programs).

**Director 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 48.

**3000- and 4000-level courses** require a different level of performance of those registered for graduate credit.

**4320 Adaptive Physical Education Laboratory (1)** Practical work, including student teaching, supplementing 4110. E

**4505 Advanced Ballet Technique (2)** Styles and principles. Prereq: 3030. May be repeated with consent of instructor. F

**4506 Advanced Composition (4)** Application of compositional, production and administrative skills culminating in a complete choreographic work. Prereq: 3082, 4020. A

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

**4800 History of Dance II (3)** Survey of dance of various societies and cultures from pre-history through twentieth century.

**4900 History of Dance II (3)** Survey of development of dance in theatre, recreation, and education during twentieth century.

**5100 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.

**5140 Measurement and Evaluation in Physical Education (3)** Relationship of measurement and evaluation in physical education to critique of appropriate measures of physical fitness, sports skills and knowledge. W, Sp

**5150 Creative Rhythms for Children (3)** Methods and materials for grades 1-6, 3 hrs and 1 lab. F

**5455 Methods of Teaching Dance (3)** Principles and practical application in mini-teaching experience. Prereq: Upperclass or graduate standing and consent of instructor.

**560 Movement Notation (3)** Fundamentals with emphasis on notation and reading of elementary movement studies.

**580 Motor Behavior: A Theoretical Perspective (4)** Examines motor behavior from information processing perspective and applies current research to support theoretical base. Prereq: Senior or graduate standing or consent of instructor. F

**585 Motor Behavior Laboratory (2)** Beginning experience in methodology and instrumentation for assessing factors related to or affecting motor learning/perform ance. Prereq or coreq: 4860 or consent of instructor. Prereq: 4140 and/or 5320 or consent of instructor. W

**5000 Thesis (1-15)** P/NP only. 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 Administrative Problems in Health and Physical Education (3)**

**5120 Problems of the Curriculum in Physical Education (3)**

**5130 Methods in Physical Education (3)** Characteristics of different levels of most comprehensive, systematic, and revealing aspects of metaphysical, theo retical, and axiological status of sport. Prereq: Consent of instructor. W

**5150 Systematic Philosophic Analyses of Sport (3)** Critical examination of most rigorous and sophisticated essay pieces concerning metaphysical, epistemological, and axiological status of sport. Prereq: Consent of instructor. W

**5220 Readings in Physical Education (3)** Comprehensive review of literature in physical education and related areas. Sp
topics in literature related to physical education. 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: 5340 or consent of instructor. Sp

6410 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: 5110 and 5210 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: 5610. May be repeated with consent of instructor. S/NC only. F, Sp

6640 Research Participation in Applied Physiology (1-6) Advanced research techniques 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 Public Health

MAJOR DEGREE

Public Health M.P.H.

Professor: W. B. Hope, Jr. (Chairperson), M.P.H., Sc.D., Johns Hopkins; B. D. Franta, Ph.D., Illinois; B. C. Wallace, Ed.D., Colorado State.

Associate Professors: G. B. Hamilton, Dr.P.H., Oklahoma; R. J. Pursey, Ph.D.

Assistant Professor: J. Ellison, Ed.D., Tennesse.

Lecturer: M. Duffy, M.D., Pennsylvania.

Master of Public Health degree with a major in Public Health. Option in community health education is accredited by the American Public Health Association. Options with specialization in health planning/administration or occupational/environmental health and safety are also available.

Public Health

3110 Communicable and Noncommunicable Diseases (3) Modern concepts of diseases, etiology of common communicable and chronic disease problems including prevention and control. Prereq: 1 yr of biological science and 1 course in bacteriology. F, W, Sp

3320 Sanitation (3) History of sanitary awakening; disease-producing relationships and controls of water, sewage, refuse, milk, and other foods, air, insects, and soil; sanitation of homes, swimming pools, industrial plants, markets, restaurants, camps, and public bathing places. Healthful school living as affected by buildings and grounds, lighting, acoustics, thermal control, and safety provisions. Prereq: 1 yr biological science, 1 course in microbiology. 2 hrs and 1 lab. E

4210 Urban and Industrial Health (3) Health problems created by a burgeoning population and the megalopolis; industrial health problems of concern to management, supervisor, and industrial workers; control of occupational diseases, poisons, accidents, and other conditions incidental to industry. Sp

4220 Communications for Better Health (3) Selective study of communications in health enterprise. Consideration in logical progression of the problems of transmitting current and new information to practitioners; communications among members of the modern health teams, among health agencies, and use of mass media for transmitting health information. W, Sp

4410 Consumer Health and Safety Education (3) (Same as School Health 4410).

4700-10 Field Practice in Public Health (3, 3) Field practice in public health under supervision of public health profession. Prereq: E

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 (3-6) For teachers, nurses, case workers, sanitarians, and other voluntary and public health agency personnel; emphasizes the problem-solving approach through email group interaction, case method, and critical incident technique. May be repeated. Su

4840-50-60 Problems in Public Health Education (1, 1, 1) Individual identification and study of current problems in public health education. Extensive reading of literature required. 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

5100-20-30 Workshop in Public Health Education (3-6, 3-6, 3-6) Designed to deal with specific public health problems in short or extended period of time. Su

5100-60 Field Practice and Seminar in Public Health Education (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 life's survival, prevention of disease, performance and enjoyment. Lecture, demonstrations, laboratory, and field practice. Prereq: Consent of instructor. Su


5150 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 communities: types of sickness afflicting individuals and groups. Su

5410 Epidemiology (3) Incidence and prevalence of disease in man. W, Su

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

5430 Vital and Medical Statistics (4) Application of basic statistical principles to living things. 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) Test skills in communications and group process in solving problems, setting objectives, 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 prefaces exploration of conflicting theories and divergent styles of practice in community organization and development. Laboratory to delineate a community near campus and to practice, 2 hrs and 4 labs. F

5560 Functions and Roles of the Public Health Educator (3) Professional science is examined with special attention to roles and functions. Consideration of philosophy and motivation and differences between health education service and health education program for community learning levels. 1-2 hr lecture-seminar session per week. F

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

5705-10-15 Advanced Professional Health Education: Health Planning I, II, III (3-5, 3-5, 3-5) Theory and practice in selected areas. F, W, Sp

5730 Dental Health Education (3-5)

5735 Emergency Medical Services (3-5) Sp

5745 Family Health Unit (3-5) Sp

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) F


5900 Graduate Seminar in Public Health (1-2) Scope of public health as discipline and inter-relatedness to other academic and professional disciplines. Speakers both internal and external to UTK. Prereq: Baccalaureate degree in health-related field or consent of instructor. May be repeated. Maximum 6 hrs. (Same as Nursing 5900, Nutrition and Food Science 5910, Physical Education 5900, and Social Work 5900.) S/NC only.

6000 Doctoral Research and Dissertation (3-15) P/NP only. E

6210 Health Aspects of Gerontology (3) (Same as School Health 6210.)

6220 Seminar on the Nation's Health (3) (Same as School Health 6220.)

6230 International Health (3) (Same as School Health 6230.)

Division of Recreation

MAJOR DEGREE

Recreation M.S.

Professor: M. L. Peters (Chairperson), Ph.D., Illinois.

Assistant Professors: M. D. Blanton, Re.D., Indiana; K. L. Krisk, Re.D., Indiana.

The Recreation Division offers the following degree programs:

1. 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 and organization, program services, finances, and public relations. Prereq: 3140, 3200, 3900, or consent of instructor. F

4200 Survey of Recreation for Special Populations (3) Responsibility of recreation programs to minority groups whose leisure opportunities and needs may require special services. Prereq: 3140, 3200, 3900, or consent of instructor. F

5500 Functions and Roles of the Public Health Educator (3) Professional science is examined with special attention to roles and functions. Consideration of philosophy and motivation and differences between health education service and health education program for community learning levels. 1-2 hr lecture-seminar session per week. F

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

5705-10-15 Advanced Professional Health Education: Health Planning I, II, III (3-5, 3-5, 3-5) Theory and practice in selected areas. F, W, Sp

5730 Dental Health Education (3-5)

5735 Emergency Medical Services (3-5) Sp

5745 Family Health Unit (3-5) Sp

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) F


5900 Graduate Seminar in Public Health (1-2) Scope of public health as discipline and inter-relatedness to other academic and professional disciplines. Speakers both internal and external to UTK. Prereq: Baccalaureate degree in health-related field or consent of instructor. May be repeated. Maximum 6 hrs. (Same as Nursing 5900, Nutrition and Food Science 5910, Physical Education 5900, and Social Work 5900.) S/NC only.

6000 Doctoral Research and Dissertation (3-15) P/NP only. E

6210 Health Aspects of Gerontology (3) (Same as School Health 6210.)

6220 Seminar on the Nation's Health (3) (Same as School Health 6220.)

6230 International Health (3) (Same as School Health 6230.)
4310 Camp Administration (3) Program planning and organization, personnel management, camp site development and maintenance, camp operation for administrators and supervisors. W

4500 Specialized Study in a Selected Area of Recreation (1-8) 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 9 hrs. E

5000 Thesis (1-15) P/NP only. 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

5130 Interpretations of Leisure (3) Concepts of leisure including social, psychological, cultural, and philosophical; recreational uses of leisure. Prereq: 3140 or consent of instructor. F

5140 Leisure Service Delivery Systems (3) Various systems—public, private, and commercial—involves provision of leisure services for community at large. Prereq: Consent of instructor. F

5150 Current Issues in Recreation (3) Identification and consideration of broad issues—social, environmental, ethical—which currently have greatest impact on use of leisure, and implications for recreation administrator. Prereq: Consent of instructor. Sp

5250 Implementation of Recreation Services for the Ill or Disabled (3) Policies and guidelines for organizing and implementing programs for recreation for ill or disabled in treatment centers and other community agencies. Prereq: 4200 or consent of instructor. Sp

5260 Leisure and Mental Health (3) Relationship between leisure activity and mental health, with emphasis on its use in therapeutic recreation. Prereq: Psychology 3650 or equivalent, and consent of instructor. W

5300 Seminar in Recreation (1) Presentation and general discussion of students' research studies, projects, and thesis in recreation. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. S/NC only. F, W, Sp

5340 Administration of Recreation Funds (3) Development and management of budgets for recreation agencies with special emphasis on obtaining federal funds appropriated specifically for recreation, management of revenue received, and exploration of funding alternatives. Prereq: 4130. Sp

5350 Organizational Policies for Recreation (3) Advanced study in the analysis of organizational policies and functions of management in recreation. Prereq: 4130. W

5360 Management and Operation of Recreation Facilities (3) Management process as it pertains to operation of recreation facilities. F

5440 Problems and Projects in Recreation (1-9) Individual research on problem of special significance to student. Research projects of limited nature undertaken in lieu of thesis. May be repeated. Maximum 9 hrs. New problem must be undertaken for each repetition. E

5450 Specialized Study in Recreation (1-9) Advanced comprehensive study in selected specialized area within leisure and recreation field. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E
Department of Instruction

Chemical, Metallurgical and Polymer Engineering

MAJORS

DEGREES

Chemical Engineering
M.S., Ph.D.

Metallurgical Engineering
M.S., Ph.D.

Polymer Engineering
M.S., Ph.D.

Professors:

H. C. Johnson (Head), D. Eng., Yale; D. C. Bogue, Ph.D. Delaware; B. S. Bowie, Ph.D. Massachusetts Institute of Technology; C. A. Brooks, Ph.D. Tennessee; E. S. Clark, Ph.D. California (Berkeley); L. W. Crawford, Ph.D. Cincinnati; C. O. Culbertson, Emeritus (University of Texas); J. F. Fellers, Ph.D. Akron; G. C. Frazier, Ph.D. Johns Hopkins; J. M. Holmes, Ph.D. Pennsylvania; H. H. Hsu, Ph.D. Wisconsin; S. H. Jury, Emeritus (University of Wisconsin); C. D. Lunden, Ph.D. Pennsylvania; C. M. Rudser, Polytechnic; C. J. McHargue, Ph.D. Kentucky; C. F. Moore, Ph.D. Louisiana State; B. F. Oliver, Ph.D. Pennsylvania State; J. J. Perona, Ph.D. Northwestern; W. R. Prados, Ph.D. Tennessee; J. E. Sproul, Ph.D. Tennessee; J. E. Stansbury, Ph.D. Cincinnati; C. O. Thomas, Ph.D. Tennessee; R. A. Vandermeer, Ph.D. Illinois Institute of Technology; J. S. Watson, Ph.D. Tennessee; R. A. C. Weaver, Ph.D. Princeton; J. L. White, Ph.D. Delaware; M. W. Wright, Ph.D. Wales.

Associate Professors:

W. T. Becker, Ph.D. Illinois; D. L. Brun, Ph.D. Houston; R. M. Counce, Ph.D. Tennessee.

Assistant Professor:

F. Weber, Ph.D. Minnesota.

Lecturers:


Graduate programs lead to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering with concentrations in chemical engineering, chemical bioengineering, advanced control systems, and polymer science and engineering, in Metallurgical Engineering, and in Polymer Engineering.

*Alumni Distinguished Service Professor.
*Space Institute, Tuscaloosa.

College of Engineering

R. E. C. Weaver, Dean
W. K. Stair, Associate Dean
W. A. Miller, Associate Dean
A. W. Spickard, Assistant Dean

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

OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEO TAPE

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 class in specially-equipped 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 class and are played back at remote locations.

Telephone 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 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 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, 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 to the company requesting the study. In such case, the whole expense will be carried by the parties requesting the investigation.
metallurgical engineering faculty concerning development of individual special programs compatible with their backgrounds. Areas of specialization within the program may be physical metallurgy of structure-property relations, corrosion, joining, solidification, microscopy, electron and optical, chemical process metallurgy, failure analysis, mechanical behavior of materials and structures.

**UTK-JAPAN COOPERATIVE PROGRAM IN POLYMER ENGINEERING**

The UTK-Japan Program provides a means for Japanese research professors to teach 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, 5130, 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 balances, mechanical energy balances; flow in tubes, piping systems, and packed beds; metering devices, pumps. Prereq: Chemical and Metallurgical Engineering 2020, Mathematics 2850.

3420 Heat Transfer (4) Differential and overall energy balances; steady and unsteady state, heat conduction in simple geometries; heat transfer in tubes and heat exchanger construction 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.

3610 Introduction to Process Dynamics and Control (3) Introduction to concepts of process dynamics and control. Steady-state analysis of chemical process control systems. Unsteady state nature of chemical processes. Laplace transform techniques, block diagram algebra, transfer functions. Theoretical and practical applications in various chemical processes.

3620 Chemical Process Control (3) Basic control theory applied to chemical processes; feed-back control systems, feed-forward control, stability analysis, frequency response. Survey of modern control of typical industrial unit operations. Prereq: 3610.

4110 Chemical Engineering Data Analysis (3) Analytical and experimental identification of system parameters; statistical properties of samples and source systems; empirical modeling of processes; statistical process control. Prereq: 3420 and Mathematics 3150.


4130 Introduction to Optimization (3) Principles and applications of optimization techniques to chemical process design; unconstrained, equality constrained optimization, inequality constrained optimization, and dynamic programming. Prereq: Mathematics 2840.


4420 Process Design and Economic Analysis (3) Development of basic information on a process into an integrated plant design considering mass and energy balances, product specifications, equipment characteristics, capital investment, operating costs and economic merit. Prereq: 4410, 4510.

4430 Special Problems in Design and Economics (3) Extension of 4420 for student 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 Problems (3) Chemical and physical properties of domestic coals, sulfur concentration methods and equipment, both physical and chemical methods; fluidized bed combustion with both thermal and synthetic SOx sorbents; stack gas SOx scrubbing. Prereq: Consent of instructor.

4480 Coal Processing to Liquid Fuels (3) Characterization of various types 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: 3420, 3430.


4730 Mass and Energy Flow in Biological Systems (3) Basic physicochemical and organizational principles applicable to biological systems. Deriva-
tions of general equations of biomass and energy transfer. Thermodynamics of transport and equilibrium in biological systems. Discussion of Volterra'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 transport processes. Structure and rheology of physiological fluids, membrane and interfacial phenomena; analysis and design of artificial organs. Prereq: 3440, 3450 or consent of instructor.

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

4760 Principles of Biochemical Separation (3) Fundamental aspects and similarities of modern biochemical separation methods; classroom demonstration, design of production and analytical systems. Prereq: Consent of instructor.

5000 Thesis (1-15) P/NP only. E

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

5050 Engineering Analysis (3) Analytical formulation of mathematical models and process engineers in various engineering problems involving deformation of solids, heat transfer and motion of fluids. (Same as Metallurgical Engineering 5050 and Polymer Engineering 5050.)

5100 Heat Convection (3) Analysis of heat convection in fluids under viscous and turbulent flow conditions, emphasizing analytical approach; steady and unsteady convection, and natural convection of fluid in porous media. Prereq: 5050.

5100 Methods of Optimization (3) Principles and applications of various mathematical programming techniques; model-based and systematic approaches to optimization; variational method, maximum principle, dynamic programming, and geometric programming. Prereq: 4130.

5210 Process Dynamics (3) Analysis of recycle operations, steady state simulation and optimization of typical processes.

5250 Chemical Process Industry Economics (3) Analysis of economic components of chemical processes, internal economics, chemical process design and costing, evaluation of alternatives, profitability analysis, concept of capital recovery, depreciation, income statement, balance sheet, income tax, relation of resultant properties with service performance. Suggested for mechanical and industrial engineering students.

5310 Thermodynamics of Heterogeneous Equilibrium (3) Phase rule, equilibrium between phases; composition relationship between phases; differential equations of state and heat and momentum transfer analogies. Prereq: Mathematics 2840.

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

5410 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: 4530.

5500 Doctoral Research and Dissertation (3-15) P/NP only. E

5610 Process Optimization (3) Optimization of chemical process equipment and systems by various techniques: static and dynamic systems. Prereq: 5100.

5620 Advanced Diffusional Operations (3) Fixed and fluidized bed operations, stagewise and differential mass transfer bed concepts. Prereq: Consent of instructor.

5625 Venture Analysis in the Process Industries (3) Interactions among the 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.


6210 Advanced Diffusional Operations (3) Fixed and fluidized bed operations, stagewise and differential mass transfer bed concepts. Prereq: Consent of instructor.

6250 Stability Phenomena in Chemical Engineer- ing: Continuous Systems (3) Instabilities in fluids based upon interaction of heat transfer, diffusion and chemical reactions. Emphasis on formulation of problems and methods of solution. Stability of jets and formation of emulsions; Benard instability, Marangoni turbulence. Prereq: 5810 and 5620 or equivalent.

6410 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.


6710 Process Dynamics (3) Development of dynamical models of reacting systems 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.

6130 Engineering Materials III (3) Extension of 2110 or 3110 with emphasis on control of thermal and magnetic properties of materials by specification of composition, thermal, and mechanical treatment; control of residual properties with service performance. Suggested for electrical engineering students.

6140 Engineering Materials IV (3) Extension of 2110 or 3110 with emphasis on materials processing: specification and evaluation. Suggested for mechanical and industrial engineering students.

6150 Engineering Materials V (3) Extension of 3110 with emphasis on the mechanisms and control of reactions of engineering alloys with aqueous, nonaqueous, and gaseous environment. Prereq: 3110 or equivalent.

6160 Engineering Materials VI (3) Extension of 2110 or 3110 with emphasis on materials of significant in nuclear engineering; nuclear reactor construction materials, nuclear fuel materials, and interaction of radiation with solids to produce changes in engineering properties. Suggested for nuclear and mechanical engineers.


3220 Diffusion and Annealing (3) Introduction to solid state kinetics; point defects, solid solutions, diffusion equations and mechanisms; diffusion of cold worked structures. Prereq: 3210. Mathematics 2840.

3310 Biomedical Applications of Materials for Life Scientists (3-15) Applications of various materials in medical science and engineering; metals, polymers, and ceramics; methods of fabrication of components; corrosion; applications of medical devices and dental materials. Prereq: Chemistry 1110-20-30 or equivalent.

3710 Metallurgical Applications in Manufacturing Technology (3) Fabrication methods and principles of mechanical/thermal processing for finished and semifinished articles; casting, powder metallurgy, plastic forming, joining, heat treatment. Prereq: 2110 or equivalent.

4240 Engineering Materials Design (3) Property changes through heat treatment; nucleation and transformation in ferrous alloys. Plain carbon steels, alloy steels, and tool steel processing for property selection and design requirements. Prereq: 3220 or consent of instructor.

4250 Design and Analysis (3) Design and laboratory sessions on analysis of materials, requirements and performance in engineering structures and components. Prereq: Senior standing.

4500 X-Ray Diffraction and Its Application (4) Basic principles and application of x-ray diffraction from materials. Theory, powder technique, precision lattice constants, chemical, analysis and phase identification, preferred orientation. 3 hrs and 1 lab.

4540 Fracture-Safe Design (3) Same as Engineering Science and Mechanics 4540.

4730 Mechanical Metallurgy I (4) Elastic behavior; description of stress, strain, and stress-strain relationships; plane strain loading; failure by yielding; stress concentration and notch sensitivity; ductile fracture; brittle fracture due to geometry and rate effects. Prereq: First course in Materials Science and Engineering Science and Mechanics 3511. Also suggested for mechanical engineering and materials science and engineering students.

4740 Mechanical Metallurgy II (4) Brittle fracture due to metallurgical and environmental factors; fatigue, residual stresses; creep and stress rupture; effect of microstructure; plastic strain and
plastic stress-strain relations; fabrication by forging, rolling, deep drawing; formability testing. Prereq: 5910 or Mechanical Engineering 3650 and first course in Materials Science, or consent of instructor. Suggested for polymer science and mechanical engineering students.

6760 Casting and Welding (3) Principles and processes of casting and welding; heat transfer, solidification segregation, gas-metal and slag-metal interactions, thermal treatments, associated stresses. Prereq: 3120 or 3320. 3 hrs or 2 hrs and 1 lab.

5000 Thesis (1-15) P/NP only. E

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

5050 Engineering Analysis (3) (Same as Chemical Engineering 5050.)

5110 Dissolutions (3) Theoretical and experimental analysis of line defects and their interactions in solids. Prereq: 4730 or consent of instructor.

5120 Plastic Deformation (3) Geometry and mechanisms of plastic deformation of single crystals; slip and twinning; work hardening; effects of temperature and alloying on short-term loading. Prereq: 5110.

5130 Plastic Deformation II (3) Plastic deformation of polycrystalline materials; theoretical and experimental analysis of texture formation resulting from deformation and annealing 5150. 2 labs.

5140 Diffusion in Solids (3) Analysis of models and experimental observations relating to phenomenological and mechanistic description of diffusion and annealing of point defects.


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

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

5540-50 Electron Microscopy I and II (3, 2) Kinematic and dynamic electron diffraction theories are developed and their application to electron diffraction patterns and contrast effect in transmission electron microscopy is discussed. Special attention is given to metallurgical applications such as plastic deformation, fracture, precipitation, and phase transformations. Prereq: 4510-20.

5560 X-Ray Metallurgy (3) Application of x-ray diffraction theory and techniques to metallic systems. Powder and single crystal techniques; reciprocal lattice; analysis of scattered intensity; line profiles; orientation of single crystals; preferred orientation; phase analysis; order-disorder transformations.

5750 Corrosion (3) Analysis of corrosion processes in terms of polarization measurements and the Pourbaix diagram. Influence of stress, temperature, and localized conditions contributing to pitting, crevice, and stress corrosion.

5840-50 Metallurgy of Deformation and Fracture (3, 3) Theoretical and engineering analysis of effect of stress state, strain rate, environment, temperature, and metallurgical structure on mechanical behavior in service, testing, and fabrication.

5900 Special Topics in Metallurgical Engineering (3) Recent advances in metallurgical engineering and related fields: fiber composites, ordered alloys, grain boundaries and radiation effects. May be repeated. Maximum 9 hrs.

5910-20-30 Metallurgical Thermodynamics (3, 3, 3) Application of thermodynamics and phase equilibrium 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 (3-15) P/NP only. E

6110-20-30 Theoretical Metallurgy (3, 3, 3) Phases of solid state physics applicable to metallurgy: elasticity, introductory quantum theory, specific heats, electron theory of lattice and thermal conductivity, magnetic properties, theory of alloy formation. Prereq: 4610 or Physics 3720; Mathematics 4550 and consent of instructor.

6160-70 Phase Transformations II and III (3, 3) Continuation of 5150 with emphasis on advanced theoretical formulations of nucleation and growth theories, and applications related to martensitic transformations and shape memory phenomenon. Prereq: 5150.

6320-30 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 phenomena. Prereq: 5310.

6410-20 Thermodynamics of Solids (3, 3) Classical and statistical thermodynamics and stability of solid solutions, compounds and ordered phases. Prereq: 5910-20-30 or consent of instructor.

6510-20 Advanced X-Ray Diffraction (3, 3) Generalized theory; crystal structure determination; thermal motion; lattice faults, diffuse scattering. Prereq: 5560.

6900 Special Topics in Metallurgical Engineering (3) Developments in the science and technology of metals and alloys. May be repeated. Maximum 9 hrs.

Polymer Engineering

4910 Applied Polymer Science (3) First course in the physical properties, synthesis and experimental observations of polymer structure and properties of amorphous and crystalline polymers, crystallization kinetics and mechanical properties are discussed. Not for credit for Polymer Engineering majors.

4920 Polymer Processing (3) Rheological properties of polymer melts and solutions, viscometry, unit operations of fiber, plastics and rubber industries; dimensional analysis and scale-up, flow through dies and pipelines, screw extrusion, spinning of fibers, injection molding. Not for credit for Polymer Engineering majors.

4930 Principles of Fiber and Textile Engineering (3) Chemical and crystalline structure of important fibers; preparation of polymer materials; drawing and texturing; preparation of yarn; dyeing, weaving and knitting. Emphasis on quantitative aspects.

4940 Plastics Fabrication Operations (3) Lecture and laboratory course treating unit operations of the plastics industry. Types and mechanisms of operation of machinery used and the structure and properties of fabricated parts. Operations to include extrusion, coextrusion, injection molding including structural foam, thermoforming, blow molding, rotational molding.

5000 Thesis (1-15) P/NP only. E

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

5050 Engineering Analysis (3) (Same as Chemical Engineering 5050.)

5110 Structural Characterization of Polymers with Electromagnetic Radiation (3) Theory of scattering and diffraction of electromagnetic waves by matter, special application to experimental techniques applied to polymers. Wide angle x-ray scattering (WAXS), small angle x-ray scattering (SAXS), small angle light scattering (SALS). Interpretation in terms of polymer chain conformation, crystal structure, morphology and superstructure.

5120 Characterization of Orientation in Polymer Systems (3) Representation of orientation in materials characterization using electromagnetic radiation orientation factors. Experimental methods of mapping for solid and solution samples under x-ray diffraction, and dichroism. Prereq: 5110 or consent of instructor.


5230 Mechanical Behavior of Solid Polymers (3) Application of linear viscoelasticity and large deformation elasticity to solid polymer (especially Vulcanized rubber and crystalline polyolefins) properties. Dynamic modulus and loss tangents; wave propagation, friction, tearing, tensile failure, abrasion. Experimental methods of determining properties. Prereq: Engineering Science and Mechanics 3111.

5310 Polymer Solution Properties and Characterization (3) Molecular weight determination, chromatography, solution thermodynamics, phase separation; application to synthetic and naturally occurring macromolecules. Prereq: Undergraduate physical chemistry.

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, film production.

5450 Principles of Injection and Blow Molding Operations (3) Basic experimental procedures for polymer characterization, x-ray diffraction and optical methods. Coreq: 5110 or consent of instructor. 2 labs.

5511 Laboratory Methods in Polymer Engineering I (1) Basic experimental procedures for polymer characterization, x-ray 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 and processing, orientation, melt flow, processing. Coreq: 5120 or consent of instructor. 2 labs.

5610 Textile Processing (3) (Same as Textiles and Clothing 5610.)

5620 Textile Engineering Mechanics (3) (Same as Textiles and Clothing 5620.)

5710 Phase Transformations in Polymer Systems (3) Analysis of nucleation and growth of phases in polymer systems, spinodal decomposition, application to crystallization from the melt, precipitation from solution.

5810 Physical Properties of Polymer Structures (3) Advanced principles including copolymers plus structures of two phase block polymers and polymer mixtures as related to glassy and amorphous polymer crystalline transitions, phase incompatibility, thermal-mechanical, and optical properties.

5910-20-30 Metallurgical Thermodynamics (3, 3, 3) Application of thermodynamics and physiochemical principles 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 (3-15) P/NP only. E

6110 Optical Properties of Polymers (3) Maxwell's
equations and electromagnetic theory of light, optical properties of keratropic and birefringent dielectrics, including theory of birefringence, applications to spherical and cylindrical lenses and fibers studies of Stein, light scattering from polymeric materials.

6150 Advanced X-Ray Diffraction Methods for Characterization of Macromolecules (3) Classical methods of crystal structure determination; Patterson functions; Fourier functions; Bessel nets and Bessel function techniques; levels of order, thermal motions, defects, order-disorder transitions and para-crystallinity. Precision and technology photography, single crystal and powder diffractometry with applications to synthetic and biological macromolecules.

6210 Nonlinear Viscoelasticity (3) Tensor formulation of nonlinear equations for viscoelastic materials subjected to large deformations. Integral, differential, and acceleration tensor formulations. Applications to polymer 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 structures formation to analysis of polymer process operations. Prereq: 5210.

6230 Advanced Mechanical Behavior of Polymers (3) Stress analysis with emphasis on developing constitutive models for relating behavior of solid polymers, failure analysis and general deformation mechanics of solid polymers. Relation of microstructural properties to molecular structure.

6250 Large Deformation Elasticity (3) Curvilinear tensor analysis, theory of finite strains, Mooney-Finger-Rivilin formulation of isotropic non-linear elastic materials, solution of large homogeneous and non-homogeneous deformation problems, application to vulcanized rubber, reinforcement with inextensible cords. Prereq: 5210 or equivalent.


6610 Advanced Industrial Polymer Chemistry (3) Chemistry and properties of new polymeric 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 the technology of polymers. May include topics of morphology, structure, characterization. Prereq: Consent of instructor.

Civil Engineering

MAJORS
Civil Engineering M.E., M.S., Ph.D.
Environmental Engineering M.E., M.S.

Emeritus Professor:
C. R. Walker, S.M. Massachusetts Institute of Technology, P.E.

Professors:
W. L. Gracco (Head), Ph.D. Michigan State, P.E.;
E. G. Burdette Ph.D. Illinois, P.E.; C. Chatterton,
Ph.D. North Carolina State, P.E.; J. W. Fortey,
Doctoral, d'Universite de Toulouse (France);
D. W. Goodpasture, Ph.D. Illinois, P.E.;
K. W. Heathington, Ph.D. Northwestern, P.E.;
W. H. Hightier, Ph.D. Purdue, P.E.; J. B. Humphreys, Ph.D. Texas A&M, P.E.; R. A. Minear, Ph.D. Washington;
B. A. Tachanch, Sc.D. New Mexico State, P.E.;

Associate Professors:
Friedrich, BSE Clarkson College of Technology, P.E.; J. H. Hansen, Ph.D. Missouri;
D. C. Jameson, Jr., M.S. Tennessee, P.E.;
H. L. Johnson, M.S. Tennessee, P.E.; G. D. Kressin, J.D. Tennessee; A. B. Moore, M.S. Tennessee; G. D. Reed, Ph.D. Illinois; R. F. Tiry
(Emirius), B.S. Marquette, P.E.

Assistant Professors:
E. S. Houglund, Ph.D. Virginia Polytechnic Institute;
R. B. Robinson, Ph.D. Iowa State, P.E.

Lecturers:
J. E. Beavers, Ph.D. Vanderbit, P.E.; J. M. Corum, Ph.D. Illinois; C. Frank, B.S. Tennessee;
G. J. Hayden, Ph.D. Vanderbit, R. L. Joffey, 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 environmental engineering, structural engineering, soils engineering and 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 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, prerequisite undergraduate courses may be indicated, and in general these must be completed before courses for graduate credit can be taken.

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

Option I: The student must present a minimum of 45 quarter hours of approved graduate courses. The major shall include a minimum of 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 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 graduate degree of Master of Engineering are available to qualified graduates of A.B.E.T. accredited undergraduate curricula in civil engineering or environmental engineering leading to the Bachelor of Science degree. At least one-third of the program of study must be characterized 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.

Special 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 56 credits must be in doctoral level courses. Doctoral Research and Dissertation will be required.

2. A minimum of 36 quarter hours of graduate courses in the Civil Engineering Department, exclusive of thesis or dissertation credit, at least 9 hours of which must be 6000-level courses.

3. Supporting courses in related scientific and engineering fields, amounting to approximately 36 quarter hours, subject to approval by the student's faculty committee. 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; footings, and retaining walls. Prereq: 4110 and 4410, Sp

4220 Foundations (3) Subsurface investigations; design of shallow and deep foundations on cohesive and cohesionless soils. Foundations on rock, lateral earth pressure, Stability of slopes in homogeneous clays. Prereq: 3315 and Geology 2610, Sp, Su

4240 Structural Design (3) Plate girders, composite steel and concrete beams, connections and details, and design of small industrial buildings. Prereq: 3250 and 4110. 2.5-hr periods, W, Sp

4260 Photogrammetry (3) Methods of plotting maps from aerial photographic plotting instruments; applications. Prereq: 2390, Forestry Summer Camp for forestry majors.

4420 Analysis of Framed Structures (3) Maximum stresses due to moving loads; uses of influence lines; lateral forces due to earthquake and wind;
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 algebra, vectors, stability conditions for determinate and indeterminate analysis of plane, trusses, general members and structures composed of general members. Prereq: 4540 or consent of instructor. Sp
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 structures having many degrees of freedom; elastoplastic behavior considered for structural systems. Prereq: 5110. Sp
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 5860. (Same as Engineering Science and Mechanics 5180.) Sp, A
5220 Pavement Design (3) Pavement loads; pavement design; construction and maintenance. Prereq: 3130. Sp
5250 Advanced Properties of Materials: Bituminous Substances and Mixes (3) Serviceability concepts; pavement failures and remedies; bituminous pavement maintenance techniques; other uses of asphalt products. Prereq: 4720. Sp
5270 Planning and Transportation (3) Preparation of transportation and elements of comprehensive development plans. Analysis of relationships between various transportation systems 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
5320-30 Engineering Practice Applied to Administration of Engineering Projects (3, 3) Engineering administration; planning of governmental and industrial projects; cost estimates and methods of financing. W
5410 Construction Contract Law and Administration (3) General principles applicable to construction contracts and construction related sales contracts. Emphasis on role of engineer in preparation, award, and administration of construction contracts. Case study method of instruction. Prereq: 4230 or consent of instructor.
5420 Structural Model Analysis (3) Experimental methods of shear, moment, and stress analysis.
5430-40-50 Construction Management I, II, III (3, 3, 3) Management and organization of heavy and building construction projects. Prereq: 4430 or consent of instructor. W, Sp
5460-70 Construction Estimating I, II, III (3, 3, 3) Project costs, estimating techniques; market cost conditions and feasibility of design as it applies to costs. Prereq: 4430 or consent of instructor. W, Sp
5550 Slope Stability and Retaining Structures (3) Stability of natural and cut slopes and embankments, lateral earth pressure theories. Design of rigid retaining structures; cut slope and retaining structures; pile walls and anchored bulkheads. Coreq: 4220
5560 Shear Strength and Stress Behavior of Soil (3) Shear strength of fine grain soil from perspective of idealized, simple clay. Drained and undrained shear strength. Stability-aspect behavior of real soils. Consolidation theory. Coreq: 4220
5570 Soil Mechanics—Seepage (3) Saturated flow through embankments, drains, seepage forces and velocities, subsurfaces, and embankment failures. Prereq: 3310 or consent of instructor. Sp
5610 Behavior of Steel Structures (3) Behavior of structural steel members under static and fatigue loading; relation between research results and current specialization for design. Prereq: 3230. W
5730 Prestressed Concrete (3) Properties of prestressing materials and anchorage systems; methods of pretensioning and posttensioning; analysis and design of members and continuous structures. F
5740 Behavior of Reinforced Concrete Members (3) Ultimate strength and behavior of reinforced concrete members; relation between research results and current specifications for design. Prereq: 4120. W
5800 Urban Systems: Engineering and Management I (3) Management of various urban systems usually under city manager and/or city engineer. Organization, finance, personnel administration, purchasing and equipment management and dealing with engineering consultants as each deals with municipal public works. Prereq: Graduate standing in Civil or Environmental Engineering or consent of instructor. W, A
5805 Urban Systems: Engineering and Management II (5) Continuation of 5800. Management and engineering of urban systems involving transportation, water, land use planning, zoning, cleaning and snow removal, water supply and waste water drainage, solid waste, air pollution and regulations. Prereq: 5800. F
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 vehicular signal systems; progressions systems; one-way operations; reversible flows; system operation, including computerized networks; legal aspects of operational controls. Prereq: 5810. 2 hrs and 1-2 hr lab. W
5840 Geometric Design (3) Advanced theory and practice in the geometric design of highways. Prereq: 4600. Sp
5850 Functional Design of City Streets and Urban Freeways (3) Effect of street systems upon urban growth and development; classification and function of streets; design features, including cross section, intersections, urban design, and current specifications for design. Prereq: 4120. Sp
5860 Urban Transportation Planning (3) Prediction of traffic demands and vehicular flows; land use planning; parking needs. Prereq: 5810. F
5870 Public Transit Planning (3) Person movement by bus, rapid rail and taxicab transit. Nature of public transit; its various roles and how they fit community's need; user preferences; modal split models; total social, political, economic and technical impacts of public transit. Prereq: 4600 or graduate standing. W, A
5880 Highway Safety I (3) Transportation safety, highway safety, Legislation, federal-state-local relations, current highway safety standards. Prereq: Graduate standing or consent of instructor.
5885 Highway Safety II (3) Effect of current tort law upon highway safety activities; roadside safety design; cross-section, barriers, guardrails and energy attenuators; identification and correction of high accident locations and system deficiencies. Prereq: 5880 and graduate standing.
5890 Traffic Accident Reconstruction (3) Proper traffic accident data collection and analysis as basis of designing accident prevention or control programs. Many contributing factors to an accident; protocol and secondary accident causes as they relate to roadway improvements. Prereq: 4640 or 5810 or consent of instructor. Sp, A
5900 Special Problems in Civil Engineering (1-9) To fulfill the special problem requirement in the non-
course requirement in the non-
civil engineering majors. May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation (3-15) P/NP

6110 Research Development (3) Development of research activities in private and public sectors. Improving skills to become competitive in attracting research funding. Course cannot be used to satisfy 6000-level course requirements in doctoral programs. Prereq: E 6110.

6510 Behavior of Steel Bridges and Buildings (3) Behavior, analysis, and design of steel girders, columns and composite members subjected to static and dynamic loading. Prereq: E 5170 and E 5110. Sp, A.

6740 Behavior of Reinforced Concrete Beams and Slabs (3) Strains and stresses in reinforced concrete beams and slabs; behavior and design using the AASHO code. Emphasis on interrelation of various conditions and/or designs. Prereq: E 5150 or Mechanics 3150, or consent of instructor. Sp.

6750 Behavior of Reinforced Concrete Slabs and Beams (3) Behavior, analysis and design of reinforced concrete slabs; finite element solutions. Prereq: AC Code Methods, yielding theory, and Mechanics 3150 or Engineering Science and Mechanics 6310. Sp, A.

6830 Traffic Flow Theory (3) Queuing theory, Markov processes, Monte Carlo methods, simulations of various conditions and/or designs. Prereq: E 5450 or Mathematics 3150. Fall.

6860 Statewide Passenger Transportation Planning (3) Comprehensive multimodal transportation plan, intercity traffic models, functional classification, programming and scheduling. Emphasis on government policy decisions, as they affect air and highway investments. Prereq: E 5860. W, A.

6870 Future Transit Technology and Research (3) New transit systems and new technology; identification of possible research areas in technology and planning process and possible research designs. Prereq: E 5870. Summer.

6880 Planning Models for Transportation System I (3) Introduction to planning and programming; applications of optimization mathematical, statistical, and computer science techniques. Modal split, trip distribution, and trip assignment procedures integrated into urban transportation planning process. State-of-the-art and new modeling techniques. Prereq: E 5860 or E 5270. Mathematics 3150 and Statistics 3450. W, A.


6910-20-30 Special Topics in Civil Engineering (1-3, 1-3, 1-3) Selected advanced problems of current interest to civil engineering. Prereq: Consent of instructor. E.

Environmental Engineering

4000 Environmental Protection (3) Managing water and waste, water and waste management in urban environment, solid wastes, commercial insects and rodents, food, and excretion of physical energy to public wealth, promotion of health, to promote efficiency and comfort, and to safeguard balances in natural ecosystems. Principles of environmental protection; objectives of design and practice without detailing design of practice methods.

4030 Environmental Engineering Chemistry (3) Functions and interrelationships of water and wastewater systems, generation, formation analysis, and removal of environmental contaminants. Prereq: Chemistry 1130 and senior standing.

4160 Urban Water Management (3) Introduction to urban water modeling; evaluation of optimum urban water policies; formulation of system constraints and analysis of system development; management of storm water for beneficial use. Prereq: E 3330. Sp.

4210 Water Resources Engineering Design (3) Elements of water resource structures and systems, including reservoirs, dams, controls, works, and open channels. Design of safety control, environmental impact of reservoir projects. Prereq: E 3330 or consent of instructor. F.

4220 Water Resources Engineering Development (3) Multiobjective evaluation processes for comparing and selecting among water resources development alternatives; achieving project optimality; single- and multi-purpose projects; special topics in new developments in water resources engineering. Prereq: E 3330 or consent of instructor. W.

4330 Hydrologic Design (3) Application of frequency and regression analysis to hydrologic design of water resources projects; application of runoff and streamflow modeling; urban peak runoff design using kinematic wave theory; evaluation of effects of urban uses on streamflow quantity and quality. Prereq: E 3330. Fall.

4510 Elements of Water and Wastewater Transportation Systems (3) Introduction to theory and design of water transportation and distribution systems and wastewater collection systems. Prereq: E 3120 and E 3330. F, W.


4525 Water and Wastewater Treatment Plant Design (3) Detailed process design of water and/or wastewater treatment plants; sludge handling systems, ultimate disposal of residuals. Prereq: E 4520 or equivalent.

5301 Stormwater Modeling I (3) Interpretation of hydrologic data using methods of systems analysis. Hydrologic components are analyzed as linear and nonlinear systems integrated into mathematical models of watershed response. Optimizing model parameters with illustrative examples. Prereq: Consent of instructor. W.

5302 Stormwater Modeling II (3) Continuous streamflow records interpreted using methods of stochastic hydraulics, including flow frequency and time series analysis. Application of unit operations and processes integrated into mathematical models of streamflow simulation techniques including auto-correlative and fractional Gaussian noise models. Prereq: Consent of instructor. Sp.

6100 Urban Water Management (3) Functions and interrelationships of water and wastewater systems, generation, formation analysis, and removal of environmental contaminants. Prereq: Chemistry 1130 and senior standing.

5322 Sediment Transportation (3) Sediment properties and measurements; bed loads and suspended load movement; erosion, scour, transport and deposition of sediments; models for flow over bed; settling of reservoirs and related topics. Prereq: E 5230. W.

5323 Flood Damage Reduction (3) Regional, local flood problems; hydrologic design criteria; traditional flood control measures; land use controls and adjustments; flood proofing, flood insurance, and other flood damage reduction elements; interdisciplinary approach in floodplain management; case studies. Prereq: Consent of instructor.

5211 Basic Principles of Remote Sensing (3) Applications of remote sensing in agriculture, engineering, forestry, meteorology, land use planning, and resource management; properties of remote sensing radiation including wave theory, physical, geometrical, and biological properties of data. W.


5301 Stormwater Modeling I (3) Interpretation of hydrologic data using methods of systems analysis. Hydrologic components are analyzed as linear and nonlinear systems integrated into mathematical models of watershed response. Optimizing model parameters with illustrative examples. Prereq: Consent of instructor. W.

5302 Stormwater Modeling II (3) Continuous streamflow records interpreted using methods of stochastic hydraulics, including flow frequency and time series analysis. Application of unit operations and processes integrated into mathematical models of streamflow simulation techniques including auto-correlative and fractional Gaussian noise models. Prereq: Consent of instructor. Sp.

5211 Basic Principles of Remote Sensing (3) Applications of remote sensing in agriculture, engineering, forestry, meteorology, land use planning, and resource management; properties of remote sensing radiation including wave theory, physical, geometrical, and biological properties of data. W.


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6100 Urban Water Management (3) Functions and interrelationships of water and wastewater systems, generation, formation analysis, and removal of environmental contaminants. Prereq: Chemistry 1130 and senior standing.

5322 Sediment Transportation (3) Sediment properties and measurements; bed loads and suspended load movement; erosion, scour, transport and deposition of sediments; models for flow over bed; settling of reservoirs and related topics. Prereq: E 5230. W.

5323 Flood Damage Reduction (3) Regional, local flood problems; hydrologic design criteria; traditional flood control measures; land use controls and adjustments; flood proofing, flood insurance, and other flood damage reduction elements; interdisciplinary approach in floodplain management; case studies. Prereq: Consent of instructor.

5211 Basic Principles of Remote Sensing (3) Applications of remote sensing in agriculture, engineering, forestry, meteorology, land use planning, and resource management; properties of remote sensing radiation including wave theory, physical, geometrical, and biological properties of data. W.


5301 Stormwater Modeling I (3) Interpretation of hydrologic data using methods of systems analysis. Hydrologic components are analyzed as linear and nonlinear systems integrated into mathematical models of watershed response. Optimizing model parameters with illustrative examples. Prereq: Consent of instructor. W.

5302 Stormwater Modeling II (3) Continuous streamflow records interpreted using methods of stochastic hydraulics, including flow frequency and time series analysis. Application of unit operations and processes integrated into mathematical models of streamflow simulation techniques including auto-correlative and fractional Gaussian noise models. Prereq: Consent of instructor. Sp.
5503 Advanced Water and Waste Treatment Systems (3) Theory, design, operation, and control of water and waste treatment systems. Emphasis on those systems used for wastewater reclamation. Prereq: 4520. W

5530 Environmental Engineering and Natural Systems Behavior (3) Seminar in selected issues of environmental science research relating to natural system behavior. Emphasis, trace metals and trace organics. Prereq: Graduate standing or consent of instructor.

5551 Water Quality Management (3) Water quality control objectives, methods, and philosophies; water quality criteria; effect of various uses on water quality; receiving water characteristics and waste assimilation capacity; regulatory standards; economic considerations. Prereq: 4520. W

5582 Microbiology for Sanitary Engineers (3) Microorganisms and microbiological processes significant in sanitary engineering, including basic microbiology, detection and identification, enzymes, metabolic reactions, energy transfer, synthesis and growth; aerobic and anaerobic biological treatment processes. Prereq: Graduate standing. Sp

5593 Advanced Environmental Engineering Laboratory (3) Application of modern and typical methods, principally instrumental, to analysis of environmental pollutants. Prereq: 4530. 2 hrs and 1 lab.


5630 Design of Solid and Hazardous Waste Disposal Systems (3) Unit operations and processes for solid and hazardous waste disposal: soil contamination, incineration and heat recovery, biological processes, fixation and encapsulation, and resource recovery. Prereq: 4600, 5592, 5503. 1 lab.

5700 Planning and Air Pollution Control (3) Relationship between air pollution, area development, and urban growth. Social, economic, and political processes involved in air pollution control.

5710 Air Pollution Control Engineering (3) Emission control systems for industrial and power generating processes, stack sampling methods, air treatment, dispersion of pollutants. Prereq: Graduate standing.

5715 Ambient Air Monitoring (3) Physical and chemical techniques for ambient air monitoring. Survey of methods and practice of control and certification of air quality data. Use of monitoring data in air quality management programs. Prereq: Consent of instructor.

5720 Air Pollution Particle Collection Theory (3) Measurement of suspended particles suspended in gaseous medium including particle motion, coagulation, and aerodynamic capture of particles. Prereq: Engineering Science and Mechanics 3110. W

5725 Air Quality Modeling and Impact Assessment (3) Techniques to assess the air quality impact of major transportation projects and industrial air pollution sources. Application of atmospheric dispersion models and evaluation of meteorological and air quality data. Prereq: Graduate standing. Computer Science 3150. Sp

5730 Air Pollution Control Device Design (3) Design and evaluation of systems used to control emission of gaseous and particle air pollutants. Comprehensive design of specific devices and systems. Prereq: 5720. Sp

5735 Industrial Source Sampling (3) Sampling methods for gaseous and particulate air pollutants emissions from industrial processes. Prereq: Graduate standing. 2 hrs and 1 lab.

5745 Ambient Air Chemistry (3) Reaction mechanisms for production of secondary air pollutants from emissions from industrial processes. Prereq: 5725. Sp

5760 Diffusion in the Atmosphere (3) Movement and dilution of natural or man-made material released into the atmosphere. Basic theory. Rise of buoyant plumes, relation between Eulerian and Lagrangian descriptions for instantaneous and continuous sources, diffusion in a zone of wind shear and diffusion from urban area sources. Prereq: 5710. F

5900 Special Problems in Environmental Engineering (1-6) To fulfill the special problem requirement in the non-thesis program. Enrollment limited to environmental engineering students in the non-thesis program. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

5910-20 Special Topics (1, 6, 4-6) Problems and topics related to current developments in field of environmental engineering not included in other courses. May be repeated. E

5990 Environmental Engineering Seminar (1) All phases of environmental engineering including reports on current research at The University of Tennessee, Knoxville. Course credit not applicable to graduate degree program. Prereq: Active graduate standing in environmental engineering. May be repeated. S/NC only. F, W, Sp

6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) (Same as Engineering Science and Mechanics 6110-20).

6230 Kinematic Wave Theory (3) Approximations of DeSaint Venet equations by kinematic wave theory applied to overland flow and streamflow. Criteria for approximation and methods of linkage of infiltration and overland flow and streamflow. Prereq: 5230 or equivalent. Sp, A

6510 Industrial Waste Unit Operations and Processes (3) Laboratory and pilot plant development of physical, chemical and biological variables for treatment of industrial wastes and residuals, utilization of variables in design. Prereq: 5501, 5502, 5503, 5505. 1 hr and 4 labs.

6520 Industrial Waste Management (3) Sources and characteristics of industrial wastes; recycling, waste reduction, energy recovery, resource recovery, and treatment options, ultimate disposal of residuals including thermal processes, land application, recovery, and encapsulation; design oriented. Field trips. Prereq: 5501, 5503 or consent of instructor.

6530 Rate Processes in Environmental Pollution (3) Application of scientific principles concerning movement and fate of chemicals at interfaces of three geospheres of environment (air, water and earthen solids). Development of intuitive sense to enhance problem solving. Prereq: 5501, 5503 or consent of instructor.


9190-20 Special Topics in Environmental Engineering (3, 3) Selected advanced problems of current interest in environmental engineering. Prereq: Consent of instructor.

NOTE: Prerequisite to all graduate courses: Consent of instructors.

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Electrical Engineering

MAJOR Electrical Engineering

DEGREES M.S., M.E., Ph.D.

Professors: J. M. Googe (Head), Ph.D., Georgia Institute of Technology; E. L. Hall, Ph.D., Georgia Institute of Technology; B. A. Bishop, Ph.D., Tennessee; J. D. Tillman, Ph.D., Tennessee; R. E. Bodenheimer, Ph.D., North Carolina; D. W. Bouldin, Ph.D., Vanderbilt; D. D. Frick, Ph.D., Temple; J. A. Medlock, Ph.D., University of Arkansas; J. M. Bailey, Ph.D., Georgia Institute of Technology; F. A. Gorham, Ph.D., University of Tennessee; H. P. Neff, Ph.D., Auburn, P.E.; M. O. Pace, Ph.D., Georgia Institute of Technology; P. Z. Peebles, Ph.D., Pennsylvania; C. D. Pacifici, Ph.D., Pittsburgh; T. W. Reddoch, Ph.D., Louisiana State, R. W. Rochelle, Ph.D., Maryland; F. W. Symonds, Ph.D., Notre Dame; M. W. Eldridge, Ph.D., Auburn; C. H. Weaver, Ph.D., Wisconsin, P.E.

Associate Professors: D. W. Bouldin, Ph.D., Vanderbilt; D. Rosenberg, Ph.D., New York; H. M. Scull (Emeritus), M.S.


Assistant Professors: J. D. Birdwell, Ph.D., Massachusetts Institute of Technology; J. S. Lawler, Ph.D., Michigan State.

MASTERS OF SCIENCE PROGRAM

Graduate work leading to the Master of Science degree in Electrical Engineering may be completed during one academic year of full-time study, or the degree may be obtained in two or three years of study in the evening. Graduate assistantships are available for outstanding students, who may obtain the Master's degree in one calendar year.

MASTERS OF ENGINEERING PROGRAM

A graduate program leading to the Master of Engineering degree is available to qualified graduates of accredited undergraduate curricula in electrical engineering or its equivalent.

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.

DEGREE REQUIREMENTS

Specific degree requirements which must be met include:

1. Electrical Engineering 5070-80 and 5170. Electrical Engineering 5710 is normally available in both fall and spring quarters. Students electing courses such as 5650-60, 5720-30, or 5750-60 which require 5710 as a prerequisite should register for 5710 in the fall quarter.

2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics 4710, 4550, and 4520, or 4510-20. Other approved 4000-5000 level mathematics courses must be selected 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.

The 18 quarter hours of 5000-level work in electrical engineering must be divided equally between two different electrical engineering areas.

4. Master's thesis, totaling 9 quarter hours or more.

5. A final oral examination covering the thesis and related course work.

DOCTORAL PROGRAM

The Ph.D. degree with a major in Electrical Engineering may be pursued in the areas of circuit theory, computers, electronic, communication systems, and technology.

*Space Institute, Tufaloma.

**Distinguished Service Professor.
theory, plasma engineering, power systems, solid-state electronics, and control systems. Students in 30-hour graduate courses for the Ph.D. degree include the following:

1. A Master of Science or Master of Engineering degree.
2. A minimum of 72 quarter hours of course work beyond the B.S. degree excluding thesis, research, and dissertation credit.
3. A minimum of 36 quarter hours of work in electrical engineering at the 5000 and 6000 levels.

Courses required in electrical engineering undergraduate curriculum cannot be used in either the M.S. or Ph.D. programs. In addition, 4000-level courses in electrical engineering may not be used if 5000-level courses are available in the same area.

A minimum of 36 quarter hours credit in doctoral dissertation.

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. Satisfactory performance on both a qualifying and comprehensive examination. The qualifying examination is prepared by the electrical engineering faculty and consists of a 3-hour written examination in each of four areas. Areas (1) mathematics and transform methods, and (2) basic passive and active networks are required of all Ph.D. students. An additional 3-9 hours are chosen from two of the 12 graduate course divisions in the department and cover material from undergraduate courses and first year graduate courses. A student who fails the qualifying examination must take and pass the examination the next time it is offered to remain in the Ph.D. program. The qualifying examination is normally taken after the comprehensive exam, but must take place or immediately after completion of a Master’s degree. A minimum of 27 hours of graduate course work must be completed after the student has taken the qualifying examination the first time.

The comprehensive examination is prepared by the student’s doctoral committee and consists of a 3-hour written examination in the student’s major area, a 2-hour written examination in a related area, and an oral examination. The comprehensive examination is normally taken at least six months after passing the qualifying examination. Part of the comprehensive oral examination will be a defense of a written dissertation proposal. The comprehensive examination must be passed and the dissertation proposal accepted by the student’s doctoral committee before the student is reported as ready for admission to candidacy for the Ph.D. degree.

Participation in departmental seminars.

Many of the electrical engineering courses are offered in the evening. Engineering workshops are encouraged to participate in the department’s graduate program.

Departmental graduate programs providing special opportunities for academic and research work in areas pertinent to atmospheric and space flight are also available at the Space Institute, Tullahoma.

3010 Transient Analysis (3) Analysis of transient response of networks and systems; Laplace transform method and classical differential equation methods for evaluation of frequency response. Includes Fourier transforms, poles, and zeros; zero-pole concept and pole-zero concepts; applications to engineering problems. Prereq: 2030.


3050 Basic Field Theory (3) Forces between charges, electric and magnetic fields, Gauss’s law and divergence, potential and line integrals, material bodies, polarization, magnetic circuits, Maxwell’s equations, dynamic potentials. Prereq: Mathematics 2860.

3060 Propagation I (3) Propagation of waves in transmission lines and in other guiding systems. Impedance and reflectance analysis of waves, standing wave and traveling wave measurements. Introductions to impedance matching, transmission line filtering, microwave circuit construction, graphical and computer aided design methods. Prereq: 3050. 3 hrs including biewky lab.


3110 Basic Electrical Engineering—Circuits and Fields (3) For non-electrical engineering majors. Prereq: Mathematics 2850, Physics 2310-30. 3 hrs including biewky lab.

3120 Basic Electrical Engineering—Electronics (3) For non-electrical engineering majors. Prereq: 3110. 3 hrs including biewky lab.

3130 Basic Electrical Engineering—Machinery (3) For non-electrical engineering majors. Prereq: 3110. 3 hrs including biewky lab.

3160 Logic Design of Digital Systems (3) Introduction to boolean algebra and design of combinational circuits. Presents gate and flipflop characteristics. Design of clocked sequential circuits and other systems containing memory. Introduction to minicomputer architecture and system components to include basic structure and function of arithmetic, storage, input-output, and control systems. Instruction set capabilities and machine language programming. Prereq: 3010 and 3040. 3 hrs including biewky lab.

3180 Plasma I (3) Engineering applications of plasma physics, plasma effects and devices. Topics include plasma sources and applications, plasma configurations. Prereq: 3150. 3 hrs including biewky lab.

3190 Plasma I (3) Engineering applications of physical electronics, plasma effects and devices. Topics include plasma sources and applications, plasma configurations. Prereq: 3150. 3 hrs including biewky lab.

3270 Linear Systems Analysis (3) Steady state and transient response, frequency and time domain characteristics, problems in time and frequency domains, and systems for nonlinear systems. Prereq: Mathematics 2850. 3 hrs including biewky lab.

3470 Plasma II (3) Magnetohydrodynamics. Prereq: 3190.
4480 Plasma III (3) Macroscopic plasma equations, particle orbits, interactions, oscillations and waves. Prereq: 3190.


4500 Electro-optics Detection and Instrumentation (3) Sensitivity, resolution (frequency response) and noise concepts of and practical engineering data for both spatial and temporal domains (e.g. photographic emulsions) and temporal detectors (e.g. photodiodes) will be given. The last third of the course will be devoted to understanding electro-optic instrumentation systems (e.g. laser light scattering, optical data processing, holographic interferometry).


4570 Electro-Acoustics (3) Wave equation for sound, radiation from pistons, impedance of a piston, loudspeakers, horns, speaker systems, phonograph recording and reproduction, time recording and reproduction, noise reducing systems. Prereq: Senior standing.

4600 Analog Signal Processing Circuits for Electronic Instrumentation (3) Operational amplifiers, integrators, differentiators, other integrated circuits in signal processing. Active filters, amplifiers, attenuators, function generators, active rectifiers, and linear signal processing analyzers. Analysis of interfacing problems between transducers and signal-processors. Prereq: 3630. 3 hrs including project laboratory.

4610 Analog-Digital Systems (3) Principles of analog computing components. Applied to analog computing to include problem set-up and scaling. Characteristics of analog multipliers, dividers and function generators are developed. Prereqs: 3630 to include bookwork.


4640 Introduction to Pattern Recognition (3) Role of pattern recognition within framework of artificial intelligence. Topics dealing with learning and adaptive machines. Typical applications of pattern recognition to problems of practical significance. Computer recognition of data. Pattern recognition problems. Prereq: Either 3100 and Computer Science 3150, or Statistics 3450 and Computer Science 1510. (Same as Computer Science 4820.)

4650 Digital Image Processing (3) Principal methods of computer processing images by means of digital computers. Computational algorithms for image operations. Prereq: 3100 and Computer Science 3150, or Statistics 3450 and Computer Science 1510. (Same as Computer Science 4820.)

4660 Small Computer Systems (3) Basic structure of small computer systems, input-output techniques, microcomputer and assembly language programming. Course is project oriented. Prereq: Basic Engineering 1410, Computer Science 1510 or 3150 or consent of instructor. (Same as Computer Science 4850.)

4670 Special Electrical Engineering Problems (3, 3) Problems in electrical engineering involving library and experimental research.

5000 Thesis (1-15) P/NP only. E

5040-50-60 Electrical Engineering Research (3, 3, 3)

5070-80 Modern Transform Methods (3) Digital signal processing and complex variable theory. Z-transform, difference equations and distributed parameter systems.


5120 Network Synthesis and Design (3) Frequency domain and time domain synthesis of network functions; realization of one-port and two-port networks by R, L, and C approximation problems and filter design; computer aided techniques. Prereq: 5070 or equivalent.


5140 Basic Requirements for Plasma Fusion (3) Historical study of fusion systems in nature. Lawson break-even criterion. Inertial fusion systems—hydrogen bomb, laser fusion, and electron-beam fusion. Magnetically-confined plasma systems, tokamak, mirror system, and exotic systems. Confinement and stability, tokamak, mirror system, and exotic systems. Prereq: Consent of instructor or plasma physics background or employment in fusion work.

5150 Diagnostics for Fusion (3) Hot plasma. Simple gross measurements—resistivity and diamagnetism. Microwave methods. Charge-exchange technique. X-ray methods in their limitations. Future possibilities. Prereq: Consent of instructor or plasma or physics background or employment in fusion work.

5160 Engineering of Fusion (3) Materials in a thermonuclear environment. Sequential machines as a finite automata; identification experiments on sequential machines. Bi-weekly lab. Prereq: Elementary linear algebra and some programming variables. (Same as Computer Science 5175.)

5180 Bioengineering Systems II Bioelectrical Phenomena (3) Electrical phenomena associated with biological systems. Bioelectric systems (e.g. electrocardiogram). Applications of quantitative theories in neurophysiology and electrophysiology. Prereq: 4660 or consent of instructor.

5190 Bioengineering Systems III Instrumentation and Analysis (3) Process by which information is gathered and transmitted from biological system. Under test and process by which this information is treated, to signal analysis and modeling, to maximize yield of meaningful information. Prereq: Consent or basic biological system. Prereq: 4660 or consent of instructor.

5210-20 Advanced Electrical Machinery (3, 3) Fundamental processes of electromechanical energy conversion; application in conventional devices. Differential equations for rotating machinery. Park's transformation and two-axis model, transient behavior, isolation and simulation of rotating machines. Prereq: 4780 or equivalent.

5220 Advanced Electrical Machinery Applications (3) Linear motors; pole amplitude modulation and other advanced machines. Prereq: 4780 or equivalent.

5271 Modern Systems Theory I (3) Introduction to linear systems theory. State-space model, linear dynamical systems, sampled data systems, exponential, controllability, observability, real-time system theory, pole placement, observers, stability theory for linear systems. Prereq: Consent of instructor.


5310 Basic Requirements for Plasma Fusion (3) Historical study of fusion systems in nature. Lawson break-even criterion. Inertial fusion systems—hydrogen bomb, laser fusion, and electron-beam fusion. Magnetically-confined plasma systems, tokamak, mirror system, and exotic systems. Confinement and stability, tokamak, mirror system, and exotic systems. Prereq: Consent of instructor or plasma physics background or employment in fusion work.

5320 Diagnostics for Fusion (3) Hot plasma. Simple gross measurements—resistivity and diamagnetism. Microwave methods. Charge-exchange technique. X-ray methods in their limitations. Future possibilities. Prereq: Consent of instructor or plasma or physics background or employment in fusion work.

5330 Engineering of Fusion (3) Materials in a thermonuclear environment. Sequential machines as a finite automata; identification experiments on sequential machines. Bi-weekly lab. Prereq: Elementary linear algebra and some programming variables. (Same as Computer Science 5175.)
College of Engineering/Science and Mechanics


6760 Coding Theory (3) Mathematical structure of algebraic and probabilistic codes. Coding metrics and bounds, linear codes, linear feedback shift registers, convolutional codes. Burst-error-correcting and bounds, linear codes, linear feedback shift registers. Prereq: 5710 or consent of instructor.


Engineering Administration

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

5900 Project in Engineering Administration (3) Study and formal report of engineering administration. An interdisciplinary program. Must have at least six quarter-hours. Must register for 5900 until project is complete. S/NC only. E

Engineering Science and Mechanics

MAJOR Engineering Science

DEGREES M.S., Ph.D.

Professors:
- W. J. Snyder (Head), Ph.D. Northwestern;
- E. Akin, Ph.D. Virginia Polytechnic Institute, P.E.;
- J. H. Forrest, Ph.D. Iowa State, P.E.; C. W. Lee, Ph.D. Illinois Institute of Technology; W. A. Miller, Ph.D. Georgia Institute of Technology, P.E.; H. Pih, Ph.D. Illinois Institute of Technology;
- C. J. Remenyik, Ph.D. Johns Hopkins; C. D. Scott, Ph.D. Texas; T. F. Shober, (Emeritus) M.S. Kansas State, P.E.; J. E. Stoneking, Ph.D. Illinois, P.E.; D. G. Thomas, Ph.D. Ohio State, P.E.

Associate Professors:
- W. E. Scott, Ph.D. Johns Hopkins; J. Wasserman, Ph.D. Cincinnati, P.E.

Assistant Professor:
- O. Soliman, Ph.D. Tennessee

Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy with a major program in Engineering Science are intended to be of 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 prerequisite courses before admission. 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 graduate 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 is intended to be of particular interest to prospective students currently employed in research, development, and design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering, or can be best met by interdisciplinary study in engineering. The department's course offerings and research activities are 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 designed to meet the needs of engineers employed in industry, or those who plan to teach in community colleges and technical institutes. It will be available, however, to any student who, in the opinion of his/her advisory committee, can benefit from additional course work more than from work on a thesis.

In Plan I a minimum of 45 quarter hours, including the thesis is required. In Plan II a minimum of 45 hours is required. The requirements include the following:

- Mathematics
  - 9 hours
  - Plan I
  - 18 hours
  - Plan II
- Engineering courses
  - Major option; may include 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.)
  - 9 hours
- Thesis
  - 9 hours
A final examination is required under both plans, covering graduate course work and the thesis (if any).

THE DOCTORAL PROGRAM

General policies and requirements of The Graduate School relating to admission, residence, languages, reseach, 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 36 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the Master's thesis. These shall include a minimum of 36 quarter hours credit in Doctoral Research and Dissertation and a minimum of 72 quarter hours credit in other courses.
2. A minimum of 36 quarter hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 5900 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, computer science, and the student's major department. This course work may be 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 5900 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. Two doctoral examinations must be passed to be admitted to candidacy for the Ph.D. in Engineering Science.

After being accepted as a potential candidate for the Ph.D., a qualifying examination must be taken at the first offering after the student has either completed a Master's degree or completed 36 quarter hours of graduate credit. The purposes of the qualifying examination are:

(a) To determine the qualifications of the student to continue the Ph.D. program, and
(b) To identify the areas of strengths and weaknesses to guide the student's graduate course work and research.

*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.
The qualifying examination will be administered by the department's Graduate Studies Committee. The examination will be written and will cover at least four graduate level subject areas. One subject area will be mathematics, and the others will be designated by the student subject to the approval of the department's Graduate Studies Committee.

The comprehensive examinations is to be taken by students within 6 credit hours of completion of graduate course work required for the Ph.D. degree. This examination is to be administered by the student's advisory committee and shall consist of both a written and oral portion.

7. After successfully passing the qualifying and comprehensive examinations, the student must present the Ph.D. dissertation research proposal to the student's advisory committee and departmental dissertation and course requirements.

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; stresses in axially loaded members; torsion; bending. Not for graduate departmental credit. Prereq: Basic Engineering 1310. Coreq: Mathematics 2850.

4010 Introduction to Biomedical Engineering (4) Designed to introduce the facets and opportunities of biomedical engineering, and to provide basic terminology and background knowledge for further courses in the field. Includes anatomy, physiology, biomeaterials, mathematical models of body systems. Coreq: Mathematics 2840 or consent of instructor.

3420 Introduction to Clinical Engineering (3) Applications in clinical/hospital setting; description, analysis, and design of health care delivery systems; hospital equipment and structure; clinical use of biomedical equipment; principles of safety engineering in the hospital and applicable codes, standards and regulations. Prereq: 3410, Physics 2320, 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; principle of virtual work; theory of motion; Newton's laws of motion; central force motion; LaGrange's equations. Prereq: 3700, 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.

4020 Computer-Aided Design (3) Use of computer graphics in various phases of mechanical analysis and design. Prereq: 4580 or consent of instructor.

4520 Biomedical Fluid Mechanics (3) Discuss objectives, review foundations and present developments in areas of mechanical properties of living tissues, biomechanics of injury and repair, and medical applications of prosthetic devices and biomechanical problems related to impact. Prereq: 3311 or 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-curve, stress intensity factors, and fracture surfaces. Prereq: 3311 and Metalurgical Engineering 2110. (Same as Metalurgical 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 gages; theory and techniques of brittle fracture; fatigue; stress analysis methods; introduction to other stress analysis methods. Prereq: 3310, Electrical Engineering 3120. 3 hrs or 2 hrs and 1 lab.

4620 Dynamic Data Acquisition (4) Instrumentation of measuring systems for dynamic events and responses; signal conditioning; oscillographs, oscilloscopes, and magnetic tape recording; telemetry and data transmission; data processing. Prereq: 3311, 4710, Electrical Engineering 3120. 3 hrs or 2 hrs and 1 lab.

4630 Introductory Photomechanics (3) Introduction to photomechanics; stress distribution and strain gauge method; interferometry, holography, and photography. Prereq: 3510, Physics 2320. 2 hrs and 3-4 hrs 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 fundamentals of physical laws and mathematical methods of analysis with emphasis on application to realistic engineering problems. Prereq: 3130, 3311, and Mathematics 3150.

4850 Elementary Structural Matrix Methods (4) (Same as Architecture 4850 and Civil Engineering 4850.)

4910 Special Engineering Science Topics (3) Problems related to recent developments and practice. Open to juniors or seniors with consent of instructor. May be repeated. Maximum 6 hrs.

5002 Thesis (115) P/NP only. E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise regulated during their study at the university and requires a faculty advisor and satisfactory performance in the student's university and/or faculty time beyond degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

5110-20 Fluid Dynamics (3, 3) Kinematics of fluids, vorticity, rate deformation, plane and axially symmetric stream functions; Navier-Stokes equation, exact solutions; boundary-layer approximations; nonviscous flow, potential theory, complex potentials, conformal mapping. Prereq: 5800.

5130 Introduction to Turbulence (3) Macroscopic effects, analogies, statistical treatment, correlation functions, intermittency, and analysis of turbulent jets and pipe flow. Prereq: 5800.

5140 Finite Element Methods in Fluid Mechanics (3) Computational fluid mechanics using finite element techniques; matrix interaction; accuracy and convergence concepts. Laminar and turbulent boundary layer flow; inviscid and aerodynamic flows; incompressible viscous flows with separation and recirculation. Prereq: 5110 and 5860.

5180 Finite Element Structural Analysis (3) (Same as Civil Engineering 5180.)

5220 Mechanics of Viscous Flow (3) Viscous forces in flow phenomena; application of Navier-Stokes equations; numerical methods of solutions; stress-optic methods of laminar flow analysis. Prereq: Mathematics 4610. (Same as Chemical Engineering 5810.)


5410-20 Theory of Elasticity (3) Stress, strain in three dimensions; torsion and bending of prismatic bars; axisymmetric stress distribution; stress concentration; plane stress, plane strain. Prereq: 5800.

5430 Thermal Stresses (3) Heat conduction; thermoelastic equations; thermal stresses in beams, rings, plates, and shells; thermal buckling problems. Prereq: 5410 or 5310-20-30, and Mechanical Engineering 3440.

5440 Theory of Linear Viscoelasticity (3) Linear viscoelasticity of solids; quasistatic problems; vibrations; problems in dynamics; stability problems; finite-dimensional linear viscoelasticity. Prereq: 5800.


5630-40 Photoelasticity (3) Physical optics, wave motion, polarized light, basic principles of photoelasticity, equipment, and techniques; application to two-dimensional elasticity and stress concentration, numerical methods in photoelastic stress analysis, photoelastic coating methods, three-dimensional photoelasticity. Prereq: 3311, Mathematics 4610, and consent of instructor. 5640: 2 hrs and 3 labs.

5710-20 Advanced Dynamics (3, 3) Physical laws relate to fluid mechanics, rigid body dynamics; variational methods; Lagrange's equations; Hamilton's principle. Prereq: 3710 or 4710, Mathematics 4610.

5730 Advanced Vibrations (3) Vibrations of multiple degree of freedom lumped parameter systems. Iterative and approximate solutions. Introduction to random vibrations. Prereq: 4710 and 4850.

5740 Vibrations of Continuous Media (3) Equations of motion for strings, rods, beams, membranes, plates, and shells; natural modes and frequencies; response of damped and undamped systems to applied dynamic loads; approximate methods of solution. Prereq: 5410 and Mathematics 4560.

5750 Orbital Mechanics (3) Planetary, satellite, and astronautic orbits and trajectories; orbital perturbation, classical principles of minimization. Prereq: 3710 and 4710.

5800 Introduction to Continuum Mechanics (3) Fundamentals of mechanics of solids and fluids; Cartesian tensors; stress, deformation, and flow in continuous medium; constitutive equations, applications to solids and fluids. Prereq: 3130 and 3311 or equivalents, Mathematics 4610.


5860 Introduction to 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 Mechanical Engineering 5540, or consent of instructor.

5910 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments and practice. Prereq: Consent of instructor. May be repeated with consent of department.

6000 Doctoral Research and Dissertation (3-15) P/NP only. E
410 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) Survey of literature on advanced convective momentum, heat, and mass transfer; boundary layer theory based on the Navier-Stokes equations; boundary layer stability analysis; phenomenological theories of turbulence; turbulent boundary layer flow; high speed flow of phenomena in reacting and reacting systems. Prereq: 5110-20-30 or equivalent; Mathematics 4510, 4540-50, 470. (Same as Environmental Engineering 6110-20.)

4140 Advanced Finite Element Methods in Fluid Dynamics (3) Computational fluid dynamics using finite element methodology. Formulation for two- and three-dimensional media, including incompressible and compressible flows, second-order turbulence closure; parabolic Navier-Stokes equations. Multidimensional, turbulent, and reacting flows. Prereq: 5130 and 5140.


310 Theory of Plates (3) Classical theory of bending of plates of various shapes; thick plates; plates of variable thickness; buckling and large deflection problems. Prereq: 5152. (Same as Mechanical Engineering 3160.)

320 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.

330 Theory of Elastic Stability (3) Theory of elas-

340 Theory of Plasticity (3) Yield conditions; strain hardening; general constitutive equations; plastic potential; uniqueness theorems; extremum variational principles; problems in perfectly plastic solids; finite plastic deformations; piecewise linear plasticity. Prereg: 5410 and Mathematics 4550.

6810 Photoelasticity (3) Stress-optic law in three dimensions and index ellipsoid, rotational effects in three-dimensional photoelasticity, techniques and apparatus for photoelastic testing, scattered light method, dynamic photoelasticity, photothermal plasticity, photoplasticity and photovisuoelasticity, recent developments in photoelasticity. Prereg: 5640, 5420 and consent of instructor. 2 hrs and 3 labs.


6800 Nonlinear Viscelasticity (3) (Same as Poly-
mer Engineering 6210.)

6810 Energy Methods (3) Virtual work, minimum potential energy, and complementary energy. Ca-
tigliano's theorem, Hamilton's principle, and La-
grange's equations of motion; variational methods; existence of solutions, uniqueness theorems, extremum variational principles; problems in perfectly plastic solids; buckling, vibrations, and advanced dynamics. Prereg: 5710-20 and Mathematics 5610-20-30.

690 Special Topics in Engineering Mechanics (3) Advanced problems of interest in mechanics, worked either as group or individually. Prereg: 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

DEGREES
M.S., M.E.

MAJOR
Industrial Engineering

Professors:
J. N. Snider (Head), Ph.D. Ohio State, P.E.; D. C. Doulet, M.S. Tennessee, P.E.; H. P. Emerson (Emeritus), S.B. Massachusetts Institute of Technology; P. E.; R. M. LaForge (Emeritus), M.S. Georgia Institute of Technology, P. E.; H. L. Lovett (Emeritus), P.E., M.S. University of Tennessee, P.E.; W. G. Sullivan, Ph.D. Georgia Institute of Technology; P. E.; A. W. P. Westbrook, Ph.D. Virginia Polytechnic Institute.

Associate Professors:
W. W. Claycombe, Ph.D. Virginia Polytechnic Institute, P. E.; D. M. DeWall, Ph.D. Virginia Polytechnic Institute; D. H. Hutchinson, Ph.D. Georgia Institute of Technology.

Assistant Professors:

THE MASTER'S PROGRAM
A graduate program leading to the degree of Master of Science is open to graduates of A.B.E.T.-accredited undergraduate curricula in industrial engineering or to graduates of other technical curricula who take an approved list of prerequisite course work. A non-theoretical type of course work plus a 3-hour design project is available.

Graduate work in Industrial Engineering provides for concentrations in operations research, engineering management, manufacturing systems, human factors engineering, information systems, reliability and quality control, and traditional industrial engineering. Either one or two minors can be elected in Engineering Mathematics, Psychology, Business Computer Science, Statistics or Economics.

MASTERS 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 electives, 9 hours of Industrial Engineering design electives and 9-hour thesis. Any 4000-level course required in the Bachelor of Science in Industrial 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 Production Systems Planning and Control I (3) Theory and applications of forecasting, capacity and material planning, production systems design and inventory control. Prereq: 3510-20. Not available for graduate credit for industrial engineering students.

4070 Production Systems Planning and Control II (3) Theory and application of master scheduling, materials requirements planning systems, lot sizing and safety stocks, distribution requirements planning. Prereg: 4060.

4080 Forecasting Methods in Industrial Engineering (3) Application of technological forecasting techniques to industrial problems, moving averages and exponential smoothing, linear and polynomial regression models, autocorrelated time-series analysis, Delphi methods and other selected industrial forecasting methods. Prereg: 4060.

4150 Project Control with CPM and PERT (3) A study of project planning and control based primarily on "critical path" techniques, including resource allocation, time-cost trade-off, flow simulation, computer program, and project control, and computer programs. Prereq: 3430.

4160 Materials Handling (3) Analysis and planning for the overall problem of moving, packaging, and storing of materials; equipment operation and selection; cost analysis. Prereg: 4520 and Engineer-
ing Science and Mechanics 3310. Not available for graduate credit for industrial engineering students.

4200 Production Facilities Design (4) Materials handling, plant layout, service areas, inventory control applications, and operating procedures design. Prereg: 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. Prereg: 3520.

4250 Work Measurement Applications (3) Application of learning curves, queuing theory, standard data and incentive systems to the design of industrial work situations.

4520 Engineering Economy (3) Methods and problems in selection of equipment. Decision making 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.

4530 Case Studies in Engineering Economy (3) Extension of basic engineering economy principles and methods 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 of manufacturing enterprise. Cost and location studies and market analysis to determine the commercial feasibility of new plants or projects.


4600 Predetermined Time Systems (3) Work design and measurement using predetermined time system; methods: standard time, basic motion time-study, or work factor. Theory and application. Prereg: 3630.

4610 Human Factors in Work Design II (3) Human capabilities and limitations affecting work place lay-
outs, working environment, design of tools and equipment, and communications and response in human-machine systems. Prereg: 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.

4870 Mini-Computer Applications in Industrial Engineering (3) Introduction to the hardware and human-computer interfaces; emphasis on small computers as element of larger system; applications and programming of small computers in solving indus-
trial engineering problems. Prereg: Senior standing.

4950 Industrial Safety (3) Development of orga-

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accidents with emphasis on OSHA Rules and Regulations.

5000 Thesis (1-15) P/N P only. E

5002 Non-Thesis Graduation Completion (3-15) Requisites: Thesis 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

5110 Work Design (3) Advanced methods analysis of design and improvement of work systems, human factors, workers' response and management participation. Prereq: Motion and time study or work methods and design.

5210 Advanced Work Measurement (3) Characteristics of predetermined time systems, application to formula construction, and practice in application. Prereq: 3600 or 3620.

5240 Facilities Planning and Design (3) Modern materials handling techniques, computer-aided layout techniques, applications of operations research models, and use of these to design manufacturing facilities. Prereq: Production facilities planning or consent of instructor.


5260 Information Systems Design (3) Systems engineering approach to information systems design: System model, analysis, and evaluation of information systems, information objectives and design criteria. Optimization and simulation in system design.


5360 Statistical Methods in Industrial Engineering (3) Basic statistical techniques and their applications in industrial engineering. Prereq or consent of instructor.


5600 Human Factors Engineering (3) Human characteristics which influence design of tools, equipment, environments, and products. Modeling of human factors for process or system controller. Prereq: Consent of instructor.

5610 Human Factors Engineering (3) Human operator, performance characteristics, and environmental requirements. Formal description of human operators, perception, mental processes, memory, and retention through questionnaire models and models describing operator as information processor. Prereq: 5600.


5701 Operations Research Applications (3) Survey of operations research techniques with emphasis on application to industrial engineering problems. Prereq: Mathematics 2860 (or equivalent), Statistics 3450, computer programming. Available for credit only to students without a B.S. degree in industrial engineering.


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. Prereq: 5700, 5760.

5730 Game Theory and Random Processes (3) Operations research theory with emphasis on applications to decision making in competitive environment, and random processes with applications to queuing, inventory models and decision making. Prereq: 5360.

5810 Theory of Industrial Automatic Control (3) Industrial control systems. Modes analysis with Laplace and Z-transforms. Compensator design using root-locus techniques, pole placement techniques; simulation of control systems; state variables as aid in model synthesis. Prereq: 4170.

5830 Health Systems Engineering II (3) Health systems for design and improvement of function and total health system. Prereq: 4830.


9000 Design Project (1-9) Industrial engineering topic to fulfill design project requirement in nonthesis program. Enrollment limited to industrial engineering students. May be repeated. Maximum 9 hrs. S/N only.

910-20-30 Special Topics in Industrial Engineering (3, 3, 3) Special problems for students qualified to do individual or group research projects. Prereq: Consent of Instructor. May be repeated. Maximum 9 hrs.


5250 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. Prereq: 5520 and 5710.

5700 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 techniques. Prereq: 5710.


6910 Advanced Topics in Industrial Engineering (3) Will cover topics not covered in other graduate courses. A forum for advanced graduate students to study individually or in groups as appropriate. Prereq: Graduate standing and consent of instructor. May be repeated with consent of department.

Mechanical and Aerospace Engineering

MAJORS

Aerospace Engineering

M.E., M.S., Ph.D.

Mechanical Engineering

M.E., M.S., Ph.D.

DEGREES

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 conversion and utilization, power generation, machine design and dynamics, aerodynamics and gasdynamics, aeroscoustics, 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 completely fulfill the requirements of the student's program as approved by the student's committee. Specific program requirements are given below.

MASTER OF ENGINEERING PROGRAMS

Graduate students 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 conversion and utilization, power generation, machine design and dynamics, aerodynamics and gasdynamics, aeroscoustics, 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 completely fulfill the requirements of the student's program as approved by the student's committee. Specific program requirements are given below.
student's advisor will assist in planning the program of study to ensure that it includes the necessary design content.

**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.

**MASTER'S PROGRAM OPTIONS**

Three program options are available:

1. **The Thesis Option.** The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 36 quarter hours of course work 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 thesis.
   3. Participation in the departmental seminar program.

2. **The Course Option.** Normally, this program is restricted to those students who have had significant engineering work experience. The evaluation of the work experience and the final selection of the student's program of study are left to the student's committee. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 45 quarter hours of course work which includes at least 27 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally 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 work submitted for the degree.

**GRADUATE CREDIT FOR UNDERGRADUATE COURSES**

Junior (3000-level) and senior (4000-level) mechanical and aerospace engineering courses may be taken for graduate credit by non-mechanical or non-aerospace engineering majors, if approved by the student's major department. Mechanical or aerospace engineering majors may not normally use more than one 4000-level aerospace engineering course to meet their advanced degree requirements. Non-mechanical or non-aerospace engineering graduate students should consult with instructors regarding prerequisites for undergraduate courses.

**Mechanical Engineering**

3000 Energy—An Overview (4) Introduction to available energy resources, recovery and utilization; power generation technologies including conservation schemes; emphasis on the resources-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.

3390 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 problems.

3440 Heat Transfer (3) Heat transfer processes, heat conduction, thermal radiation.

3520-36-49 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. Prerequisite: 3610.

**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.

**ENRICHMENT COURSES**

Courses numbered 4000-level or above may be taken for graduate credit by non-mechanical or non-aerospace engineering graduate students to meet their advanced degree requirements. Non-mechanical or non-aerospace engineering graduate students should consult with instructors regarding prerequisites for graduate courses.

**Mechanical Engineering**

3000 Energy—An Overview (4) Introduction to available energy resources, recovery and utilization; power generation technologies including conservation schemes; emphasis on the resources-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.

3390 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 problems.

3440 Heat Transfer (3) Heat transfer processes, heat conduction, thermal radiation.

3520-36-49 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. Prerequisite: 3610.


3650 Introduction to Machine Design (3) Ductile-brittle behavior of materials under static and cyclic loading. Stress concentration 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) Operating and design characteristics including new technology development; selected directed conversion techniques.

4150 Energy Conversion Systems (3) Fossil fuel systems with emphasis on coal technology.

4180 Design of Energy Conversion Systems (3) Synthesis and design of system including economic and technical aspects. Participation in team design effort including formal presentations and design report.

4170 Turbo-Machinery (3) Basic principles of turbo-machinery; systematic methods or analysis, design, performance evaluation.

4180 Energy Production and Utilization (5) Thermodynamics constraints on energy production; comparison of power generation methods; evaluation of new energy sources and concepts; energy conservation schemes.

4220 Environmental Noise (3) Basic principles of acoustic—measurement and control of noise in industrial and community environments.

4420 Heat Transfer (3) Heat transfer by free and forced convection, heat transfer with phase changes, heat exchanger applications.

4450 Lubrication (3) Hydrodynamic theory of lubrication of sliding bearings; application of Navier-Stokes equations to infinite and finite bearings; analytical and numerical solutions; applications to design.

4471-91 Experimental Mechanical Engineering (3, 3) Experimental methods and 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 System Dynamics (4) Analytical models of physical systems, linearization, Laplace transforms, dynamical characteristics and stability of systems, numerical simulations, and analog computer solutions. Not for departmental graduate credit.

4520-30 Creative Design (3, 3) Application of engineering principles to the solution of current problems with emphasis on design innovation.

4621 Manufacturing Processes (3) Comparison of machining methods; plastic production; metrology.

4622 Tool Design (3) Principles underlying tool and die design, design of high-volume production tools and molds, work holding fixtures.


4624 Manufacturing Engineering Systems Design (3) Design of complete manufacturing system for a particular product; manufacturing planning, tool and fixture design, selection of manufacturing operations, redesign of product to reduce costs.

4625 Manufacturing Process Engineering I (3) Product specifications and conceptual analysis of size and form; true position; tolerance theory; tolerance analysis; and workpiece control for production to tolerance.

4631 Energy Methods in Mechanical Design (3) Application of strain energy principles in complex beams and structures.
4650 Materials and Manufacturing Process (3) Selection of materials in design process, emphasizing relationship between stress and strain analysis, materials properties, environment, temperature, manufacturing technology and cost.

4670 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design machine elements, springs and shafts, selection of sleeve and rolling element bearings.

4680 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design gears, bearings, brakes and clutches; election of chains and belting.

4690 Machine Design (3) Innovative design of complete machine; documentation including specifications, design calculations, working drawings and cost analysis. Written and oral report.

4710 Thermal Environmental Systems (3) Vapor compression and absorption cycles; heat pump systems; moist air properties; psychrometric processes.

4720 Thermal Environmental Systems (3) Design and analysis of heating ventilation and air conditioning systems.

4740 Solar Energy Utilization (3) Nature and availability of solar radiation; review of selected heat transfer topics pertinent to solar energy collection and use; design analysis of solar energy collectors and indirect process applications.

4810 Internal Combustion Engines (3) Thermochemical phenomena in internal combustion and propulsion engines. Combustion, detonation, equilibrium, shock waves, analysis of internal combustion engines using ideal and real fluids.

4910-20 Selected Topics in Mechanical Engineering (3, 3) Problems related to developments and practice in mechanical engineering.

5000 Thesis (1-15) P/NP only. 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 credit.

5110 Conduction Heat Transfer (3) Analysis of steady and transient heat conduction by analytical and numerical techniques. Prereq: 3910, 4420 and Mathematics 3150.

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 heat transfer coefficient; selected applications.


5140 Phase Change Heat Transfer (3) Fundamentals of thermal radiation, review of selected topics; measurement and prediction of nucleate, transition and film boiling; critical heat flux; forced convection boiling and post dry-out heat transfer to two-phase flow; and pressure drop concentration heat transfer. Prereq: 5120 or consent of instructor.

5210 Classical Thermodynamics (3) Macroscopic thermodynamics with emphasis on First and Second Law analyses, equilibrium criteria, and thermodynamics of phase relationships. Prereq: 3330.

5220 Microscopic Thermodynamics (3) Thermodynamics of gases and heat theorem and statistical mechanics. Prereq: 5210.

5230 Special Topics in Thermodynamics (3) Prereq: Consent of instructor.

5310 Intermediate Fluid Mechanics (3) Vector descriptions in fluid mechanics; derivation of basic equations; two dimensional potential flows; viscous flows with emphasis on boundary-layer theory. Prereq: 3410.


5410-20-30 Research in Mechanical Engineering (3, 3, 3) Design of experiments; data analysis; experimental investigation.

5510-20-30 Mechanical Engineering Design (3, 3, 3) Design of mechanical engineering units and systems.


5601 Dynamics of Mechanical Systems (3) Computational techniques derived from Lagrangian mechanics and Hamiltonian mechanics. Application to complex mechanical systems. Prereq: 4831 or consent of instructor.

5602 Computer Aided Mechanical Design (3) Application of computer aided design methods to simple and complex systems. Theory of elasticity; experimental methods; photoelasticity; strain gages; lacquer coatings.

5640-50-60 Advanced Machine Design (3, 3, 3) Theory of design of bearings, gears, shafting; lubrication.

5670-80 Dynamics of Machinery (3, 3) Kinematics and kinetics; fixed, moving, and rotating coordinate systems; linear and angular momentum; energy methods; variable mass; rigid body dynamics; Lagrangian methods. Prereq: 3620, 3910.

5690 Vibrations of Mechanical Systems (3) Forced and free vibrations of single and multiple degree of freedom systems; linear and non-linear. Prereq: 3630.


5800 Transfer Matrix Methods in Elastomechanics (3) Application of transfer matrix method to static and dynamic analysis and design of complex, three dimensional, statically indeterminate structures. Prereq: 5601 or consent of instructor.

5610-20-30 Experimental Stress Analysis (3, 3, 3) Techniques for experimentally determining stresses in the static and dynamic analysis and redesign of complex, three dimensional, statically indeterminate structures. Prereq: 5601 or consent of instructor.

5670-80 Dynamics of Machinery (3, 3) Kinematics and kinetics; fixed, moving, and rotating coordinate systems; linear and angular momentum; energy methods; variable mass; rigid body dynamics; Lagrangian methods. Prereq: 3620, 3910.

5800 Transfer Matrix Methods in Elastomechanics (3) Application of transfer matrix method to static and dynamic analysis and design of complex, three dimensional, statically indeterminate structures. Prereq: 5601 or consent of instructor.

5810-20 Advanced Topics in Fluid Mechanics and Heat Transfer (3) Advanced theory and applications of fluid mechanics and heat transfer; natural convection, two-phase flows, high speed heating and non-reacting flows, advanced boundary layer techniques. Prereq: Consent of instructor.

5830-40 Advanced Radiation Heat Transfer (3) Radiation heat transfer in absorbing, emitting and scattering media; interaction of thermal radiation with condensation and convection heat transfer; radiation heat transfer in hypersonic flow; radiative characteristics of luminous flames and nonuniform gases; scattering by planetary atmosphere. Prereq: 5110-20-30; Mathematics 4550.

5420 Selected Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium of pure substance; metastable states. Prereq: Consent of instructor.

5430 Selected Topics in Thermodynamics (3) Basic phenomena-plastic flow, fracture, hardening. Prereq: 3650, 3440, and Metallurgical Engineering 2110.

5510-20-30 Rocket Propulsion System (3, 3, 3) Rocket propulsion fundamentals. Chemical, electrical and nuclear propulsion systems.

5540-50-60 Advanced Mechanical Systems (3, 3, 3) Rocket propulsion fundamentals. Chemical, electrical and nuclear propulsion systems.

5601 Dynamics of Mechanical Systems (3) Computational techniques derived from Lagrangian mechanics and Hamiltonian mechanics. Application to complex mechanical systems. Prereq: 4831 or consent of instructor.

5602 Computer Aided Mechanical Design (3) Application of computer aided design methods to simple and complex systems. Theory of elasticity; experimental methods; photoelasticity; strain gages; lacquer coatings.

5640-50-60 Advanced Machine Design (3, 3, 3) Theory of design of bearings, gears, shafting; lubrication.

5670-80 Dynamics of Machinery (3, 3) Kinematics and kinetics; fixed, moving, and rotating coordinate systems; linear and angular momentum; energy methods; variable mass; rigid body dynamics; Lagrangian methods. Prereq: 3620, 3910.

5690 Vibrations of Mechanical Systems (3) Forced and free vibrations of single and multiple degree of freedom systems; linear and non-linear. Prereq: 3630.


5800 Transfer Matrix Methods in Elastomechanics (3) Application of transfer matrix method to static and dynamic analysis and design of complex, three dimensional, statically indeterminate structures. Prereq: 5601 or consent of instructor.

5610-20-30 Experimental Stress Analysis (3, 3, 3) Techniques for experimentally determining stresses in the static and dynamic analysis and redesign of complex, three dimensional, statically indeterminate structures. Prereq: 5601 or consent of instructor.

5670-80 Dynamics of Machinery (3, 3) Kinematics and kinetics; fixed, moving, and rotating coordinate systems; linear and angular momentum; energy methods; variable mass; rigid body dynamics; Lagrangian methods. Prereq: 3620, 3910.

5800 Transfer Matrix Methods in Elastomechanics (3) Application of transfer matrix method to static and dynamic analysis and design of complex, three dimensional, statically indeterminate structures. Prereq: 5601 or consent of instructor.
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performance and maneuvers; theory and design of control surfaces; stability.

5000 Thesis (1-15) P/NP only. 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 Fundamentals of Aerodynamics (3) Kinematics and dynamics of perfect fluids; potential flow about a body; conformal mapping; hodographs. Prereq: 4220 or Mechanical Engineering 5310. Mathematics 4250.

5120 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests (supersonic and subsonic), water table experiments, supersonic flow measurements, boundary-layer measurements. Prereq: 4210-20 or Mechanical Engineering 5310. S/NC only.

5150-60-70 Air Vehicle Aerodynamics and Performances (3, 3, 3) Application of aerodynamics to air vehicles to provide estimates of performance, stability, and control characteristics for subsonic to hypersonic speeds. Relations among thrust, drag, lift and altitude. Propulsion systems, vehicle performance, thermodynamics, and trajectory optimization. Prereq: 4220.

5210-20 Aerodynamics of Compressible Fluids (3) One-dimensional flow; waves; small-perturbation theory, slender body theory; similarity rules; methods of characteristics. Prereq: 4210 for 5210, and 5210 for 5220.

5240 Dynamics of Viscous Fluids (3) Equations of viscous fluid flow; laminar and turbulent flow; transition; boundary layers; free molecule and rarefied gas dynamics. Prereq: 5210.

5250 Introduction to Hypersonic Flow (3) Slender body flow theory; continuity; Newtonian theory; blunt body flow; viscous interactions; free molecule and rarefied gas flow. Prereq: 5240.

5260 Selected Topics in Aerodynamics (3) Transonic, supersonic, and hypersonic flow theories. May be repeated. Maximum 9 hrs.


5310 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics, thermodynamic and theoretical field of aerodynamics. Turbulence, 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 protection systems. Prereq: 5220. Recommended: 5240.

5440-50 Transonic Flow (3, 3) Theoretical and experimental aspects. 5440—Nature of flow at transonic speeds. 5450—Behavior of specific problems in non-linear flow, strong viscous interaction, development of small disturbance solutions and similarity parameters, shock-wave in transonic flow and assumption of irrotational motion, solution techniques. 5460—Shock and expansion waves, theory and design of flight vehicles. Wind tunnel testing at transonic speeds, interference problems. Prereq: 5220 or equivalent.


5620 Aeroacoustics I (3) Special topics and recent research in acoustic phenomena and their applications to airplane, rocket, ground vehicle, and jet propulsion. Discussion of special topics according to students' interest. Prereq: 5110, 5220, and 5240 or equivalent.

5630 Aeroacoustics II (3) Special topics and recent research in acoustic phenomena and their applications to airplane, rocket, ground vehicle, and jet propulsion. Discussion of special topics according to students' interest. Prereq: 5110, 5220, and 5240 or equivalent.

5640-50 Advanced Aerodynamics (3, 3, 3) Application of nonlinear analysis to typical modern system. Prereq: 5110, Mathematics 5620.

5650-60-70 Advanced Aerodynamics (3, 3, 3) Crossflow and transonic, supersonic, and hypersonic flows treated in a generalized and unified manner with combined viscous/inviscid effects. Relationships among various regimes of fluid flows. Fundamental assumptions, limitations of approximations and consequences. Foundations of gas dynamics with emphasis on applications to airplane, rocket, ground vehicle, and jet propulsion. Discussion of special topics according to students' interest. Prereq: 5110, 5220, and 5240 or equivalent.


5690 Advanced Topics in Gasdynamics (3) Advanced kinetic theory, perturbation techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

Nuclear Engineering

MAJOR

DEGREES

Nuclear Engineering M.S., M.E., Ph.D.


Associate Professor: L. Miller, Ph.D. Texas A & M, P.E.

Assistant Professors: E. M. Katz, Ph.D. Tennessee; B. Upadhyaya, Ph.D. University of California, Berkeley.

The Department of Nuclear Engineering offers degrees leading to the Master of Science, Master of Engineering, and Doctor of Philosophy with concentrations in nuclear dynamics, nuclear reliability 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 to the necessary prerequisite courses before beginning graduate work.

The student must complete a program of study of 45 quarter hours which has been approved by the student's advisory committee and which includes the following:

1. Course work consisting of a minimum of 18 quarter hours of graduate courses in nuclear engineering.

2. A minor of 9 quarter-hours in mathematics, computer science, or computer science.

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.

4110-20-30 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. F, W, Sp

4140 Thermonuclear Systems (3) Fusion reactions; properties of plasmas; plasma containment; plasma diagnostics; thermonuclear devices. Prereq: Physics 3750, 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 and neutron detection measurements, analog computation, diffusion properties of neutrons, critical loading experiments, control rod calibration, statistical weight, shielding, fission polarization, prompt critical 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. W

4730 Nuclear Reactor Design (3) First order reactor design and operation with non-nuclear heat transfer and power conversion systems. System optimization; description of typical systems. Coreq: 4120. Sp

4810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation, shield design. Prereq: Physics 3720, 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 reactor safety concepts and criteria; credible accidents; fission product release and transport; containment systems; accident analysis; engineered safeguards. Prereq: 4110. W

4930 Nuclear Fuel Management (3) Discussion of problems associated with processing of nuclear materials; fuel cycle analysis; burnup calculation. Prereq: 4120. W

5000 Thesis (1-15) P/NP only. E

5002 Non-Thesis Graduation Completion (3-15) Required for students who do not otherwise register during any quarter when such a student uses university facilities and/or faculty time before degree is granted. May not be used toward degree requirements. 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, block diagrams, linear and non-linear systems, and sensitivity analysis by state variable methods. Dynamic analysis of distributed systems. Prereq: 4720; Consent of instructor.

5220 Reactor System Dynamics (3) Application of methods of general system dynamics to reactor systems. Modeling of neutronic and non-neutronic processes. Dynamics, stability, and control of zero power reactors and power reactor systems. Prereq: 5210, 4130 or equivalent. W


5240 Reactor Instrumentation (3) Instrument components and systems for operation, control, and safety of nuclear reactors; role of instrumentation in public health and safety protection of nuclear power plants. Prereq: 4820, or consent of instructor. A

5310-20-30 Nuclear Systems Reliability (3, 3, 3) System reliability analysis as applied to nuclear systems. Qualitative and quantitative methods. Coreq: Statistics 3450. F; W; Sp

5410 Nuclear Fuel Cycle Analysis (3) Alternative fuel cycles, symbiotic reactor systems and appropriate resource utilization, potential growth rates and system design considerations. Impact of selecting alternative systems from a national and economical viewpoints. Prereq: 4130 or equivalent.

5420 Reprocessing and Waste Disposal (3) Basic processes related to solvent extraction of nuclear fuels. Reprocessing of light water reactor and advanced reactor fuels. Disposition of radionuclides. Reprocessing, site selection and environmental effects. Prereq: 4130 or equivalent.

5510-20-30 Nuclear Systems (3, 3, 3) Various reactor systems. Analysis and design as applied to nuclear systems. Prereq: 4810-20-30 or equivalent or consent of instructor.

5710-20-30 Nuclear Design (3, 3, 3) Analytical techniques for neutron transport aspects of nuclear reactor core design. Design group discrete ordinate theory, multigroup PN theory, integral transport theory, perturbation theory, and others. Generation of required multi-group constants formulated with available point data and Nordheim 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 Boltzman transport equation to shield design problems. Spherical harmonics, moments methods, numerical solutions, adjoint calculations, and variational imbedding cases studied. Prereq: 4810. F


5810 Fundamentals of Fusion Physics and Engineering (3) Basic principles of fusion plasma physics and description of fusion engineering problems. Plasma properties; collision processes; electromagnetic confinement criteria; kinetic theory; fluid equations; plasma equilibria, transport, and stability; plasma heating and fuelling; confinement experiments; gas targets; magnetic and electrostatic heating; plasma components; and fundamental fusion engineering problem areas.
5820 Plasma Engineering (3) Integration of plasma physics models, fusion engineering design criteria, and fusion technology constraints into design of fusion plasma experiments and reactors. Requirements of fusion reactors; particle, momentum, and energy balance equations; burn dynamics; power balance; fuel cycles, heating and fueling requirements; plasma wall interaction; and simulation of various fusion reactor plasmas. Prereq: 5810.

5830 Fusion Technology (3) Engineering problems associated with fusion reactor design: vacuum and magnetic systems, materials and irradiation; plasma heating, fueling, and impurity control; first wall, blanket, shield, and neutronics; electrical systems; maintenance, environment; and review of major reactor design studies. Prereq: 5820.

5840-50 Fast Breeder Reactors (3, 3) Special characteristics of fast breeder reactors; emphasis on LMFBR. Need for breeders; neutron physics and thermal characteristics of reactor core; development status of engineering components; 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 nuclear 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) P/NP only. 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 Belick, Dean
Jay Stauss, Associate Dean, Graduate Studies and Research
Fran Andrews, Assistant Dean, Undergraduate Studies
Helen Grove, Assistant to the Dean

Graduate studies in Home Economics prepares the student for teaching, research and public service in colleges and universities or managerial positions in government, business, and industry.

The College of Home Economics offers two graduate degrees, the Master of Science and the Doctor of Philosophy. The Ph.D. degree in Home Economics is offered in three optional areas: interdisciplinary, food science, and nutrition. The M.S. degree program has seven major or minor areas. Both thesis and non-thesis options are available except in public health nutrition (non-thesis only).

PROGRAMS LEADING TO THE DEGREE OF MASTER OF SCIENCE
Thesis Option:
Child and Family Studies
Consumer Studies and Housing: Public Policy
Interior Design and Housing
Food Science
Food Systems Administration
Nutrition
Textiles and Clothing

Major (minimum of 9 hours of 5000 courses) ........................................ 18 hrs
Thesis ........................................ 9 hrs
Minor area(s) of study
(minimum of 12 hours of 5000 courses) ........................................ 18 hrs
Total 45 hrs

A minimum of 30 hours at or above the 5000-level is required.
In some instances two related minor areas may be selected with 9 hours in each area and a minimum of 3 hours of a 5000 course in each.
Minor area(s) of study are chosen in an area other than in home economics with the approval of the major professors.
An oral examination is required.
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 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 with 18 hours at the 5000 and 6000-level. A minimum of 30 hours of 5000 and 6000-level courses is required in the program. Some majors may require 9 hours in one minor area. A written comprehensive examination is required.

CONSUMER STUDIES AND HOUSING: PUBLIC POLICY
The Master of Science in Consumer Studies and Housing: Public Policy is offered through the Departments of Child and Family Studies (CFS) and Textiles, Merchandising and Design (TMD). Students choose either consumer studies (CFS) or housing (TMD) as the base area. A minor area comprising 12 credit hours is required; these hours are to comprise a related sequence of courses which support the student's program and may be drawn from any unit within the University. A minimum of 9 hours must be taken outside the College, and a minimum of 27 credit hours within the College. A minimum of 30 hours at the 5000-6000 level is required. Students must also take a 3-hour course in research methods or statistics. The thesis option requires 24 credit hours in the base area, including 9 hours of Thesis. The non-thesis option requires 21 credit hours in the base area, including 6 hours of practicum.

DOCTORAL PROGRAM
The doctoral program in Home Economics includes three options of study: interdisciplinary, food science, and nutrition. The interdisciplinary option is available in all departments in the College.

The doctoral 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 directed by the major professor and approved 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. Final oral examination.

Other Requirements:
Interdisciplinary option: The interdisciplinary option of the Doctor of Philosophy degree in Home Economics provides for advanced graduate study with an approach that focuses on the development, integration and application of knowledge to innovative solutions of the multi-level problems of society. A student in the interdisciplinary doctoral program is in the relatively unique position of having a number of alternatives available which are developed as a function of the student's creativity within the general framework:

Individual and Family Behavior (base department of Child and Family Studies):
• normal developmental processes in individuals and families
• socialization through childhood, adolescence, and adulthood
• behavior in diverse environmental and cultural settings
• interaction processes within families
• community services and planning to meet development needs of individuals and families.

Physiological Development and Well-being (base department of Nutrition and Food Sciences):
• physiological response to nutrient intake
• improvement of nutritional status through informed community action
• cultural, economic, and technological influences on food selection.

Environmental Factors (base department of Textiles, Merchandising, and Design or Nutrition and Food Sciences):
• design, space planning, housing, food service systems, clothing, and textiles as they relate to human needs
• cultural, sociological, psychological, and economic change
• technological developments
ACADEMIC COMMON MARKET

The ACM is an interstate agreement among southern states for sharing academic programs. Through this agreement students from participating states are eligible for In-state tuition. Potential students enrolled in the doctoral program in Home Economics at The University of Tennessee, Knoxville, who are residents of Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, South Carolina, or West Virginia are eligible to participate in the Academic Common Market. Those who plan to enter a Master's program in Food Systems Administration in the College of Home Economics and are residents of Arkansas, Kentucky, or West Virginia also are eligible. Those who plan to enter the Master's program in Nutrition (public health) and are residents of Alabama, Kentucky, or Virginia are eligible. Those who plan to enter the Master's program in Consumer Studies and Housing; Public Policy and are residents of South Carolina are eligible.

APPLICATION FOR ADMISSION AND FINANCIAL AID

Requirements for admission to The Graduate School are on page 10 of this catalog. A College of Home Economics application and three Graduate School Rating Forms are required. These may be obtained at the Dean's Office, Jessie Harris Building, or write/call:

Jay Stauss, Associate Dean for Graduate Studies and Research College of Home Economics
The University of Tennessee
Knoxville, Tennessee 37996-1900
Phone: (615) 974-5221

Graduate Record Examination scores for the aptitude, quantitative, verbal, and analytical sections are required for application to all programs except Interior Design and Housing and Textiles and Clothing.

Departments of Instruction

Child and Family Studies

MAJORS

Child and Family Studies
Consumer Studies and Housing/Public Policy

DEGREES

M.S.

Ph.D.

Professors:

N. Beck (Dean), Ph.D. Michigan State; V. M. Nordquist, Ph.D. Tennessee; P. White (Head), Ed.D. Tennessee.

Associate Professors:

J. C. Cunningham, Ph.D. Michigan State; D. B. Eastwood, Ph.D. Tufts; J. Stauus (Associate Dean), Ph.D. Washington State; R. M. Swagler, Ph.D. Ohio State; S. Twardosz, Ph.D. Kansas.

Assistant Professors:


4220 Conserving Time and Energy in the Home (3) Application of management principles to home-making activities; evaluation of equipment, work centers and work procedures in terms of time and energy demands. Adaptations for the handicapped.

4260 Adult Development and Aging (3) Adult life in our society. Adjustment to internal and environmental changes through years. Prereq: 2110 or Home Economics 1510 or equivalent background in adult development or consent of instructor.

4350 Advanced Child Development (3) Survey of selected theories relevant to child development with emphasis on research literature and research methodology. Prereq: 4 hrs psychology and 6 hrs child development or equivalent.

4420 Learning Experiences with Parents (3) Dynamics of parent-child interaction. Emphasis on a variety of techniques for developing communication and working relationships between parents and teachers through experiences in a variety of settings. Prereq: 3210 or Home Economics 1510.

4430 Family Interaction (3) Dynamics of family interaction at different points in the life cycle. Includes dynamics of parent-child relationships and the marital dyad, with family and as family interacts within community; formal and informal support systems within community. Prereq: 3515.

4610 Child in the Community (3) Needs of children; community agencies meeting these needs; visits to agencies contributing to the welfare of children. Prereq: 2110 or Home Economics 1510 or equivalent.

4620 Administration of Programs for Young Children (3) Planning, starting, housing, financing, scheduling, and financing for day care of infants and young children, nursery school programs, and specialized programs for deprived preschool children. Prereq: 3350 or 4110.

4710 Contemporary Developments (1-3) Student or staff-initiated course for study of special topic(s) pertinent to the field. Topics selected to be determined by students and instructor with departmental approval. Elective credit only. Prereq: Consent of instructor. May be repeated with departmental approval. Maximum 9 hrs.

4810 Afro-American Families (3) Historical background, contemporary family structure and relationships, emerging needs and programs. Prereq: 4 hrs in social sciences.

4920 Consumer and the Market (3) Analysis of elements in marketplace which create problems for consumers. Special attention is given to consumer decision making, need for information and constraints and opportunities associated with government protection of consumers. Prereq: Economics 2110.

4990 Consumer and the Market (3) Application of economic principles to individual, group, and institutional decision making. Prereq: Consent of instructor. May be repeated. S/C only.

5000 Thesis (1-15) P/NP only E

5002 Non-Thesis Graduation Completion (3-15) Required for the nonthesis 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/C only.

5060 Practicum (1-12) Field experience in selected agencies and organizations that focus on solutions to problems in consumer studies. Prereq: Consent of instructor. S/C only.

5110 Field Work in Family Life (2) School and community programs concerned with education for family living. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/C only.

5140 Consumption and Standards of Living (3) Economic and welfare aspects of consumption. Analysis of factors associated with changes in the standard of living. Review of major consumption studies. Prereq: 4830 or 5170 or consent of instructor.

5150 Assessment of Family Behavior (3) Methods of measurement related to study of family. Current methodological issues. Prereq: 5410 or 5530 or consent of instructor.

5160 Management of Time and Energy in the Home (3) Labor-saving methods and devices for
College of Home Economics/Home Economics

able-bodied and handicapped. Survey of literature. Current trends and methods of research. Prereq: 5190 or consent of instructor.

5170 Consumer Economics (3) Consumer functions in economy; structure of consumer markets; government action relating to consumers; factors affecting prices of consumer goods.

5174 Public Consumption (3) Relationships between consumers and public sector. Market system failures from consumer perspective. Government re- sponse and action in terms of their impacts on consumers. Effects of consumer oriented public agencies. Prereq: 5170 or consent of instructor.

5180 Family Financial Consultation (3) Analysis of family expenditure patterns, common financial difficulties, avenues by which families are assisted. Field experience with consumer consulting services. Prereq: 4210, 4950 or 5170. Sp

5190 Standards in Consumer Protection (3) Product and performance standards in consumer protection. Theoretical and operational questions relating to standards: analysis of costs and benefits to consumers. Prereq: 4830, 5170 or consent of instructor.

5210 Theories of Child Development (3) Prereq: 4350 or equivalent. W

5220 Family Life Programs (3) School and community programs in family life; survey and evaluation of programs concentrated on type best suited to their experience and future professional orientation. Prereq: 3 hrs child development, 3 hrs family relationships, 3 hrs sociology. 2 hrs and 1 lab.

5310 Theory and Research on Human Sexuality (3) Cultural, social, and psychological dimensions of human sexuality. Major contributions from anthropological, sociological, and personality theory and research.

5410 Advanced Family Relationships (3) Problems in modern family life; individual adjustments, group relationships. Prereq: 3515, 4430, or consent of instructor.

5420 Parents and Children (3) Common problems of young children faced by parents and teachers; emphasis on methods available to modify problem behavior.

5420 Families in Crisis (3) Interpersonal transactions in disordered family behavior. Prereq: 5410 or equivalent. W

5450 Conceptual Frameworks for the Family (3) Theoretical perspectives for understanding families. Exploration and applications of frameworks of theoretical and research levels. Historical to contemporary development of family studies. Prereq: 5410 or consent of instructor. Sp


5600 Seminar in Child, Family and Consumer Studies (1-3) Advanced study of child development and family variables in family planning programs. In- tructor. 6 hrs programs clinic. May be repeated. Maximum 9 hrs.

5610 Teaching Child and Family Studies (3) Seminar and practicum in techniques for teaching child development and family relationships. Prereq: Consent of instructor. S/NC only.


5720 Consumer Protection (3) Regulatory agen- cies, standards, information disclosure and other consumer protection issues. Emphasis on methods available to modify consumer behavior.

5800 Problems in Child, Family and Consumer Studies (1-3) Advanced study of child development and family variables in family planning programs. In- tructor. 6 hrs programs clinic. May be repeated. Maximum 9 hrs.

5850 Children's Effects on Parents and Marriage (3) Theory and research about how children change parents and influence marital relationships. Prereq: 5540 or equivalent. Sp

5900 Seminar in Child and Family Studies (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5910 Research Seminar (1-2) Required 1 hr for M.S. students, 2 hrs for Ph.D. students. S/NC only. E


6250 Advanced Topics (3) Individual study and research in areas of applied behavior analysis in natural settings. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6310 Individual and Family Development—Physiological Determinants (3) Family members' physiological potential and development, and status. Fam- ily's contribution to members' physiological potential for growth and development and to realization of hu- man potential. Prereq: 6 hrs advanced child and family studies, 4 hrs nutrition, 4 hrs physiology, or equivalent. Sp

6320 Individual and Family Development: Cogni- tion (3) Processes through which human individuals acquire knowledge and develop cognitive processes. Emphasis on understanding, criticizing and con- structing theoretical models based on research find- ings. Prereq: 5410 or consent of instructor.

6330 Individual and Family Development: Socialization (3) Processes of socialization throughout life cycle. Family as primary socializing agent. Prereq: 5210, 5410, or equivalent.

6410 Theory Construction in Family Studies (3) Process and application of theory construction in contemporary research areas and family studies. Emphasis on understanding, criticizing and con- structing theoretical models based on research find- ings. Prereq: 5410 or consent of instructor.

6540 Seminar in Programs for Infants and Pre- school Children (3) Research related to programs for infants and young children. Various program models for education of infants and young children, methods of working with parents, and student training programs. Prereq: 5210, 5540 or equivalent. W

6610-20 Applied Behavior Analysis in Natural Settings (3, 3) Individual supervision in application of applied behavior analysis in natural settings. Prereq: 5420 or consent of instructor.

6710 Elements of Consumer Choice (3) Analysis of consumer decision making, theory of consumer choice. Impact of affluence on consumers, and con-
Nutrition and Food Sciences

MAJORS
Food Science M.S.
Nutrition M.S.
Food Systems Administration M.S.
Home Economics Ph.D.

Professors:
R. E. Beauchene, Ph.D. Kansas State; B. R. Carruth (Head), Ph.D. Missouri; M. J. Hitchcock, Ph.D. Wisconsin; J. R. Savage, Ph.D. Wisconsin; J. T. Smith, Ph.D. Missouri; M. A. Smith (Memphis), Ph.D. Tennessee.

Associate Professors:

Assistant Professors:
J. B. Bittie (Memphis), Ph.D. Tennessee; M. M. Brooks (Memphis); M.S. Alabama; M. R. Evans, M.A. Kentucky; J. D. Skinner, Ph.D. Oregon State; C. M. Wilson, Ph.D. Missouri.

DEGREES
3130 Applied Organic Chemistry (4) Basic nutrition and food chemistry. Prereq: Chemistry 1510-20-30. Not for graduate credit for majors.
3140 Physiological Chemistry (4) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Not for graduate credit for departmental majors. Prereq: 3130 or equivalent. Sp, Su
4000 Origin of Food and Foodways (3) Food origin and development of individual and group foodways. Prereq: 8 hrs social science or humanities. F, Su
4020 Introduction to Sensory Evaluation of Foods (3) Sensory evaluation methods. Prereq: 4010 or 9 hrs of food technology and science; Plant and Soil Science 3610 or equivalent. 2 hrs and 1 lab.
4040 Food in Contemporary Society (3) Consumers' options, responsibilities, and potential influence with respect to food supply. F, Su
4050 Food Preservation (3) Application of basic principles and research findings to food preservation in home. Prereq: 2010 or 3010, 4 hrs microbiology and 1150 or equivalent recommended. 2 hrs and 1 lab.
4110 Introduction to Nutrition Research (3) Nutrition principles and laboratory experiments involving small animals. Prereq: 3160. 2 hrs and 1 lab. Sp
4130 Nutrition in Disease (1) Nutrition problems in diseases influenced by diet. Prereq: 3160. W, Su
4131 Clinical Experiences in Dietetics (1) Planned clinical experiences applying principles of nutrition in disease. Coreq: 4130. Open only to students in the coordinated undergraduate program in dietetics. Su
4140 Nutrition in Disease (2) Interdisciplinary lectures and discussions on the metabolic processes of normal and diseased organs and tissues and the dietary or behavior modifications required. Prereq: 4130. Designed for senior students in the coordinated undergraduate program in dietetics. F
4150 Community Nutrition (3) Nutrition problems and services in the community; supervised field experiences. Prereq: 3120 or 3160. Sp
4190 Diet and Drug Therapy (3) Effect of drug therapy on absorption, utilization and toxicity of drugs. Prereq: 3160 or consent of instructor.

4210 Design and Layout of Food Systems (3) Design of physical facilities, selection and purchasing of equipment for food service systems. Prereq: 3220. Sp
4220 Food and Lodging Information Systems (3) Design of information system for decision-making 3 hrs lab in hotel-motel complex; computer application in hospitality industry. Prereq: Accounting 2130; Computer Science 2120.
4240 Food Systems Personnel Development (3) Development of training programs and personnel management policies for food systems personnel. Prereq: Economics 3420 or Psychology 4460 or consent of instructor.
4250 Food Systems Managerial Cost Control (3) Cost analysis for food and beverages; use of financial statements for decision making in food service systems. Prereq: 3220.
4260 Food and Lodging Physical Plant Planning and Maintenance (4) Fundamentals of mechanical systems and building components of food and lodging physical plant; organization and assignment of properties management. Prereq: 4210. 3 hrs and 1 lab.
5000 Thesis (1-15) P/NP only. 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. Prereq: 5000. 3 labs. E
5010 Food Textures (3) Classification of foods according to textural parameters; instrumentation in evaluation of textures. Prereq: 4010 or Food Technology 4500; Plant and Soil Science 3610 or equivalent; or consent of instructor. F
5020 Food Sensory Testing Methods (3) Principles and methodology of sensory evaluation of food; application of methods; analysis of sensory data. Prereq: 4010; Plant and Soil Science 3610 or equivalent; or consent of instructor. W
5030 Advanced Experimental Food Science (3) Application of research methods to individual problems. Prereq: 5010-20 or consent of instructor. Sp
5040 Food Behavior of the Individual (3) Development of and changes in choices of food and principles of food habits of individual. Prereq: 4000, 3 hrs of nutrition, or consent of instructor. Sp or Su
5050 Foodways in the United States (3) Current foodways of selected subcultures in United States and historical basis for their development. Prereq: 4000, 3 hrs of nutrition, or consent of instructor. W
5060-65 Advanced Food Science (3) (3) Biochemical and biophysical interactions in food. Prereq: 4010; 3150 or equivalent, or consent of instructor. W; Sp
5070 Carbohydrates and Fats in Relation to Food Science (3) Physical and chemical characteristics of milk, eggs, flour, and meat with emphasis on their behavior in food. Prereq: 4010; 3140-50 or equivalent.
5075 Proteins in Relation to Food Science (3) Physical and chemical characteristics of the proteins of milk, eggs, flour, and meat with emphasis on their behavior in food. Prereq: 4010; 3140-50 or equivalent.
5100 Advanced Physiological Chemistry (4) Bioenergetics and related metabolism of nutrients. Prereq: 3140 or equivalent. 3 hrs and 1 lab. F
5105 Advanced Physiological Chemistry (3) Nutritional factors in relation to fluid body, gas transport, and endocrine function. Prereq: 3140. W
5110 Community Nutrition (3) Nutrition problems and practices in community; supervised field work. Prereq: 3160 and consent of instructor. 3 labs. F
5115 Community Nutrition (3) Observations and participation in nutrition programs of local and state agencies. Prereq: 5110 and consent of instructor. 3 labs. W
5120 Community Nutrition (3) Nutrition programs of state and federal agencies; preparation of material for nutrition education; supervised field work. Prereq: 5110.
5125 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of depth study to be selected in consultation with instructor. Prereq: 5115 and consent of instructor. S/NC only. Sp
5130 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students in training at Child Development Center, UT Center for the Health Sciences, Memphis. Prereq: Consent of department head. F, W, Sp
5135 Nutrition in Mental Retardation and Developmental Disorders (1-12) Interdisciplinary diagnosis and treatment of developmentally-handicapped children and their families. Prereq: 5130. Clinical experience and practical problems in meeting requirements. Prereq: 3160 and 5160. W; Su
5160 Physiological Bases for Diets in Disease (3) Development of dietary treatment of disease in which nutrition plays a major role. Prereq: 3160 or equivalent. Su
5170 Survey Methods in Human Nutrition (3) Food consumption, food practices and nutritional status of population groups. Prereq: 5150-55. 2 hrs and 1 lab.
5175 World Food Supply and Human Nutrition (3) Food supplies and food practices as related to human nutrition throughout the world. Regional, national and international agencies concerned with food and nutrition problems. Prereq: 5150-55. Sp
5180 Nutrition and Aging (3) Nutritional problems of the group. Prereq: 5165. 3 hrs of nutrition or consent of instructor. W
5210-20 Experimental Quantity Food Study (3, 3) Analysis of food production, holding environment, and service problems related to quality of food prepared in volume. Management resources. Prereq: 3210, 3220, or consent of instructor. F, Su
5230 Methods of Food Systems Research (3) Research methods applicable to food systems administration. Prereq: 3210 or equivalent. W, A
5240 Experimental Design of Food System Facilities (3) Environment in which food is prepared, held, and served in volume. Prereq: 4210.
5250 Food Systems Evaluation (3) Management resources in food systems. Standards for control. Prereq: Consent of instructor. F
5270 Administration of Food Service Delivery Systems (3) Role and responsibilities of administrator in maintaining desired qualitative and quantitative standards in food service delivery systems. Prereq: 3220 or consent of instructor. W, A
5310 Clinical Training in Health Care Agencies (3) Instructional and supervisory techniques in clinical settings by nurses and dietitians for training of entry-
level health care providers. Prereq: Nursing 4760 or consent of instructor. Sp

5340 Foods and Nutrition: Physicochemical Principles (3) Thermodynamics: physicochemical properties of proteins, carbohydrates and lipids; chemistry of colloidal state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: 3140 or equivalent. Sp, A

5350-50 Research Techniques (3, 3) Human metabolic balance experiments. Analytical methods for assessing food and biological materials. Prereq: 5140. 3 labs. A

5380 Field Experience (3-9) Experience in food-related industry or agency under supervision of faculty member. Prereq: Consent of instructor.

5700 Current Programs and Trends (1-3) Recent advances in nutrition and food sciences; implications for professionals. Prereq: Consent of instructor. May be repeated.

5800 Problems in Nutrition and Food Sciences (1-3) Advanced study in nutrition and food sciences. Prereq: Consent of instructor. May be repeated. Maximum 5 hrs. S/NC only.

5900 Seminar (1-3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. S/NC only.

5910 Graduate Seminar in Public Health (1-2) (Same as Public Health 5900, Nursing 5900, Physical Education 5900, and Social Work 5900.) S/NC only.

6000 Doctoral Research and Dissertation (3-15) P/NP only. E

6010 Food Dispersions (3) Physical characteristics of solutions, colloidal dispersions, and suspensions in relation to treatments applied. Prereq: 5050.

6020-30 Food and Sociocultural Change (3, 3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5040 or 5050; or consent of instructor. F, W

6110 Proteins and Amino Acids (3) Lectures, reports, and discussions. Prereq: 5150 or 55. Sp, A

6120 Mineral Metabolism (3) Lectures, reports, and discussions of functions of minerals in physiological processes. Prereq: 5150-55. Sp, A

6130 Lipid Metabolism (3) Lectures, reports, and discussions. Prereq: 5150-55.

6140 Vitamin Metabolism (3) Lectures, reports, and discussions. Prereq: 5150-55. A

6210 Manpower Planning and Training for the Food Service Industry (3) Identification of manpower needs by skill levels; programs for personnel in food service industry. Prereq: 4240, 5250 or consent of instructor. Sp

6220-30 Quantitative Methods to Control Resources in Food Service Systems (3, 3) Interrelationships of resources and evaluation of efficiency and effectiveness in food service systems. Prereq: 5230 or consent of instructor. Taken in sequence. Credit for 6220 contingent upon completion of 6230. F, A

6310 Advanced Topics (3) Comprehensive individual study and group discussion of topics related to current problems in food science. Prereq: Consent of instructor. May be repeated.

6900 Seminar (1-3) May be repeated. S/NC only. E

Textiles, Merchandising, and Design

MAJORS

DEGREES

Textiles and Clothing M.S.

Interiors Design and Housing M.S.

Consumer Studies and Housing: Public Policy M.S. The Economics Ph.D.

Professors:

R. G. Blakemore, Ph.D Florida State; J. O. Delonge (Head), Ph.D Iowa State; B. C. Goswami, Ph.D. Manchester (England).

Associate Professors:


Faculty Associate:

T. L. Vigo, Ph.D. Polytechnic.

Assistant Professors:

C. E. Cox, Jr., Ph.D. Tennessee; S. Dillard, M.S. Tennessee; O. K. McCurry, M.S. California State.

Interior Design and Housing

A student's course of study may include intensive training in interior design beyond an undergraduate program, behavioral design research, and advanced study in interior architecture. Students interested in housing may elect an interdisciplinary course in Consumer Studies and Housing: Public Policy.

ACQUISITIONS AND EXHIBITIONS

Prospective graduate students pursuing a degree in advanced interior design should submit a portfolio to the graduate coordinator for an undergraduate studio work to the department. This portfolio may include slides or original work.

4320 Family Housing Problems (3) Housing requirements of families. Reading and judging house plans; effective use of space; maintenance problems; housing regulations and restrictions. Prereq: Consent of instructor. Sp, A

4450-51 Advanced Interior Design (6,6) Intensive interior design experiences: complex design problems utilizing systematic design methodology. Project types: multi-family housing, commercial and institutional environments, or complex working environments. Assistance and critiques from area professionals. Prereq: 9432 or 4450. Courses taken in sequence or consent of instructor.

4781 History of Contemporary Interior Architecture (4) Furniture; design and design philosophies of Europe and America in relation to forces that shaped them; methods, materials, technology, cultural advances, and technology, and natural milieu.


5000 Thesis (1-15) P/NP only. 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

5040 Seminar in Design (3) Invasive reading, discussion and critical evaluation of twentieth-century design concepts, persons, motivation, and creative components leading to visual innovation.

5050 Advanced Design Studio (4) Strength, structural analysis and design 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, Mediterranea

nean area and/or America. May be repeated. Maximum 18 hrs.

5210 Furniture Appreciation (3) Aesthetic qualities of past and present styles. Significant structural and formal characteristics.

5310 Interior Design (3) Advanced problems in planning and design of interior space; applications of research information in making design decisions. 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 interior architectural environments—derivation of design implications from analysis of 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. Comprehensive design research project. Maximum 3-6 credit hours. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5610 Furniture Design (3) Analysis of human factors in design of furniture, storage systems, and storage furniture pieces 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 in housing; identification of policies 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 housing and housing objectives. Prereq: 4320 or consent of instructor.

5620 Experimental Methods in Household Equipment (3) Research methods and techniques in determining performance of household equipment. Prereq: Consent of instructor. 1 hr and 2 labs.

5630 Environmental Requirements for Family Work Centers (3) Trends in planning work centers such as kitchens, laundry and bathrooms: adequacy, convenience, surface treatment, facilities and costs; problems of installation and remodeling.

5815 Environmental Design Research (1-3) Evaluation and application of research methodologies to interior design problems. Hours and credit arranged. 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.

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.

9100-30 Seminar (1-4, 1-4, 1-4) Hours and credit arranged. Prereq: Consent of instructor.

6110 Contemporary Housing Issues and Problems (3) Individual study and group discussion of various issues and problems related to housing. Prereq: Consent of instructor.
6120 Advanced Topics in Housing Research (3) 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: 5610-20-30.

6420 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.

Textiles and Clothing

4210 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

4280 Design Analysis: Functional Apparel (3) Systematic approach to apparel design incorporating aesthetic, psychological, social and physiological aspects of apparel problems for special reference groups. Garment specifications translated for production. W

4410 Apparel Production Management (3) Management perspective of apparel production industry: production planning, process, and management of human resources. Plant tours and case studies on production problems. Field trips required. S

5000 Thesis (1-15) F/P/N only. 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 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 (1-8) Off-campus experience with business, industry, governmental agencies and civic groups; preplanned; supervised. Prereq: Consent of major advisor and department head. May be repeated. Maximum 9 hrs. S/NC only.

5250-60-70 Problems in Textile Chemistry (4, 4, 4) Theoretical and experimental study of chemistry of textile fibers including polymerization, reactions, dyeing and finishing. 5250 must be taken first, 5260 and 5270 need not be taken in sequence. 5250—Emphasis on structure; property relationships and reactions of fibers. 5260—Emphasis on fabric finishes. 5270—Emphasis on dyes and dyeing. 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. Maximum 9 hrs. W

5510 Textile Processing (3) Methods and mechanics of texturing continuous filament yarns, methods and mechanics of processing staple yarns, spinning system, composite yarns weaving, knitting, non-woven fabric formation. Prereq: Engineering Science and Mechanics 3311, Mathematics 2840. (Same as Polymer Engineering 5610.)


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 field 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 6 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 I (3) Fundamentals of yarns and fabric structures; relationship of structure to physical characteristics of textile materials. Prereq: 5120, or consent of instructor.

6910 Seminar in Textiles and Clothing (1-3) May be repeated. Maximum 6 hrs.
Intercollegiate Programs

Aviation Systems

MAJOR
Aviation Systems

DEGREE
M.S.

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; W. L. Young, Ph.D. Northwestern.

Associate Professors:
F. G. Collins, Ph.D. California (Berkeley); R. D. Kimberlin, M.S. Tennessee; J. R. Maus, Ph.D. North Carolina State.

Assistant Professors:
W. B. Baker, Jr., Ph.D. Tennessee; V. K. Smith, Ill, 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 or administration in various phases pertinent to aviation. The program features 18 quarter hours major field credit in various aspects of aviation systems, 6 or more quarter hours credit in each of the areas of research, development and administration, and electives which permit further specialization to either area.

To qualify for admission to this program, the applicant must possess a Bachelor’s degree in engineering or science from a recognized institution, show evidence of ability to pursue and benefit from the program, and fulfill The University of Tennessee Graduate School admission procedures and grade point standards. Subject matter prerequisite to the program includes basic knowledge of computer utilization (Computer Science 3150 or equivalent), a background in statistics (Statistics 3430 or equivalent), a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance (Aerospace Engineering 4110 and 4120 or equivalent), background in accounting (Accounting 5010 or equivalent basic accounting courses), a basic knowledge of economics (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, Industrial Engineering 5700 and 5710; for the administration area, Economics 5030.
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, 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, Industrial Engineering 5700, 5710, and 5720; for the administration area, Economics 5030, and Finance 5010-20.
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 Aviation Systems 5100.
6. Satisfactory completion of a comprehensive final written examination on all course work submitted for the degree and defense of the project course paper.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.

Courses suitable for credit in the major field include: Aerospace Engineering 5810 and 5820, Industrial Engineering 5940; 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 4550 and 5655-65-75; Industrial Engineering 4080, 4150, 4230, 5720, 5730, 6700, 6730; Mathematics 4225-35-45, 4510-20-30; Metallurgical Engineering 5810-20-30; and Statistics 3450.

Election by 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 5130, 5220, and 5910.

5000 Thesis (1-15) P/NP only, 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 5810.

5080 Collection and Distribution (3) Capabilities, technology, plans, programs and developments for collecting and distributing passengers and freight to and from various types of airports. Ground, water, air and mixed transportation modes, present and future: requirements analysis, and model analysis of the system. Prereq: Aerospace Engineering 5810.

5090 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure and administrative and enforcement procedures. Prereq: Aerospace Engineering 5810.

5100 Project in Aviation Systems (3) In-depth study and form report on aviation systems topic, normally performed during last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.

Applicants for admission to the Master of Science degree program whose backgrounds include no formal training in the biomedical field beyond the baccalaureate 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 will generally be expected to have: Master's degree in one of the biological sciences or a professional degree in one of the medical sciences. Selected individuals having baccalaureate degrees with strong backgrounds in the physical and biological sciences may be admitted upon presenting evidence of satisfactory performance on the Graduate Record Examination.

Exceptions to the above requirements may be made at the discretion of the Admissions 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 programs.

For additional information, see sections in this catalog on College of Veterinary Medicine and College of Medicine—Knoxville, or write to the Office of Research and Graduate Programs, P.O. Box 1071, Knoxville, TN 37901.

Intercollegiate Programs/Ecology

MAJOR
Comparative and Experimental Medicine

DEGREES
M.S., Ph.D.

Joint Graduate Coordinating Committee
H. Kitchen (Chairperson); C. C. Congdon; J. E. Fuhr; J. M. Holland; J. E. Lawler; R. L. Michel.

The Comparative and Experimental Medicine degree program (M.S. and Ph.D.) is a joint program between the College of Veterinary Medicine and the Graduate School. The program is designed to prepare students for teaching and/or research careers in the health sciences. This program emphasizes the comparative approach to the study of pathology, including experimental pathology, embryological metabolism, oncology, and genetic disorders.

Applicants must meet the general requirements for admission to The Graduate School and the College of Veterinary Medicine. Applicants must also complete the admission requirements for admission to the College of Veterinary Medicine. The application should be submitted to the College of Veterinary Medicine, College of Medicine—Knoxville, and the Graduate School.

APPENDIX A

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Comparative and Experimental Medicine

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5000 Thesis (1-15) P/NP only. E

5100 Special Problems in Ecology (1-3) Individual investigations in ecology. May be repeated with consent of instructor. Maximum 3 hrs.

5210-20 Principles of Ecology (2, 2, 2) Theories and problems 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 of human-caused changes 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 similar interdisciplinary studies; preparation, and evaluation of environmental impact statements and similar multidisciplinary studies; 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.

5610 Environmental Toxicology (3) (Same as Biochemistry 5610.)

5640 Techniques in Environmental Toxicology (3) (Same as Biochemistry 5640.)

6000 Doctoral Research and Dissertation (3-15) P/NP only. 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 (3)

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.) S/NC only.

Industrial and Organizational Psychology

MAJOR DEGREES

Industrial and Organizational Psychology M.S., Ph.D.

Committee:
J. M. Larsen, Jr. (Chairperson); W. H. Calhoun; H. D. Dewhirst; K. T. Ladd; J. W. Lounsbury; M. C. Rush; J. E. A. Russell; E. D. Sundstrom; D. J. Whicker; M. S. Wortman, Jr.

(For complete Faculty Listing, see Department 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 consulting relationships with industry. The emphasis is upon applied research utilizing a thorough theoretical background, including classical and modern organization theory, organizational behavior, psychology, and 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 of the 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 both The Graduate School and the Chairperson, Industrial and Organizational Psychology Program, 413 Stokely Center for Management Studies, Knoxville, Tennessee 37996-0545.

Two separate applications must be completed: one by the applicant for admission to The Graduate School (apply for major in "Industrial and Organizational Psychology") and one application for admission to the Industrial and Organizational Psychology program. Deadline: For fall entrance, all materials should be received by the Graduate Office no later than March 1 if financial assistance consideration is desired. 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 at or above the 69-79th percentile on the aptitude tests. (This corresponds to a raw score of approximately 600 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-psychology majors.

THE DOCTORAL PROGRAM

I. Course Requirements (Currently under review and subject to change for Fall 1983 entrants)

A. Management or Psychology 5170-80-90.
B. Statistics 5050-60-70 and 3 hours of applied psychometrics.
C. Eighteen hours of additional coursework to be selected primarily from among the 5000-level course offerings in management and psychology [e.g., Management 5110, 5220, 5230].
D. Nine hours of Psychology or Management 5000 (Master's Thesis).

II. Program Requirements

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.

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 (Currently under review and subject to change for Fall 1983 entrants)

A. Minimum course requirements

1. Management or Psychology 5170-80-90.

3. Minimum of five 6000-level seminars to be selected from Psychology or Management 6250-60-70, and Management or Psychology 6260.

II. Master's Examination

A. Recommended electives

1. For preparation for advanced section (81) GRE: Psychology courses as appropriate.

2. For students who require preparation in psychometrics: Applied psychometrics.

3. For students who require preparation in management: Management 5110, 5220, 5230.

4. For students who wish to pursue special research interests aside from their dissertation: Management 5250, 5260, Management or Psychology 6500.

5. Courses available in areas related to industrial and organizational psychology:
   a. Through College of Business Administration;
   b. Through College of Liberal Arts;
   c. Others as approved by advisor.

II. Program Requirements**

A. Attainment of a B average*** in Management or Psychology 5170-80-90.

B. 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 beginning 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 twelve quarters. This examination may be repeated once, normally no later than six months after the first attempt, at the discretion of the student's doctoral committee.

E. By the end of nine quarters a student is expected to choose a major advisor (Chairperson of Doctoral Committee).

F. Completion of an oral examination following the preparation of a doctoral dissertation. This examination covers the field of doctoral research and related topics, and must be passed at least four years prior to the awarding of the degree.

G. Maintenance of at least 3.0 grade point average.

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*May be repeated for additional credit.

**Any student in the doctoral program may be required to prepare a Master's thesis by the industrial and Organizational Psychology Committee. This policy will be implemented by the committee at such time as a review of the student's record suggests that additional data on the qualifications for pursuing a Ph.D. are required.

***See program handbook for definition of a B average.
Life Sciences

MAJOR DEGREES
Life Sciences M.S., Ph.D.

Coordinating Council:

The programs leading to the M.S. and Ph.D. degrees in Life Sciences are interdepartmental and intercollegiate programs which augment the programs of individual departments.

The graduate program in Life Sciences supports studies and research in the following concentrations: animal physiology, cellular and molecular biology, environmental toxicology, ethology, plant physiology/biochemistry, and reproductive and developmental biology. Students interested in any of these areas should contact either the chairperson of Life Sciences or the director of the area of interest. Each concentration area is overseen by a committee and may have unique admission and graduation requirements above the minimums for the overall program.

GENERAL ADMISSION REQUIREMENTS
1. A Bachelor's degree with a major in a biological, behavioral or physical science.
2. GRE (aptitude) scores.
3. Three letters of recommendation.
4. Course work including a year of calculus (differential and integral), one year of chemistry, and a year of physics. Specific course deficiences may be corrected during the first year.

GENERAL PROGRAM REQUIREMENTS
The program requirements are in general the same as those of The Graduate School. The Master's program requires 45 hours of study approved by the student's committee, a thesis, and a comprehensive oral examination. The minimum requirements for the doctoral program include at least 9 hours above the 6000 level, 36 hours of course 6000, a pattern of courses approved by the student's committee, a comprehensive examination, a doctoral dissertation, and a final examination. Individual concentration areas may have additional requirements.

AREAS OF CONCENTRATION
Animal Physiology: The inter-departmental program in physiology includes research in the areas of regulatory, reproductive, comparative, exercise, cellular, developmental, muscle, or neuro-physiology.
Cellular and Molecular Biology: The inter-departmental program in cellular and molecular biology includes research in structural or functional aspects of cells or subcellular components, or the interactions between cells.
Environmental Toxicology: The toxicology program provides intensive training in basic toxicological principles and techniques.

Courses and research expose trainees to mechanisms of intended and unintended interactions between living systems and potentially toxic agents from the point of view of basic chemical, physiological, ecological, public health, environmental law and regulation, pest management, pollution control and repair, and testing and residue analysis of toxicants.

Ethology: Ethology is the naturalistic study of normally occurring animal and human behavior. The program provides intensive training in basic ethology with specialized studies available in the development, evolution, and physiology of behavior; human ethology; and behavioral ecology and sociobiology.

Plant Physiology/Biochemistry: This program provides the opportunity for intensive training and research experience in areas transcending the usual boundaries of botany, biochemistry, and agricultural plant sciences. It devotes itself to seeking solutions of problems concerning the interactions of energy and agriculture, primarily at the biochemical and physiological level.

Reproductive and Developmental Biology: The inter-departmental program includes research in animal and plant development, reproductive endocrinology and control of reproductive function, gene regulation and cellular interactions in development.

5110-20-30 Cellular and Molecular Biology (3, 3) Survey of cell structures and functions at molecular and supramolecular level. 5110—Cellular organization; cell metabolism; energy production and use; membrane structure and function; cellular communication. 5120—Flow of biological information, cell growth and replication; cellular motility; virus-cell interactions. 5130—Structure and function of specialized cells; muscle, nerve, germ cells, blood; endocrine and immune systems: chemotaxis and phototaxis; differentiation, aging and cancer. Prereq: Consent of instructor.

Management Science

MAJOR DEGREE
Management Science M.S.

Committee:
R. S. Garfinkel (Chairperson), Management Science; R. W. Boling, Management; J. S. Bradley, Mathematics; E. Glusoff, Economics; J. K. Ho, Management Sciences; W. J. Morse, Accounting; R. E. Rossenthal, Management Science; R. E. Shrivastava, Finance; C. C. Thigpen, Statistics; M. G. Thomason, Computer Science; K. C. Gilbert, Management.

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 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 p. 41.
FOREIGN STUDY COURSES

Foreign study courses offered in some departments of the College provide an opportunity to undertake independent study outside of 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

MAJOR

Anthropology

DEGREES

M.A., Ph.D.

Professors:

W. M. Bass (Head), Ph.D. Pennsylvania; C. H. Faulkner, Ph.D. Indiana; A. K. Guthe, Ph.D. Michigan; P. L. Janitz, Ph.D. Kansas; P. W. Parmalee, Ph.D. Texas A. & M.

Associate Professors:


Assistant Professors:

B. J. Howell, Ph.D. Kentucky; W. E. Klippel, Ph.D. Missouri.

Instructor:

M. A. Bass, (Part-time), Ph.D. Kansas State.

The Department of Anthropology offers the Master of Arts and the Doctor of Philosophy degrees with concentrations in physical anthropology, cultural anthropology, archaeology, zooarchaeology, and folklore.

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 a thesis. Thirty-six of these 45 hours must be in anthropology, 9 hours may be taken in closely related disciplines (at least two-thirds of the courses must be at the 5000 level).
3. Satisfactory completion of the Graduate Examination at the end of the first year.
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.

3370 Genetics and Society (3) (Same as Botany 3070.)

3410 Principles of Cultural Anthropology (3) Basic concept and objectives in study of culture. Range of cultural phenomena and approaches to its study. Recommended prereq: 2530. F or W

3440 Religion of Primitive Peoples (3) Religions of nonlittepe peoples. Place of religion in their social and cultural systems. Recommended prereq: 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 prereq: 2530. A

3530 Peoples and Cultures of Africa (3) Ethnographic survey of the aboriginal cultures of sub-Saharan Africa. Cultural diversity and human ecology in area perspective. Recommended prereq: 2530. F

3540 North American Indian (3) An ethnographic
survey of cultures of Arctic, Southwest, Plains and Eastern Areas. Emphasis on cultural differences of peoples occupying these areas during precontact period. Recommended prereq: 2530. For Sp

3555 Cherokee Ethnohistory (3) Survey of sociopolitical aspects of internal affairs and external relations during first European contact to present. Emphasis on eighteenth and nineteenth centuries.

3575 Afro-American Anthropology (3) Anthropological perspectives on Blacks in New World: examination of Afro-Americans via anthropological theories and methods. Recommended prereq: 2520. A

3580 Peoples and Cultures of Mesoamerica (3) Ethnographic survey of aboriginal peoples and post-conquest changes in Indian cultures. Emphasis upon analysis of small rural communities using modern village studies as source material. Recommended prereq: 2530. A

3610 Archaeology of United States and Canada I (3) Survey of prehistoric peoples north of Mexico from initial occupation to European contact. Recommended prereq: 2520. F

3611 Archaeology of United States and Canada II (3) Historic archaeology of Euro-American, Afro-American, and Asian cultures in United States and Canada from 15th to 20th centuries.

3620 European Prehistory I (3) Cultural developments during Paleolithic, Mesolithic, and Neolithic. Recommended prereq: 2520. W, A

3630 European Prehistory II (3) Cultural developments during Metal Ages. From the close of Neolithic through Iron Age. Recommended prereq: 2520. 3620 and 3630 should be taken in sequence. W, A

3650 Prehistory of Tennessee (3) History of archaeological research in Tennessee and survey of prehistoric Native American cultures identified through research. Sp

3670 Principles of Archaeology (3) Research strategies in archaeological excavation, interpretation, and explanation. Prereq: 2520 or consent of instructor. A

3700 Forms of Folklore (4) Introduction to the anthropological study of folklore.

3000 Language and Culture (3) Relationship between linguistic categories and patterns of culture. Prereq: 2540 or consent of instructor. Recomm:nded: 2530.

3011 Introduction to Museology (3) (Same as Art 3811.)

3900 Human Osteology (4) Intensive examination of the human skeleton. Prereq: 2510 and consent of instructor. 3 hrs and 1 lab. F

3920 Principles of Physical Anthropology (3) Survey of materials and methods in physical anthropo-

3930 The Biology of Races of Man (3) Processes of racial differentiation; criteria of significant differences among existing stocks; influence of biology and culture in race formation; analysis of studies concerning blood groups, race mixture, constitution growth and nutrition. Recommended prereq: 2530. Sp

3950 Human Identification (3) Introduction to techniques in identification of human skeletal material in forensic medicine. Sp, A

4200 Contemporary North American Indian (3) Peoples occupying these areas during early Euro-Ameri-can contact to present; emphasis on culture change. U.S. Government Indian policy, reservation life. Prereq: 2530 or consent of instructor. A

4210 Ethnographic Research Techniques (3) Method of collecting, ordering, and utilizing data. Prereq: Consent of instructor. A

4240 Applied Cultural Anthropology (3) Application of anthropological theory, methods and findings to current local and national development, public health, international aid, and military assistance. Examination of the roles of anthropologists, questions of values and ethics in intervention schemes, and of organization of planned changes in applied programs. Intensive analysis of selected case studies. Prereq: 2530. A

4250 Medical Anthropology: Lecture (3) A survey of medical anthropology. Emphasis on Western and non-Western aspects of health, disease, disability, treatment, death, and related concepts. Focus on analyses and descriptions of anthropological fieldwork. Sp


4310 Field Work in Anthropology (3-9) Practicum work surveying, excavating, processing, and analyzing data of field reading. Prereq: 2510-20-30 and consent of instructor. May be repeated. Maximum 9 hrs.

4360 Field Work in Physical Anthropology (3-9) Survey of prehistoric and modern human cultures. May include either skeletal or living non-Western cultures of the United States. Prereq: 2530 or consent of instructor.

4400 Cultural Ecology (3) Survey of concepts and methods in studying dynamic interaction between cultures and their environments. Topics include ecological theory, methods of analysis, and application from selected case studies. Prereq: 2520, 2530, 3410 or consent of instructor. A

4420 Dynamics of Culture (3) Culture change: innovation, diffusion and acculturation; cultural continuity and stability. Prereq: 2530 or consent of instructor. A

4430 Personality and Culture (3) Analysis of relation between individual, society and culture. Application of psychological techniques in cross-cultural studies. Cultural differences and their influence on group behavior. Prereq: 2530 or consent of instructor.

4440 Urban Anthropology (3) Survey of theoretical and methodological issues anthropologists encounter researching cross-cultural urban settlements. Focus on anthropological perspective and urban problems and planning. Prereq: 3480 or consent of instructor. A

4480 Current Trends In Anthropology (3) Analyti-cal integrative review in symposium of the current debates, research directions, theories, fieldwork methods, and general assumptions of the four subfields of anthropology: archaeology, physical anthropology, linguistics, and cultural anthropology. Sp

4550 Indians of the Southeastern United States (3) Survey of prehistoric and historic Native American cultures emphasizing on aboriginal adjustment to environment; lifeways of Southeastern Amerind groups prior to Euro-American contact. Prereq: 2530, 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.

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 evi-dence of human activity to time of European contact. Prereq: 2520 or consent of instructor. A

4640 Zoarchaeology (3) Basic osteological studies of vertebrate classes; emphasis on aboriginal human's utilization of native animals in subsistence and culture. Identification, analysis, and interpretation of archaeologically derived molluscan and vertebrate remains. F

4650 Archaeology of Southeastern United States (3) Intensive study of prehistoric American Indian. Special emphasis on Tennessee prehistory. Prereq: 3610 or consent of instructor. W, A

4690 Prehistory of Northwest North America (3) Survey of prehistoric cultures of the Columbia Plateau, Northwest Plains, and Northwest Coast. Recommended prereq: 2520. A

4720 American Folklife (3) Anthropological perspec-tives of folkloric of geographical regions and ethnic groups of the United States. Prereq: 3700 or consent of instructor.

4740 Southern Appalachian Folk Culture (3) Survey of settlement history and economic development of Southern Appalachian mountain culture: technology and economics, social organization, beliefs and values, oral traditions, and customs. Prereq: Consent of instructor.

4741 Research in Southern Appalachian Folk Culture (3) Research-oriented, wide range of tradi-tional culture in Southern Appalachia: settlement patterns, folk housing, economy, clothing, beliefs, speech, art, song, dance, and oral traditions and customs. Prereq: 4740. May be repeated. Maximum 6 hrs.

4760 Italian Folklore (3) (Same as Italian 4760.)

4870 Cherokee Language (3) Linguistic survey of structure of the Cherokee language.

4930 Physical Growth and Constitution (3) Compar-ative growth patterns throughout the human life cycle. Biology and cultural factors affecting size and changes in growth; human constitutional types. 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 living populations. Emphasis on North American Indi-ans. Prereq: 2510 or consent of instructor. A

4950 Primate Studies (3) Survey of field and labora-tory investigations of comparative anatomy and nonhuman primate behavior. Prereq: 2510 or consent of instructor. F

4960 Primate Paleontology (3) Survey of fossil pri-mate forms; origin and evolution of major primate lineages, emphasizing the earliest Hominid and re-lated forms. Prereq: 2510. Recommended prereq: Zoology 4380. W


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) P/NP only. E

5010 Graduate Research (1-9) Independent investi-gation of special problems in anthropology. May be repeated. Maximum 18 hrs. E.

5100 Seminar in Cultural Anthropology (3-9)

5110 Foreign Study (1-12) See page 96.

5120 Off-Campus Study (1-12) See page 96.

5150 Independent Study (1-12) See page 96.

5140 Seminar in Zooarchaeology (3) Approaches to analysis and interpretation of archaeological faunas. Intensive reading; evaluation and discussion of major faunal studies, geological identification, methods of presenting faunal data. May be repeated. Maximum 6 hrs. A

5149 Laboratory Studies of the Vertebrate Skeleton (4) Examination and comparison of skeletons of major groups of fish, amphibians, reptiles, birds, mammals. Oriented toward identification of archaeologically derived faunas. May be repeated. Maximum 12 hrs. A

5159 Laboratory Study of the Molluscs (4) Exami-nation and identification of terrestrial and fresh-water mollusks of eastern U.S. Emphasis on living and fossil gastropods and pelecypods. Prereq: 4640. 1 hr and 3 labs. Sp, A
5160 Seminar in Archaeology (3-9) Theoretical and practical issues central to contemporary archaeology. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5180 History of Thought in American Archaeology (3) Intensive review of continuity and change in concepts and methodologies; contributions of influential archaeologists. Prereq: 2520, 3610 and consent of instructor.

5200 Special Topics in Anthropology (3) Lecture and/or seminar course for advanced students on selected topics of current interest to field of anthropology as a whole. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5210 Community Anthropology: The Local Community (3) Ethical issues, researcher models and research methods on local community. Prereq: 4440 or consent of instructor.

5340 Fieldwork in Anthropology (3-9) Practicum work surveying, excavating, processing, and analyzing of data. Intensive reading. Prereq: 9 hours of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

5400 History of Anthropological Theory (3) Theoretical contributions of more influential anthropologists. Prereq: Consent of instructor. A

5440 Peasant Societies (3) Critical analysis of existing literature and theories regarding rural-urban polarities, interactions, and different cultural manifestations of agricultural populations. Prereq: Consent of instructor.

5450 Comparative Social Organization (3) Social structure in nonliterature societies. Kinship, age, sex, and ethnic factors in determining relations between individuals and groups. Prereq: At least one area course.

5460 Quantitative Methods in Anthropology (3) Application of quantitative methods to anthropological data. Use of correlation, regression, discriminant analyses, and analysis of variance. Prereq: Statistics 2100 or equivalent.

5470 The Healer in Cross-cultural Perspective (3) Graduate seminar dealing with socialization, methods of diagnosis, and therapeutic modes of healing in non-Western societies. Prereq: 4250. W

5510 Education in Cultural Perspective (3) Same as Curriculum and instruction 5516. F

5511 Non-Western Education: Anthropological Approaches (3) Analysis of traditional educational processes in non-literate peoples. Problems and limitations of application. Prereq: Consent of instructor. W

5500 Theory in Archaeology (3) Review of development of archaeological theory. Coverage up to and including recent systems approaches. F

5510 Problems in Northern American Archaeology (3) Seminar to explore specific research problems in Northern American archaeology. Research topics on prehistoric ecology and settlement patterns in North America. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. A

5520 Problems in Old World Archaeology (3) Selected topics and research problems in European, Asian and African prehistory investigated in depth. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. (Same as Classics 5520.)

5530 The Maya (3) Intensive survey of Mayan culture of Yucatan and Guatemala from pre-Columbian times to present. Prereq: 3580. A

5540 Archaeological Resource Management (3) Theory and practice—public, conservation, contract, and salvage/research archaeology. Legislation; contracts, responsibilities, and certification; agencies and policies; project design, administration, and logistics; standards of field work, analysis and publication; archaeology and public; conservation of archaeology as career. May be repeated. Maximum 6 hrs. W

5560 Seminar in Prehistoric Lithic Technology (3) Analysis of techniques employed in production of prehistoric lithic raw materials; raw materials employed; resultant implements, morphology and function; and typological constructs utilized in archaeological analysis. Prereq: Consent of instructor. A

5570 Seminar on Aboriginal Lithic Resources (3) Training and research in stone materials utilized by prehistoric populations—properties, natural occurrence and geological context, relative abundance and quality extraction and distribution, processing and ultimate forms and functions. Theory and implementation of testing probes, discrete relations in terms of lithology and cultural homogeneity, particularly East and Middle Tennessee. Input from professional geologists, and field research. Recommended prereq: 5560.

5700 Theory in Folk Culture Studies (3) Seminar analyzing major theoretical viewpoints of European and American folklore and folk life study trends from inception to present.

5710 Problems in Folk Culture Studies (3) Topical seminar dealing with selected problems and aspects of traditional behavior in Euro-American culture. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5900 Dental Anthropology (3) Dental anatomy, theories of dental evolution, genetic and environmental influences controlling dental morphology, comparative methods, dental trauma analyses, use of dentition for skeletal aging, and dental casting. Prereq: 3900. A

5910 Measurement of Man (3) Techniques of measuring and describing skeletal material and human subject with emphasis upon practical applications to growth, nutrition and human engineering. Prereq: Consent of instructor. A

5920 Advanced Physical Anthropology (3) intensive investigation of theory and problems in physical anthropology.

5930 The Human Skeleton in Forensic Medicine (3) Application of physical anthropology to problems in human identification. Determination of age, race, and sex of skeleton and preparation of reports for legal medicine. Prereq: 3900. Sp

5940 Skeletal Biology of Early Human Population (3) Practical and theoretical approaches to analysis of prehistoric human skeletal populations. Demography, vital statistics, pathology, nutrition, and measurement of biological relationships as they relate to population as adaptive unit. Prereq: 3900. F

5945 Comparative Primate Anatomy (4) Laboratory-oriented course dealing with functional anatomy of primates. Musculoskeletal system and evolution of various primate adaptive patterns. Prereq: Osteology and one dissection course in zoology.

5950 Paleopathology (4) Identification and descriptive analysis of pathological conditions affecting 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; genetics and polymorphism; 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 relationship of variation to population structure. Prereq: 3900 or consent of instructor. A

8000 Doctoral Research and Dissertation (3-15) P/NP only. E

6410-20-30 Seminar in Cultural Anthropology (3, 5, 7) Seminar is offered each quarter primarily for doctoral candidates.

6510 Selected Topics in Archaeology (3) May be repeated. Maximum 9 hrs.

6510 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

DEGREES

Art

M.A., M.F.A.

Professors:


Associate Professors:


Assistant Professors:


Instructors:

L. Kocianski, M.F.A. California (Davis); T. Taup, 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.

MASTER OF ARTS

Areas of concentration consist of ceramics, communication design, drawing, fiber-fabrics, printmaking, sculpture, and watercolor. One year of residence is required.

Curriculum:

Quarter

Thesis

9

Area of concentration

12

Drawing and composition

3
The thesis is a critical essay relevant to the area of concentration. The M.A. thesis may not be used to fulfill the project in lieu of thesis requirements for the M.F.A. A graduate exhibition is required. Final examination is oral.

MASTER OF FINE ARTS

The Master of Fine Arts is the terminal degree in studio art. It is offered with concentrations in ceramics, graphic design/illustration, drawing, fiber-fabrics, painting, printmaking, sculpture and watercolor. Inter-area concentrations are available with consent of the faculty.

Six quarters beyond the baccalaureate degree are required in residence. Residence is defined by the Department of Art as (1) a minimum enrollment of 6 hours per quarter, and (2) use of Department of Art facilities so that students are available for discussion and criticism. Final examinations are oral, concurrent with project exhibition.

Curriculum:

Quarter:

| Project in Lieu of Thesis | 30 |
| Major area | 30 |
| Art history | 12 |
| Electives | 10 |

Seminar in Art Criticism | 4
Seminar in Art History | 4
Total | 90

DEGREE REQUIREMENTS FOR M.F.A.

1. Successful completion of 30 hours of studio in concentration area. Inter-area courses 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 first three quarters in residence the student must present work for evaluation by the faculty and receive 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 receive 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, mosaic, Romanesque pilgrimage church, Gothic cathedral. F

3765 Northern European Painting: 1350-1600 (4) From courtly art of late Middle Ages to Northern Renaissance. Van Eyck, Van der Weyden, Bosch, and Durer. F, Sp

3715 Early Italian Renaissance Art: 1300-1450 (4) Development and exploration of naturalism. Revival of antiquity and development of theories of perspective in Early Renaissance. Duccio, Giotto, Masaccio, Donatello, Botticelli. 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, 1550-1830 (4) Sebastian, Titoreto, El Greco, Caravaggio, Zurbaran, Velazquez, Bernini and Goya. Artistic relations between Iberia and Latin America. F

3726 The Art of Northern Europe 1550-1657 (4) Concentrated study of Bruegel, Rubens, Rembrandt, Georges de La Tour, Vermeer, Poussin and Hals. W

3727 History of Nineteenth-century Painting in Europe and America (4) Emphasis on France; Neoclassicism, Romanticism, Friedrich, Constable, Turner, Courbet and Barbizon landscapists, Hudson River Group, pre-Raphaelite Brotherhood, Manet, Courbet, Impressionism, Eakins, Homer, Seurat through Cezanne. W

3728 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 painting, Abstract Expressionism in the U.S.A. and parallels in Europe. Pop, Op, Minimal, and Concept Art. F


3746 History of Modern Sculpture in Europe and America (4) From 1900 to present: emphasis on Cubism, Constructivism, Expressionism, Assemblage, Pop, Primary Forms, Environments, and Earthworks. Sp

3763 Crafts in America (4) Craft movement; growth and development. Educational, social, economic, and aesthetic values. Role of designer in society as producer and teacher.

3765 History of North American Art (4) Survey of landmarks in painting, architecture, sculpture, and design from prehistory to 1900. F

3766 History of Twentieth-century American Art (4) Analysis of developments in architecture, painting, sculpture, and design from prehistory to 1900. F

3777 Nineteenth-century American Painting (4) From West Point to the emergence of "The Eight." F

3775 Art of Indian Asia (4) History of Indian art with consideration of art of Central Asia and Southeast Asia. Sp

3776 Chinese Art (4) F

3777 Japanese Art (4) F

3811 Introduction to Museology (3) Concepts, practices and historical development of museums of art, archaeology, anthropology and science. (Same as Anthropology 3811.)


4006 Special Topics (2-4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.

4015 Individual Problems (4) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

4035 Special Topics in Drawing (4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.

4115 Drawing IV (4) Individualized pursuit of personal drawing techniques and concepts; individual and group critiques; weekly life drawing sessions. Prereq: 12 hrs 3115. May be repeated Maximum 12 hrs. E

4119 Advanced Design Studio (4) To explore strengths, structural variability and form potentials of design materials, aesthetic potential. Prereq: Senior or graduate standing or consent of instructor.

4206 Special Topics in Painting (4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.

4215 Painting IV (4) Individual concepts of personal expression with varied media on canvas. Prereq: 12 hrs 3215 for art majors; consent of instructor for non-majors. May be repeated. Maximum 12 hrs. E

4256 Special Topics in Fiber and Fabrics (4) Student- or instructor-initiated course to be offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.


4315 Watercolor IV (4) Individual concepts of personal expression with varied water-based media in paper. Prereq: 12 hrs 3315 for art majors; consent of instructor for non-majors. May be repeated. Maximum 12 hrs. E

4406 Special Topics in Sculpture (4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.

4415 Advanced Sculpture IV (4) Individual development of sculptural problems and techniques. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. E

4470 Advanced Wood Sculpture (4) Application of laminating, carving, and jointing techniques in designing and construction of contemporary forms. Prereq: 2450 or consent of instructor. May be repeated. Maximum 12 hrs.

4506 Special Topics in Graphic Design/ Illustration (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, constructing, display and evaluation for two- and three-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 designer. Sessions with outside guest speakers and field trips. Prereq: 4515. W
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.

4658 Studies in Art History (4) Concentration in selected areas. Prereq.: 16 hrs of art history and consent of instructor. May be repeated. Maximum 6 hrs.

4956 Special Topics in Ceramics (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.

4956 Special Topics in Ceramics (4) Student- or instructor-initiated course offered at convenience of department. Prereq.: Determined by department. May be repeated. Maximum 16 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. W

5000 Thesis (1-15) P/NP only. 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 not be repeated. S/NC only. E

5011-21-31 Exhibition in Lieu of Thesis (3, 3, 3) S/NC only.

5101 Foreign Study (1-12) See page 96.

5102 Off-Campus Study (1-12) See page 96.

5103 Independent Study (1-12) See page 96.

5115 Graduate Drawing I (2-4) 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 (2-4) May be repeated. Maximum 18 hrs. F, W, Sp

5225 Graduate Painting II (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5255 Graduate Fiber and Fabrics I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5275 Graduate Fiber and Fabrics 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 Graphic Design/Illustration I (2-6) May be repeated. Maximum 18 hrs. F, W, Sp

5525 Graduate Graphic Design/Illustration 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 (3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs.

5770 Seminar in Art History (4) A

5900 Seminar in Art Criticism (4) Theory and practice intended for majors in studio art. A

5955 Graduate Ceramics I (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. S/NC only. E

*Graduate II courses must be preceded by successful first year evaluation by the faculty. Courses offered periodically only at the Pil- Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated.

4004 Special Topics (1-4) Student- or instructor-initiated course offered at convenience of department.

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.

4654 Metal Design (1-4) Intermediate to advanced.

4664 Enameling (1-4) Intermediate to advanced.

4904 Photography (1-4) Intermediate to advanced.

5495 Ceramics (1-4) Intermediate to advanced.

Audiology and Speech Pathology

MAJORS

Audiology

Speech and Hearing Science

Speech Pathology

DEGREES

Ph.D.

M.A.

Ph.D.

M.A.

Associate Professors:

S. B. Burchfield, Ph.D. Michigan State; C. G. Mariel, M.Ed. Texas.

Assistant Professors:

A. O. Diefendorf, Ph.D. Washington; E. Hamby, Ph.D. Iowa; C. J. Ferrell, M.A. Tennessee.

THE MASTER'S PROGRAM

A major is offered in Audiology or in Speech Pathology. A major may be taken in either of the two areas when approved by the department. The intent of each major program is to provide the student with the scholarly and professional skills necessary for functioning as an independent professional clinician in any clinical environment. Within this broad coverage of speech pathology or audiology, it is possible for a student to specialize to some extent. For example, in the M.A. in Audiology program, a student may emphasize audiological assessment, aural habilitation-rehabilitation, medical or pediatric, or industrial audiology. Within the M.A. in the Speech Pathology program, a student may emphasize one of the major areas such as aphasia or stuttering. Students interested in specializing beyond the typical broad M.A. programs should consult the department office or their advisor for lists of suggested courses, practica and independent studies.

Students majoring in the two areas are expected to complete the academic requirements for clinical certification from the American Speech and Hearing Association, including the required number of clock hours of clinical practicum. An exception to this rule must be approved by the Department and the 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, 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 two-thirds of these total courses must be at the 5000 or 6000 level, no more than 5 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 32 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 Science 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