Departments of Instruction

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

Art and Music Education

Charles H. Ball, Head

Art Education

MAJOR
Art Education

DEGREE
M.S.

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

Associate Professor:
H. N. Hull, Ed.S. Peabody.

Assistant Professor:
J. P. Watkins, M.S. Tennessee.

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

The thesis option requires 45 quarter hours as follows:

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

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

1. Art Education 5210, 5310, 5320, and electives ........... 21 hrs
2. Education Curriculum & Instruction 5710, and electives 9 hrs
3. Minor (selected with committee) ..................... 9 hrs
4. Electives ........................................ 6 hrs

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

All courses in art education are offered regularly each quarter, so the student should plan his or her program carefully with a faculty advisor.

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

3920 Clay in School Program (3) Exploring methods of hand-built forms, glazing and firing procedures. Prereq: Introduction to Art Education in the Schools. 1 hr and 2 labs.

3930 Textiles in School Program (3) Exploration of processes of weaving, stitchery, batik, and silk screen. Prereq: Introduction to Art Education in the Schools. 1 hr and 2 labs.

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

4130 Three-Dimensional Design in School Program (3) Exploration of wood, wire, metal, plastics, and other sculptural materials. Prereq: Introduction to Art Education in the Schools or consent of instructor. 1 hr and 2 labs.

4150 Lettering, Posters, and Displays in the School Program (3) Design and layout; techniques and procedures. Prereq: Introduction to Art Education in the Schools or consent of instructor. 1 hr and 2 labs.

4160 Appreciation of the Arts in the School Program (3) Prereq: Introduction to Art Education in the Schools or consent of instructor. 1 hr and 2 labs.

4350-50-70 Problems in Art Teaching (3, 3, 3) Prereq: Consent of instructor.

5000 Thesis

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

5210 Organization, Administration, and Supervision of Art in the School Program (3)

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

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

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

Music Education

MAJOR
Music Education

DEGREE
M.S.

Professors:

Associate Professors:

Assistant Professor:
W. H. McDaniel, M.S. Tennessee.

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

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

Requirements for thesis program: 45 quarter hours including thesis (9 hours), the music education major (18 hours), minor areas in music (9 hours), and professional education (12 hours). Required courses: Music Education 5000, 5210, 5220, 5230; Curriculum and Instruction 5710.

Requirements for non-thesis option:
1. Minimum of 51 quarter hours of course work with a minimum of 26 hours at the 5000 level.
2. Evidence of ability to understand and interpret research through completion of:
   A. Educational Statistics 5610 or the equivalent.
   B. Music Education 5710.
3. Satisfactory performance of research activities in required courses in music education listed below.
4. Curriculum design:
   With the exception of the required courses listed below, with approval of the student's advisor, courses may be selected as described more fully below. This provides the flexibility necessary for the student to pursue in some depth specialized interests and needs in the following areas of music teaching: Elementary; Secondary (Junior and Senior); Vocal (Choral); Instrumental (Band and Orchestra); and Supervision.

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

   (3) 9 quarter hours in professional education, including Educational Statistics 5610 and Educational Psychology 4760 or equivalents and a 3-hour elective.
4. Specific course requirements:
   A. Music Education Foundation (15 quarter hours)
      (1) One seminar (3 hours)
      (2) 5210, Psychological Foundations of Music
      (3) 5240, Evaluation Procedure in Music Education
   (4) 5250, The Role of Music in Education
   (5) 5710, Research in Music Education
   B. Music
      Six quarter hours in applied music (piano; voice; a band or orchestra instrument; or theory and composition).
   C. Education (limited elective of 6 quarter hours)
      Education 4760, Advanced Child Study; or 5050, Learning and Development in Children; 5320, Advanced Educational Psychology; or other appropriate course in educational psychology with 3 hours credit.
   5. Electives (with approval of advisor):
      A. Music Education: 12 credit hours from courses numbered 5000.
      B. Music: 9 credit hours from courses at the 3000, 4000, or 5000 levels. No courses required in the undergraduate curricula may be included.
   C. Education: 3 credit hours, elected from other departments in Education.
   6. Evaluation (in addition to routine examinations in courses):
      A. Written comprehensive examination in major and minor fields.
      B. The student shall elect one of the evaluation procedures below with approval of advisor and committee:
         (1) Oral examinations in major and minor fields.
         (2) A public recital in principal instrument, piano or voice.
         (3) The presentation in public performance of an original musical composition(s).
accepted by the committee as music suitable for school music performing groups. (4) Plan, rehearse and conduct a full public performance of music by junior or senior high school music groups. This shall be worked out as a long-term project under the supervision of the student's committee.

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

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

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

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

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

5000 Thesis

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

5100 Studies in Secondary School Music (3) Development of understandings regarding growth patterns and processes through music experiences; cultural and community influences on secondary school music; problems in the administration and teaching of music in the secondary school; and relationship of music with the humanities in the curriculum. Sequel to Teaching Music in Junior and Senior High Schools.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Continuing and Higher Education

MAJOR

Adult Education

M.S.

DEGREE

[Continuing and Higher Education Major Information]

Professors:


Associate Professor:

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

Assistant Professor:


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

5000 Thesis

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

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

5110 Seminar in College Teaching (3) Effective college teaching; testing and measurement; recent research in college instruction; major problems and their solutions. Required of candidates for the M.A.T. degree.

5320 Theory and Research in Human Learning (3) Same as Educational Psychology 5330.

5360-70 Problems in Continuing and Higher Education (2-2-2) Independent study of problems and special institutes.

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

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

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

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

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

5600 Program Planning in Continuing and Higher Education (3) Theory and method for planning adult education programs.

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

5895-55-75 Practicum in Continuing and Higher Education I, II, III (3, 3, 3) Supervised practice in selected areas of instruction or administration of continuing or higher education programs.
5950-70 Seminar in Continuing and Higher Education (3) Problems and issues confronting professionals in the fields of adult or higher education.

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

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

**Curriculum and Instruction**

**MAJORS**

<table>
<thead>
<tr>
<th>DEGREES</th>
<th>CURRICULUM AND INSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S.</td>
<td>Curriculum and Instruction Ed.S., Ed.D.</td>
</tr>
<tr>
<td>M.S.</td>
<td>Elementary Education</td>
</tr>
<tr>
<td>M.S.</td>
<td>English Education</td>
</tr>
<tr>
<td>M.S.</td>
<td>Foreign Language Education</td>
</tr>
<tr>
<td>M.S.</td>
<td>Instructional Materials</td>
</tr>
<tr>
<td>M.S.</td>
<td>Mathematics Education</td>
</tr>
<tr>
<td>M.S.</td>
<td>Science Education</td>
</tr>
<tr>
<td>M.S.</td>
<td>Social Science Education</td>
</tr>
</tbody>
</table>

**Professors:**


**Associate Professors:**


**Assistant Professors:**


**Instructor:**


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

**THE MASTER'S PROGRAM**

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

**THE SPECIALIST PROGRAM**

The Educational Specialist degree program in the Department of Curriculum and Instruction will encompass concentrations in the following areas: Curriculum Elementary education English education Foreign language education Instructional materials Mathematics education Science education Social science education

The program includes a minimum of 20 quarter hours of graduate study. If the student has earned the Master's degree, a maximum of 45 hours of the Master's work may be credited to the 90 hour Ed.S. requirement. (45 hours of 5000-level courses are required.) The program must also include the following:

1. A minimum of 12 hours taken in one of the eight areas listed above.
2. A minimum of 12 hours taken within the College of Education in areas other than the student's major area.
3. A minimum of 12 hours taken outside of the College of Education.
4. A minimum of 9 hours earned through the writing of a thesis. (Students who have written a thesis for the Master's degree may be exempted from a thesis in the Ed.S. program provided, in the judgment of the student's committee, the thesis meets the standards of research appropriate for the Ed.S.)
5. A minimum of 45 elective hours taken according to a plan jointly developed by the student and the major professor in terms of the student's professional goals.

**THE DOCTORAL PROGRAM**

The doctoral major in Curriculum and Instruction 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.

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

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

**4910 International Education: Cultural Perspective (3) Education in relation to the liberal, conservative, reactionary, and radical currents of thought in American culture.**

**4159 School Library Administration (3) Same as Library and Information Science 4159.)**

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

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

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

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

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

**4251 Philosophy of Education: Introductory Studies (3) Traditions, knowledge, and evaluation in relation to the work of the schools. Prereq: History and Philosophy of Education, Child Study or Educational Psychology, Adolescence, or equivalent.**

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

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

**4300 Developmental Reading in the Secondary School (3)**

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

**4302 Language Development of Children: Birth-Preadolescence (3) In-depth view of language development during years birth through preadolescence; application of process of language development to instructional programs for early and middle childhood.**

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

**4559-60-70 Problems in Teaching English (3, 3, 3)**

**4559-60-71 Problems in Teaching Mathematics (3, 3, 3)**

**4559-62-72 Problems in Teaching Social Studies (3, 3, 3)**

**4559-63-73 Problems in Teaching Science (3, 3, 3)**

**4559-64-74 Problems in Teaching Language Arts (3, 3, 3)**

**4559-65-75 Problems in Teaching General Curriculum (3, 3, 3)**

**4559-66-76 Problems in Instructional Materials (3, 3, 3)**

**4559-67-77 Problems in Teaching Foreign Languages (3, 3, 3)**

**4559-68-79 Problems in Teaching Conservation (3, 3, 3)**
54 College of Education

4380-93-400 Problems in the Improvement of Instruction (2, 2, 2) Special conferences, workshops, or in-service programs.

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

4410 Educational Sociology (3) Emphasis on examination of the school as a social system. (Same as Sociology 4416.)

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

4451 Teaching in Kindergarten: Program Development (3) Curriculum planning and organizational aspects. Prereq: At least 9 hrs. in history or philosophy of education.

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

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

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

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

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

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

5230 Diagnosis and Remediation of Arithmetic Difficulties (3) A critical analysis of new programs, materials, and research opportunities in education, using modern electronic data processing methods and machines.

5250 Secondary School Instruction (3)

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

5280 The Teaching of Language Arts in the Elementary School (3) Trends, issues, and research in content and method for the language arts program, grades 1-8. Prereq: Undergraduate course Teaching Language Arts in the Elementary School or consent of instructor.

5281 Teaching Social Studies in the Elementary School (3) Recent trends, issues, and research in content and method for the elementary program.

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

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

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

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

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

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

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

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

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

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

5350 Curriculum Development and Evaluation (3)

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

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

5367 Diagnosis of Remedial Reading Problems (3) Prereq: 5380.

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

5382 Developmental Reading Pracitcum (3) Diagnostic and teaching children with reading difficulties. Prereq: Consent of instructor.

5383 Remedial Reading Practicum (3) Prereq: 5381.

5390 Organization and Administration of Reading Programs (3)

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

5520 Curriculum Laboratory for High Schools (3) Study and production of syllabi, courses of study, subject units, and other materials.

5530 Curriculum Planning and Development (3)

5610 Educational Statistics (3)

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

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

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

5670 Curriculum Laboratory for Early Childhood Education (3)

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

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

5691 Advanced Production of Audiovisual Software (3) Advanced local production skills such as lettering, overhead projectors, mounting, preserving, synchronizing, photocopying, non-photographic slides, and videotaping for producing classroom audiovisual software. Prereq: 5680 or consent of instructor. Library and Information Science 4750 or equivalent.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5845 Research in Instructional Media (3) Comprehensive reviews of recent developments in the field of instructional media. Prereq: Teaching Media Arts in Elementary School or equivalent.

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

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

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

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

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

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

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

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

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

5859-69-79 Problems in Education: Conservation (3, 3, 3)

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

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

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

5920 Teaching Composition in the High School (3) Techniques for teaching rhetoric.

5921 Teaching Fiction in the Secondary School (3) Reading, study, and analysis of literary selections.

5924 Teaching the Mass Media in the English Classroom (3) To acquaint the English teacher with the nature of mass media and its importance to American education and life.

5925 Teaching English in the Community/Junior College (3) Emphasis upon gaining a thorough understanding of the communication needs of community/junior college students and of the objectives, strategies, and materials for meeting these needs.

5926 Teaching Poetry in Grades 7-12 (3) A study of materials and strategies for teaching poetry.

5927 Teaching Drama in Grades 7-12 (3) A study of strategies and materials for teaching drama in the classroom.

5928 Developing and Speaking and Listening Skills in Grades 7-12 (3) A study of strategies and materials for teaching writing and listening.

5929 Instructional Theory and Design (3) Course is designed for those individuals at the Master’s and Doctoral levels who have interest in intensive study of the instructional process and its relationship to curriculum and learning.

5930-20-30 Problems in Lieu of Thesis (3, 3, 3)

5931 Directing the Forensic Program (4) (Same as Speech 5911).

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

5915 The Function of the Thinking Process in Education (3) Analysis of the thinking processes for the purpose of tracing its implications for educational theory and practice.

5920 The Teaching of Natural Science (3) Emphasis on teaching strategies, testing and evaluation techniques, and professional guidelines for program planning in science.

5931 Seminar in Science and Environmental Education (3) Comprehensive studies of recent developments in science education of concern to classroom instructors and those having interest in the interrelationships of environmental factors on science education.

5920 The Teaching of the Social Studies (3)

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

6000 Doctoral Research and Dissertation

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

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

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

6031 Seminar in Reading and Language Arts (3) A critical review of topics new to the broad area of language arts. Two topics each term chosen by the need and the instructor(s). Prereq: 5000-level course in reading and one 5000-level course in language arts.
Consideration will be given to recent and current literature in the field and to sound educational practices in guiding the learning of children. Prereq: 5640 or consent of Instructor.

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

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

6830 Studies in Mathematics Education (3) Reading and study related to historical trends and issues in mathematics education in the United States for the purpose of providing a broad perspective on current curricular problems and trends. Prereq: 5830 or consent of instructor.

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

6890 Internship (1-6) Advanced level experiences in application of principles and practices of curriculum development and instructional improvement. Program prerequisites must be met and permission of instructor required. May be repeated. Maximum 12 hrs. S/NC only.

Educational Administration and Supervision

MAJOR DEGREES

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


Programs are planned for (1) students preparing for administrative positions normally found in the educational structure of the state; (2) students preparing for the position of supervisor of education; (3) administrators and supervisors in service who wish to improve their professional competence; (4) students and teachers preparing for teaching positions involving administrative responsibilities; and (5) students preparing for teaching educational administration or for administrative positions in higher education. In addition to M.S. and Ed.D. degrees, a special two-year graduate program is offered which leads to the Ed.S. (Specialist in Education) degree and which provides advanced preparation for applicants judged to be potentially competent school administrators.

5000 Thesis

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

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

5130 Introduction to Educational Administration (3)

5180-50-200 Educational Specialist Research and Thesis (3, 3, 3)

5220 Philosophy and Theory in Educational Administration (3)

5230 Seminar in the Behavioral Sciences for Educational Administration (3)

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

5310 School Administration in a Multilingual Society (3) Seminar offering opportunity to identify and explore educational problems arising from ethnic and racial diversity, tensions, and possibilities with which school administrators must deal within the individual school or on a district-wide basis.

5420 District Level Administration (3)

5430 Building Level Administration (3) For beginning school principals and administrators, and for those operating in rural elementary, secondary, or consolidated schools.

5440 Introduction to Law, Finance, and Business Management at the Building Level (3)

5450 Organization of the School Program (3)

5470 Introduction to School Facility Planning (3)

5490 Introduction to Supervision and Personnel Administration (3) Principles, methods, and techniques of leadership.

5490 Administration of Community Education (3) Examine administrative factors of primary importance in the development of community education programs in the public schools.

5530 Introduction to Educational Planning (3)

5560 Analysis and Interpretation of Research for Educational Administrators (3)

5580 Seminar in Communication Skills for Educational Administrators (3)

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

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

5713-23-33 Problems in Educational Administration and Supervision: State School Administration (3, 3, 3)

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

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

5720 Seminar in Urban School Administration (3) Studying and analyzing administration in urban school districts.

5730 School Business Management (3)

5740 School Law (3) Study of constitutional provisions, special legislation, and legal interpretation of Tennessee law affecting educational administration.
5751-61-71 Problems in Educational Administration and Supervision: Theory (3, 3, 3)
5752-62-72 Problems in Educational Administration and Supervision: Finance (3, 3, 3)
5753-63-73 Problems in Educational Administration and Supervision: Transportation (3, 3, 3)
5754-64-74 Problems in Educational Administration and Supervision: Business Management (3, 3, 3)
5755-65-75 Problems in Educational Administration and Supervision: Personnel (3, 3, 3)
5756-66-76 Problems in Educational Administration and Supervision: School Plant (3, 3, 3)
5757-67-77 Problems in Educational Administration and Supervision: Organization and Structure (3, 3, 3)
5758-68-78 Problems in Educational Administration and Supervision: School Law (3, 3, 3)
5759-69-79 Problems in Educational Administration and Supervision: Supervision (3, 3, 3)
5770 Maintenance of School Plants (3)
5780 Supervision (3) Supervisory activities of county and city school supervisors. Use of committees, effective techniques for working with groups, relationships with local and state administrative and supervisory personnel, and techniques for the evaluation of supervisory programs.
5780 School Board-Superintendent Relationships (3)
5810 Survey Research Methods (3) Overview of descriptive studies, data collection, analysis, and interpretation for survey studies and school surveys, strategies for descriptive research in education.
5830 Contemporary Economics and Educational Finance (3)
5890 Decision Making and Decision Theory in Educational Organizations (3) This seminar is a laboratory for learning about various theoretical constructs underlying executive decision making and involves direct application of decision theory in a variety of problem-solving activities. It is designed for both the preservice and practicing administrator. Attention is given to executive decision making at the several administrative levels in the complex educational organization. S/NC only.
5910-20-30 Problems in Lieu of Thesis (3, 3, 3)
5980 Administration in Higher Education (3)
5981 Specialized Seminar: School Operation (3)
5982 Specialized Seminar: Higher Education (3)
5983 Specialized Seminar: State School Administration (3)
5984 Specialized Seminar: Preparation Programs (3)
5991 Specialized Seminar: Theory (3)
5992 Specialized Seminar: Finance (3)
5994 Specialized Seminar: Business Management (3)
5995 Specialized Seminar: Personnel (3)
5998 Specialized Seminar: School Law (3)
6000 Doctoral Research and Dissertation
6040 Seminar in Educational Administration and Supervision (1) Required three consecutive quarters. S/NC only.
6100 Internship in Educational Administration (3) May be repeated at the discretion of the student's committee. An opportunity for doctoral students and other advanced graduate students to gain experience in the performance of the critical tasks of educational administration while under the supervision of a practitioner and University representative.
6210 Modern Trends in the Theory and Practice of Educational Administration and Supervision (3)
6220 Programs for the Professional Preparation of Educational Administrators and Supervisors (3)
6460 School Personnel Administration (3) Study of personnel administration functions, both for professional and supporting staff, in educational organizations. Topics will include recruitment, selection, placement, personnel policies, employee wages and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation.
6480 Special Topics in School Personnel Administration (3) Topics such as human problems in school personnel administration; staffing, planning, systems, personnel policy development; collective bargaining in education; and staff evaluation. May be repeated. Maximum 12 hours.
6530 Futuristic Educational Planning Methods (3) Study of methods for describing alternative futures.
6550 State-Federal Relations in Education (3)
6560 Legal Foundations of Public Education (3)
6580 Administration of Complex Educational Organizations (3)
6670 Advanced Study in School Faculty Planning (3)
6990 Specialized Doctoral Seminar in Politics of Education (3) Seminar on political theories and practices as they affect the operation of the public school system. Series of appropriate interdisciplinary discussions based on literature and research from education, sociology, and political science. Students will conduct one field inquiry. Prereq: 5200, 5610 or equivalent or consent of instructor.
6996 Specialized Seminar: School Plant (3)
6997 Specialized Seminar in Organization and Structure (3) Survey and critical analysis of organizational theories in education including a systematic review of the status of organizational and leadership research in education and related disciplines; implications for further research; application of existing theory and research to known educational settings. Prereq: Consent of instructor.
6998 Specialized Seminar: Supervision (3)
6999 Specialized Seminar: Supervision (3)

Educational Psychology and Guidance

MAJORS

DEGREES

Guidance

M.S.

College Student Personnel

M.S.

Educational Psychology

M.S.

Educational and Guidance

Ed.D., Ed.D.

Professors:

L. M. DeRidder (Head), Ph.D. Michigan;
S. C. Dietz, Ed.D. Arizona State;
S. W. Huck, Ph.D. Northwestern; E. W. McClain,
Ph.D. Texas; W. A. Poppen, Ph.D. Ohio State;
E. W. Schoch, Ed.D. Florida; C. L. Thompson,
Ph.D. Ohio State; R. L. Williams, Ph.D.
George Peabody.

Associate Professors:

K. L. Davis, Ed.D. Georgia;
D. J. Dickinson, Ed.D. Oklahoma State;
J. W. Edgery, Ed.D. Tennessee; M. A. Hectar,
Ph.D. Michigan State; S. B. Lord, Ph.D.
Indiana; K. K. Swander, Ph.D. Florida.

Assistant Professors:

T. W. George, Ed.D. Tennessee; D. C. Johnson,
Ph.D. Oregon; L. M. Kindall, Ed.D. Tennessee;
M. C. McN|m, Jr., Ph.D. Florida State;

Graduate programs (thesis or non-thesis option) lead to the M.A. or M.S. degree with a major in Guidance, College Student Personnel, or Educational Psychology, to the Specialist in Education degree, and to the Doctor of Education degree. Appropriate courses taken in this department and in the Department of Psychology will satisfy requirements for certification as a school psychologist. Write the department for information concerning the program requirement. Application deadline to Ed.D. is February 1 and July 15; Ed.S. and M.S. deadline is October 15, February 1, May 1, and July 15.

4110 Psychology of Sex Role Development (3) Examination, from both a theoretical and research base, of factors which contribute to sex role development with attention to changes in sex role definition in society and role of education in these changes. Aimed at the undergraduate or graduate student with minimal background in behavioral sciences.

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

4350-50-70 Problems in Educational Psychology and Guidance (3, 3, 3)

4440 General Evaluation Procedures for Public Schools (3) Prereq: 3 hrs in Child Study or equivalent.

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

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

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

4700 Advanced Child Study (3) Prereq: 3 hrs in Child Study, Adolescence or consent of instructor.

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

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

540 Group Dynamics (3) Principles of group dynamics as they apply to a variety of group settings. Emphasis on group counseling, personal growth, and group leadership skills. (Same as Psychology 5340.)

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

5550 Student Personnel in Higher Education (3) Philosophy and scope.

5580 The College Student (3) Nature, characteristics, and needs.

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

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

5780 Career Development: Theory and Research (3)

5795 Career Development: Program Development, Implementation, and Evaluation (3) A study of career development and prevocational assessment programs and projects. K-adult with emphasis on their development, implementation and evaluation. Prereq: 5780 or equivalent, or consent of instructor.

5945 Group Counseling Practicum (3) Supervised practice in group counseling with children and/or adults. May be repeated. Maximum 6 hrs.

5960 Internship (1-6) Supervised employment in a departmentally approved internship site. Consent of instructor. May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation

6040 Seminar in Educational Psychology and Guidance Required 3 quarters.

6099 Internship (1-5) Supervised employment at a departmentally approved internship site. Consent of instructor. May be repeated. Maximum 12 hrs. S/NC only.

6110 Application of Research Design in Educational Psychology and Guidance (3) Major types of research design and statistical analysis unique to educational psychology, counseling, and college student personnel. Although several types of designs are discussed, emphasis is on those designs that are "experimental" in nature. Prereq: 2 courses in statistics or consent of instructor.

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

6219 Field Work in School Psychology: Level I (2) (Same as Psychology 6219)

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

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

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

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

6750-60-70 Problems in Educational Psychology and Guidance (3, 3, 3) S/NC only.

6810 Seminar in Counseling (3) In-depth study of a selected counseling theory, topic, or issue. Prereq: 5890 or consent of Instructor. May be repeated.

6840-50-60 Seminar in Professional Issues (1, 1, 1) Issues in professional development: Job selection, convention participation, publishing, grant proposal writing, consulting, etc. For final year doctoral students only.

6910 Special Topics Seminar (3) Intensive exploration of specific research or theoretical topics with students who have the necessary background. Prereq: Advanced standing as a doctoral student. Prereq: Advanced standing as a doctoral student. Prereq: 5890 or consent of instructor. May be repeated.

6941-42-43 Practicum in Guidance, Counseling, and Personnel Services (3, 3, 3) Supervised practice in application of guidance tools and techniques. Minimum: 90 clock hours each quarter. Prereq: 5980 and consent of instructor.

6944-45-46 Teaching Practicum in Educational Psychology and Guidance (3, 3, 3) Prereq: Acceptance in doctoral program and consent of instructor.
**Special Education and Rehabilitation**

**MAJORS and DEGREES**

**Special Education** M.S.

**Vocational Rehabilitation Counseling** M.S.

**Professors:**
- Colorado State; W. M. Holbert, Ph.D. Texas.

**Associate Professors:**
- L. J. Coleman, Ph.D. Kent State; F. V. Essery, Ph.D. Michigan (Emeritus); E. E. Glickling, Ph.D. Southern Illinois; M. G. Hannum, Ed.D.
- Northern Colorado; C. G. Kaile, M.Ed. Texas; J. H. Miller, Ed.D. Auburn; L. C. Murphy, Ed.D.
- SUNY (Buffalo); J. M. Nadolsky, Ed.D. Auburn; H. W. Sawyer, Ed.D. Auburn; W. J. Schindler, Ph.D. Kent State; W. E. Woodrick, Ed.S.
- Mississippi State.

**Assistant Professors:**
- J. L. Casey, Ph.D. Kansas; C. R. Colvin, Ed.D. Virginia; R. E. Kreisheuer, Ph.D. Kansas;
- W. D. Smith, M.S. Florida State.

**Instructors:**
- R. F. Bynum, M.S. Florida State; R. N. Freeman, Ph.D. Tennessee; M. H. Raulerson, M.A. Kentucky;
- J. E. Siefafl, B.A. Gustavus Adolphus.

**Lecturers:**
- H. L. Byrd, Jr., M.S. Tennessee; S. W. Mulkey, M.S. Tennessee; O. E. Reece, B.S. Memphis State.

**Coordinator:**

An experience program for regular teachers, special teachers, and rehabilitation personnel may be planned to meet the needs of exceptional children and adults in relationship to the program of general and special education. Specialized courses may be distributed over the several areas of exceptionality with emphasis in an area of special interests or need. Facilities are available for continuous observation and participation in direct relationships with handicapped children and adults who are hospitalized, homebound, or in residential schools, special classes, or regular classes.

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

Programs lead to the Master of Science degree in Special Education with an emphasis in one of the specialized areas. Among the areas of specialization available is disability evaluation (non-thesis only).

Under the sponsorship of Social and Rehabilitation Services, a specialized 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**

**4000 Rehabilitation Practicum (3)** Evaluation of client data; practicing rehabilitation prognosis. Prereq: 4320.

**4190 Speech Development of the Hearing Impaired (3)** Anatomy and physiology of the speech system. Relationship of speech to hearing. Development of speech and language; techniques of speech development and improvement for hearing impaired children. Prereq: Audiology 3060. (Same as Audiology and Speech Pathology 4180.)

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

**4210 Language Development of the Hearing Impaired I (3)** Systems by which formal language is presented. (Same as Audiology and Speech Pathology 4210.)

**4220 Language Development of the Hearing Impaired II (3)** Techniques; various systems by which formal language is presented. Prereq: 4210 and consent of instructor. (Same as Audiology and Speech Pathology 4220.)

**5220 Language Development of the Hearing Impaired III (3)** Techniques; various systems by which formal language is presented. Prereq: 4220 and consent of instructor. (Same as Audiology and Speech Pathology 4230.)

**4250 Communication Processes for the Hearing Impaired (3)** The various communicative skills required by the hearing impaired person; speech and language development; auditory training; speech–reading; manual language and its relation to other forms of communication. Observations and practicum. (Student must acquire a degree of proficiency in the use of manual language.)

**5240 Nature of Hearing Impairments (3)** Basic principles of audiology, anatomy and physiology of hearing and hearing loss; methods and instrumentation for the assessment of hearing impairment; interpretation of audiograms; selection and use of hearing aids; relation of audiologic services to medical and other rehabilitative disciplines. Observations and practicum.

**4250 Introduction to the Education and Psychology of the Hearing Impaired (3)** (Same as Audiology and Speech Pathology 4250.)

**4280 Curriculum Development in Elementary and Secondary Schools for the Hearing Impaired (3)** Adaptation of curriculum development and methods in public school education to meet needs of deaf and hard of hearing students in residential and integrated settings.

**4280 The Teaching of Reading to Hearing Impaired Children (3)** Reading readiness activities, developmental approaches, theories, and specialized materials for curricula in teaching reading. Prereq: 4210 or consent of instructor.

**4870 Student Teaching with Hearing Impaired Children (9) S/NC only.**

**4871 Practicum with Hearing Impaired Children (6) S/NC only.**

**4939 Laboratory in Aural Rehabilitation (1–6)** (Same as Audiology 5040.)

**5540 Educational and Vocational Guidance of the Deaf and the Hard of Hearing (3)** Evaluation, professional work with the deaf and hard of hearing; techniques for diagnosis and counseling; social and personality adjustment; occupational opportunities.

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

**5820 Curriculum Development Applied to Programs for the Hearing Impaired (3)** Analysis of current curriculum trends in order to adapt them for hearing impaired individuals. Application of new curriculum options in the education of these children. Implementation of current education theories into programs for hearing-impaired children. Prereq: Curriculum and Instruction 5580 or the equivalent and consent of instructor.

**EDUCATION OF THE MENTALLY RETARDED**

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

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

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

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

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

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

**5111 Psychology of Mental Retardation (3)** Intellectual functioning, psychological theories and learning impairments. Enrollment limited to and educational implications emphasized. Prereq: 4110.

**5112 Psychology of the Severely Mentally Retarded (3)** Program and curriculum development for training/education of the severely
60 College of Education

5113 Advanced Curriculum for the Mentally Retarded: Investigation and analysis of educational models, methodologies and curriculum in the education of mentally retarded children and youth. Emphasis on the various curriculum alternatives to the retarded child's education.

MULTIPLE DISABILITIES

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

4150 Education of Hospitalized and Home-bound Children (3) School and home responsibilities; practical and social relationships; educational adjustment, vocational needs, and cooperation with related service resources.

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

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

EDUCATION OF THE EMOTIONALLY DISTURBED

4610 Nature and Characteristics of Learning and Behavior Disorders; in-depth study of behaviors and socially disturbing behavior, degrees of severity, possible causes, and relationships to each other. Emphasis on personality characteristics and developmental factors interpreted through behavioral and psychological literature; student teaching in special schools and residential facilities in which learning and behavior disorders may occur.

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

4630 Practicum in Residential Settings Serv- ing Children with Disturbing Behavior (3) Practice in scientifically identifying, observing, and recording disturbing behaviors. Initiating behavior changes according to academic and social behaviors. Performance in a tutorial capacity, counseling, training, and participation in discussion and evaluation of relevant academic curriculum and reinforcement schedule. Prereq: 4610 and 4620 or consent of instructor.

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

4624 Student Teaching of the Emotionally Disturbed (9) Individual tutoring and classroom observation and teaching experience. Prereq: or coreq: Student Teaching Grades 1-12. S/NC only.

REHABILITATION COUNSELOR EDUCATION

5109 Orientation to Rehabilitation (3) History, philosophy, and legal bases for the rehabilitation movement; case finding, intake, diagnosis, medical, social, and educational characteristics; rehabilitation techniques and procedures.

5115 Caseload Management in Rehabilitation (3) Study of roles and responsibilities of the rehabilitation counselor in the management of cases in state rehabilitation agencies and public/private rehabilitation facilities; analysis of appropriate industrial management models related to rehabilitation programs; and simulated experience in planning, decision making, and case selection.

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

5130 Seminar in Rehabilitation (3, 3) Supervised experience in the area of rehabilitation with emphasis on the application of concepts, principles, and skills acquired in previous or concurrent course work. Prereq: Consent of instructor.

5150 Internship in Rehabilitation (9, 9)

5170 Systematic Human Relations Training (3) Instruction and exercises in active listening, observing verbal and non-verbal behavior, empathetic understanding, and communicating with handicapped individuals.

5180 Approaches to Rehabilitation Counseling (3) Exploration of various models and techniques in individual and group counseling with handicapped adults to further develop the student's counseling skills. Training in problem-solving techniques and utilization of alternative modes of counseling procedures in rehabilitation. Prereq: 5170 or consent of instructor.

DISABILITY EVALUATION EDUCATION

5700 Evaluation and Mobilization of Community Resources (3) Study of issues, processes, and programs relating to community resource development and service integration with emphasis on social and rehabilitation facilities and agencies. Introduction to the coordination of community resources to facilitate development of innovative service programs for the handicapped.

5710 Medical Aspects of Disability I (3) A study of the etiology, clinical signs, symptoms and diagnostic procedures related to musculoskeletal, neurological, circulatory, and respiratory systems encountered in the helping professions (and how these conditions effect the structure and function of the human body). Note: Techniques used to eliminate or minimize resulting handicaps are emphasized along with the skills necessary to communicate effectively with lay persons and the medical community concerning the evaluation of impairments and administration of appropriate rehabilitation services.

5720 Medical Aspects of Disability II (3) A study of the etiology, clinical signs, symptoms and diagnostic procedures related to neoplastic, skin, digestive, genito-urinary, endocrine, mental, visual and hearing disorders commonly encountered in the helping professions (and how these conditions effect the structure and function of the human body). Note: Techniques used to eliminate or minimize resulting handicaps are emphasized along with the skills necessary to communicate effectively with lay persons and the medical community concerning the evaluation of impairments and administration of appropriate rehabilitation services.

5740 Disability and Work in Society (3) The relationship of work to the physical, social, psychological, and economic development of the disabled individual. Orientation to the problems and techniques of vocational evaluation, and work adjustment services in rehabilitation.

5750 Principles and Problems of Disability Evaluation (3) Seminar; individual identification and analysis of principles and problems of disability evaluation process or structures; emphasis on problems of disability evaluation process or structures; emphasis on ideas of alternatives and sharing experience within the group. Prereq: 5700 or consent of instructor.

5760 Seminar: Functional Capacity Assessment (3) Study of the criteria for residual functional capacity assessment in disability insurance claims evaluation; problems in achievement or acquisition of residual functional capacity assessment. Prereq: 5710-20 or consent of instructor.

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

SCHOOL SPEECH AND HEARING THERAPY

4930 The Public School Speech and Hearing Program (3) Organization, administration, and procedures.

4940 Appraisal of Speech and Language Disorders (4) (Same as Audiology and Speech Pathology 4940).

4950 Stuttering (4) (Same as Audiology and Speech Pathology 4950).

4960-30-40 Clinical Practice in Speech Pathology (1-6, 1-6, 1-6) (Same as Audiology and Speech Pathology 4960-30-40).

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

4342 Seminar in Speech Correction in Public Schools (3) Prereq: Audiology and Speech Pathology 4340 and 4340K and consent of instructor.

4340 Voice Disorders (4) Prereq: Speech Science 4340.

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

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

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

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

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

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

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

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

5540 Seminar in Language Pathology (3) (Same as Audiology and Speech Pathology 5540).
4169 Education of Partially Sighted Children (3) Curricular adjustments and materials; home visits for parents; cooperation in medical care and rehabilitation; handicapped or physically handicapped.

4502 Eye Problems Encountered by the Teacher (3) Eye anatomy and hygiene; common diseases and defects; testing and treatment; educational adjustments for specific eye conditions; related service resources.

4923 Student Teaching of the Partially Sighted (3) S/NCo.

GENERAL COURSES

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

3520 Language-Speech Handicapped Child in the Classroom (3) Recognizing and understanding speech problems; observing normal and defective speech development in children; incorporating speech improvement activities into the curriculum. For students not majoring in speech-language.

4589-60-70 Problems in the Education of Exceptional Children (3, 3, 3) Prereq: Consent of instructor.

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

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a step is used by students to fulfill degree and/or time before degree is completed. May not be used toward degree requirements. May be repeated. S/NCo.

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

5400 Assessment and Remediation of Learning Disabilities (3) Three approaches involving identification and remediation of learning problems of children, emotional and neurological and medical aspects; task analysis of cognitive, affective, and psychomotor skills and use of formal diagnostic and testing material emphasizing cognitive development. Research dealing with optimizing teaching instruction combined with a prescriptive teaching approach to learning disabilities.

5401 Prescriptive Teaching for Children with Learning Disabilities (3) Diagnostic test materials to assess functional levels of ability followed by specific remedial recommendation consistent with functional ability level. Emphasis on reading and mathematics skill development. Materials designed for ethnic population, high interest-low vocabulary, assessing sensory, linguistic, and motor development.

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

5403 Resource Teachers for the Handicapped (3) To help students acquire the skill to maintain learning by children in regular public education environments; includes job descriptions and expectations, interpersonal relationships, assessment of abilities, modifications of curriculum content, and applied teaching methodologies.

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

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

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

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


5630 Seminar: Issues and Theories in the Education of the Exceptional Child (3) Current trends in the education of the exceptional child, application of philosophical approaches to their education, an analysis of current legislation and federal aid to the exceptional child. Review and discussion of current research concerning the education and/or rehabilitation of exceptional persons. Prereq: Curriculum & Instruction 5800 or Educational Psychology 5210 and consent of instructor.

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

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

VOCATIONAL-TECHNICAL EDUCATION

MAJORS

Agricultural Education

Business Education

Distributive Education

Home Economics Education

Industrial Education

Vocational-Technical Education

DEGREES

M.S.

M.S.B.

M.ACT

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.

M.S.
5260 Continuing Education in Vocational-Technical Education (3) Importance, objectives, historical development, psychological and sociological formulations, methods and techniques, research, and evaluation.

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

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

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

5850-60-70 Problems in Vocational-Technical Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation

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

6210 Curriculum Planning in Vocational-Technical Education (3) Prereq: Curriculum and Instruction 5410 or equivalent.

6220 Program Planning and Development in Vocational-Technical Education (3) Concepts and principles of planning vocational-technical and manpower state, local and institutional programs; use of research in planning, role of advisory committees, theories of planned change, administrative structures, and evaluation procedures.

6230 Evaluation of Vocational-Technical Education Programs (3)

6310 Administration of Vocational-Technical Education (3) A study of administrative principles and their relationship to vocational and technical training.

6411-12-13 Internship in Vocational and Technical Education (3, 3, 3) Field experiences in selected areas of vocational and technical education. S/NC only.

Agricultural Education

4510-20-30 Problems in Agribusiness Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

4710-20-30 Seminar in Agricultural Education (1) Prereq: Student Teaching in Agricultural Education or consent of department head.

5000 Thesis

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

5011 Problems in Lieu of Thesis (3)

5110 Graduate Seminar in Current Problems in Agriculture (1, 1, 1)

5120 Graduate Seminar in Tests and Measurement (3)

5130 Graduate Seminar in Guidance (3)

5140 Organization and Operation of Area Vocational-Technical Schools (3) (Same as Industrial Education 5140.)

5410-20-30 Practicum in Business Education (2, 2, 2)

5510 Evaluation of Research in Business Education (3) Prereq: Curriculum and Instruction 5610 or equivalent.

5611-21-31 Problems in Business Education: Typing (3, 3, 3)

5622-32-33 Problems in Business Education: Shorthand (3, 3, 3)

5623-33-33 Problems in Business Education: Bookkeeping and Accounting (3, 3, 3)

5641 Methods and Materials for Vocational Office Education (3) Course designed for concentration on methods and materials for vocational office education programs. Emphasis will be given to development of instructional aids, recent developments and research, individualized instruction, and occupational clusters for VOE.

5624 Problems in Business Education: Clerical Practice (3)

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

5617 Problems in Business Education: Business Law (3)

5618 Organization and Management of Vocational Office Education Program (3) Principles and procedures for developing office occupations with emphasis given to guidelines in cooperation, laboratories, and model office programs. Consideration will be given to instructional aids, related instructional activities (clubs), the enrollment, the instructor and advisory committees.

5628-38 Problems in Business Education: Administration (3, 3)

5619 Problems in Business Education: Payroll and Skill Building (3)

6119-20-30 Current Issues in Business Education (3, 3, 3)

6210-20-30 Advanced Studies in Business Education (3, 3, 3)

6410 Higher Education for Business (3)

Distributive Education

4130 Areas of Distribution (3) Marketing, product or service technology, social skills, basic skills, and distribution in the economy as these areas affect the distributive education curriculum in secondary and postsecondary programs.

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

4310 Organization and Operation of Distributive Education (3) Background and development; needs; federal and state legislation; curriculum implications; establishing, evaluating, reporting, and improving the programs.

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

4330 Coordination Techniques in Distributive Education (3) Selecting training agencies; job analysis, selecting and briefing the training supervisors; advisory committees; adult and other community services. Prereq: 4310, 4320.

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

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) 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.

5140 Administration and Supervision of Distributive Education (3) Operation of a distributive education program and the work of the principal, city or county supervisor. Understanding and appreciation of problems from the high school principal's and the department head's point of view. Trends in distributive education, including community surveys, state plans, teacher-coordinator qualifications, the changing curriculum.

5140 Organizing and Teaching Adult Distributive Education (3) Planning, organizing, promoting, teaching, and evaluating continuing education programs and distributive education; utilization of trade associations, employment agencies, business groups, and advisory committees in implementation.

5210-20-30 Problems in Distributive Education (3, 3, 3) Individual research problems in teaching and coordinating distributive education programs.

5500 Thesis

Home Economics Education

5000 Thesis
5002 Non-Thesis Graduation Completion (3-15)
Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110 Advanced Methods of Teaching Home-making Classes for Adults (3)

5120 Furthering Good Human Relationships in the Classroom (3) Relationships between problems in human relations, basic needs of individuals, techniques of interpersonal relations and social values in developing more effective teacher education programs.

5220 Evaluation in Home Economics Education (3) Purpose of evaluation in development of home economics programs; analysis of techniques used in evaluation. Development of techniques for determining progress of students; emphasis on individual problems of evaluation.

5310 The Problem Method of Teaching Home Economics (3) Underlying philosophy; skills and techniques. Observation and discussion.

5440 Curriculum Development and Implementation in Family Relationships Instruction (3)
Review and organization of content for teaching family relationships. Analysis and evaluation of teaching methods and methods in terms of their appropriateness for reaching curriculum objectives in family relationships.

5520 Teaching Home Economics in College (3) Methods, organization, and evaluation.

5530 Organization of the Homemaking Curriculum in Secondary Schools (3) Critical review of recent advances in home economics education. Consideration will be given to the development of teaching material in relation to total homemaking program in the secondary school—day-school, adults, home experience, and Future Homemakers of America.

5610 Supervision of Home Economics in the Public Schools (3) For teachers with successful experience in vocational home economics who are preparing for supervisory positions in vocational education. Program planning, organization, and administration. Field contacts with urban and rural programs.

5620 Wage Earning Programs in Home Economics (3) Planning, establishing and implementing wage earning programs in home economics.

5710-20-30 Special Problems for Non-Thesis Students (3, 3, 3)

5810-20-30 Problems in Home Economics Education (1-3, 1-3, 1-3) May be repeated. Maximum 3 hrs per course.

5910-20 Seminar in Home Economics Education (3, 3) Research literature and techniques. Prereq: Consent of instructor.

Industrial Education

3110 History and Philosophy of Industrial Education (3)

3210-20-30 Part-time Programs in Cooperative Industrial Training (3, 3, 3) Principles of organization, methods and materials.

3310 Shop Organization and Management (3)

3320-30 Materials and Methods for Shop and Related Subjects Teachers (3, 3)

3340 School Shop Safety (3)

3610 Development and Utilization of Advisory Committees (3) Philosophy and rationale for use of craft advisory committees. Their selection, organization, implementation and utilization.

4110 Foramanship Training by the Conference Method (3)

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

4310-20 Curriculum Building in Trade and Industrial Subjects (3, 3) Prereq or coreq: 4120.

4510-11-12 Seminar in Industrial Education (3, 3, 3) Educational innovations, current events, problems, and other topics associated with the field of industrial education.

4520-21-22 New Developments in Industrial Education (3, 3, 3) Developments, pressing problems, and recent trends in the field of industrial education as presented by a coordinating instructor in conjunction with knowledgeable resource personnel.

4621 Special Topics in Drafting (3) Industrial practices in specialized areas of drafting selected for the individual student. Prereq: 6 hrs drafting.


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

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

5000 Thesis

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

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

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

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

5310 Methods of Research in Industrial Education (3)

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

5420 Advisory Committees and Apprentice Training (3)

5430 Vocational School Administration and Management (3)

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


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

School of Health, Physical Education and Recreation

Madge M. Phillips, Director

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

THE MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: Physical Education, Recreation, Safety Education, and School Health Education. Forty-five quarter hours are required for the M.S. Approximately 23 quarter hours of work selected from courses numbered 5500 and above are included in the M.S. requirement. Course selection shall be made according to each student's professional interests in health, physical education, safety, or recreation with the approval of the major professor. Non-thesis options are available in all M.S. degree programs. 3 quarter-hour research designs 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 chairman. Students may be placed in all parts of this country.

DOCTORAL PROGRAMS

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

The Doctor of Education degree is offered with a major in Physical Education
and two collateral areas of study. The curriculum to be pursued will be determined by the student and a doctoral committee. Selection of this curriculum will be based on the past training, experience, and interest of the student.

The basic requirements for admission are:

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

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

c. A superior grade point average.

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

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

Graduate Assistantships

A variety of graduate assistantships are offered in health education, physical education, safety education, and recreation to qualified women and men who are graduates of accredited colleges or universities. These assistantships are open to students in the Master's and 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, 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 37916.

Public Health Traineeships

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

Departments of Instruction

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

Division of Health and Safety

MAJORS

Health Education

DEGREES

Ed.D., Ph.D.

Public Health

Safety Education and Service

M.S., Ed.S.

School Health Education

M.S.

Professors:

R. H. Kirk (Chairperson), H.S.D. Indiana;
W. J. Huffman, Ed.D. Illinois; R. Kent, Ph.D.
North Carolina; B. C. Wallace, Ed.D. Colorado
State.

Associate Professors:

I. A. Ahmad, Ph.D. Oregon; A. J. Brown,
Ed.D. Tennessee; C. B. Hamilton, Dr. P.H.
Oklahoma; J. Goraki, Dr. P. H. U.C.L.A.;
M. A. Miliken (Emeritus), M.A. Yale.

Assistant Professors:

A. J. Pickett, M.S. Columbia; A. F. Thompson,
Ph.D. Michigan State.

Lecturers:

M. Dufft, M.D. Pennsylvania; H. P. Hopkins,
Ph.D. North Carolina; C. P. McCammon (Emeritus), M.D. Temple.

The Health and Safety Division offers the following degree programs:

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

Master of Science degree with a major in School Health Education or Safety Education and Service (thesis and non-thesis options). Non-thesis option requires 45 quarter hours of course work.

Educational Specialist degree in Safety Education and Service.

Doctor of Education degree in Health Education.

Doctor of Philosophy degree in Health Education.

Public Health

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

3210 First Aid and Emergency Care (4) Theory and practice of first aid and emergency care. instruction in medical self-help. Course leads to Red Cross Certification in Advanced First Aid and Emergency Care. (Applicant must be at least 18 years of age for certification. Same as School Health 3216.)

3310 Communicable and Noncommunicable Diseases (3) Modern concepts of diseases; etiology of common communicable and chronic disease problems, including prevention and control. Pre-req: 1 yr of biological science and 1 course in bacteriology.

3320 Environmental Health (3) History of the sanitary awakening; disease-producing relationships and controls of water, sewage, refuse, milk, meat and other foods, air, insects, and soil; sanitation of homes, swimming pools, industrial plants, markets, restaurants, waters, parks, streets, and public bathing places. Healthful school living as affected by buildings and grounds, lighting, heating, ventilation, and control, and safety provisions. 2 hrs and 1 lab.

4120 Community Health Problems—Alcoholism (3) Explores problems of alcoholism regarding overall health of community. Emphasis placed on factors making alcoholism a serious public health problem. Various types of educational programs to control the disease covered.

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

4140 Community Health Problems—Health Education (3) Exploration of ramifications of death and dying as related to personal and community health.

4150 Urban and Industrial Health (3) Health problems created by a burgeoning population and the megalopolis; industrial health problems of concern to management, supervisor, and industrial worker: control of occupational diseases, poisons, accidents, and other conditions incidental to industry.

4220 Communications for Better Health (3) Selective study of communications in the health area for the purpose of preparing for supervision of health teams, among health agencies, and the use of mass media for transmitting health information.

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

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

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

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

4730 Workshop in Public Health Education (3-6) For teachers, nurse, case workers, sanitarians, and other personnel in public health agencies: emphasizes problem-solving approach through small group interaction. Use of course and critical incident technique. May be repeated.

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

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

5010-20-30 Workshop in Public Health (3-6, 3-6, 3-6) Designed to deal with specific public health problems in a short or an extended period of time.

5070-80-90 Field Practice and Seminar in Public Health (3-5, 3-5, 3-5) Internship or field experience under professional supervision in public health. S/NC only.

5110 Environmental Health (3-5) Varied environmental factors within the general framework of air, food, water, shelter, transportation
as they affect man's survival, prevention of dis ease, performance and enjoyment. Lecture, demonstration, laboratory and field practice. Prereq: Consent of instructor.

5120-30 Occupational Health and Safety (3, 5) Two-year workshop, occupational health and safety training and practices as they relate to overall improvement of community health. Laboratory and field practice. Prereq: Consent of instructor.

5150 Industrial Toxicology (3) Study of elements of industrial toxicology as they relate to the improvement of occupational safety and health. Prereq: Consent of instructor.

5220 Health and Sickness in the Focus of Public Health Education (2) Formulation of models of mental health and safety practice related to overall improvement of community health and safety. Laboratory and field practice. Prereq: Consent of instructor.

5510 Vital and Medical Statistics (1) Application of basic statistical principles to living things.

5520 Administration of Public Health (3) Administrative considerations of public health agencies including governmental aspects, legal bases, organizational principles, personnel factors, fiscal management, and public relations.

5540 Methods and Materials in Public Health Education (4) Study of principles and practices in the use of communication techniques and materials in community health education. 3 hrs and 2 labs.

5550 The Public Health Educator in Community Organization and Development (4) An overview of health organizations and agencies in the community as related 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.

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

5705-05 Advanced Professional Health Education (3-5) Theory and practice in selected areas.

5705-10-15 Health Planning I, II, III (3, 5, 3-5)

5730 Dental Health Education (3-5)

5755 Health Facilities Administration (3-5)

5760 Occupational Health Unit (3-5)

5780 Self-care Unit (3-5)

5795 The Training of Paramedical Personnel (3-5)

5840-50-60 Problems in Public Health Education (1-3, 1-5, 1-3) Individual identification of current issues. Extensive reading and critical analysis of literature required.

6000 Doctoral Research and Dissertation

6050 Critical Analysis of Writing and Research in Health Education (3) (Same as School Health Education 6050.)

6050-60 Seminar in Health Education (3, 3) (Same as School Health Education 6050-60.)

6210 Health Aspects of Gerontology (3)

6220 Seminar on the Nation's Health (3)

6250 International Health (3)

Safety

3520 Principles of General Safety (3) Deals with the principles, practices, and procedures in general safety. Covers safety problems in school, traffic, recreation, industry, home, and other public areas.


4410 Driver and Traffic Safety Education (5) Preparation of teachers of driver education in schools and colleges. Students are required to teach at least one non-driver. Valid driver's license required. 3 hrs and 2 labs.

4420 Advanced Driver and Traffic Safety Education (5) Development of competence in teaching of driver education through use of simulation, multimedia and multiple-car driving range. Emphasis placed on teaching skills and supervision. Prereq: 4410.

4430 Sports Safety (5) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and their interrelationship in sports injury and their control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hrs and 2 labs.

4720 Workshop in Safety (3-6) Deals with special safety education problems. For advanced undergraduate students, graduate students, teachers, supervisors, and administrators. May be repeated.

5000 Thesis

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

5320 Behavioral Problems in Safety Education and Accident Prevention (3) Problems of behavior, causes of accidents, and the application of the principles of psychology in the development of safe behavior in all segments of our environment.

5350 Problems and Research in Accident Prevention (3) Analysis of safety problems found in a wide variety of accidents that occur in the community; the findings of current research in the behavioral sciences related to variation in the incidence of accidents.

5340 Organization, Administration, and Supervision of Safety Programs (3) National, state, and local level programs including administrative, institutional, and supervisory aspects. Basic emphasis on implementation of relevant programs.

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

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


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

6010-20-30 Internship and Research in Safety (3, 3, 3) Designed to allow the student opportunities for engaging in field experience to the end that a significant problem in that experience will be identified, researched, and reported on in acceptable form.

School Health

3210 First Aid and Emergency Care (4) (Same as Public Health 3210.)

3410 School Health Instruction (3) Selection of health content treated in the school curriculum.

3420 School Health Services (3) Development, maintenance, and protection of the health of students including examination, screening, special services, communicable disease control, emergency care, and school health records.

3510 The School in Community Health (3) Role of the teacher in community health education; the school's responsibility in promoting healthful living and the place of existing media and agencies in the program. Not open to health and physical education majors.

3510 Methods in Elementary Health Instruction (3) Preparation and presentation of health topics. Teaching methods are emphasized and student participation stressed. Required for elementary teachers. Prereq: 3510 or Principles of Personal Health or Elementary Nutrition.

3620 The Teaching of Sex Education (3) Trends, content, methods and materials in sex education.

3650 Methods in Secondary Health Instruction (3) Preparation and presentation of health topics. Teaching method is emphasized and student participation stressed. Required for secondary health certification. Prereq: 3410 or Principles in Personal Health or Elementary Nutrition.

4710 Workshop in School Health Education (3-6) For advanced students, teachers, school administrators, nurses and other paramedical school personnel. Lectures, demonstrations, films, field trips, and supervised research in special school health problems. May be repeated.

4810-20-30 Problems in School Health Education (1, 1, 1) Individual identification and study of current problems in school health education. Extensive reading of literature required.

5000 Thesis

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

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

5220 Teaching of Sex Education and Human Sexuality (3) Analysis and explanation of
The Physical Education Division offers the following degree programs:

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

**Doctor of Education degree in Physical Education**

3050 Rhythmic Analysis (2) Emphasis on the analysis of organic movement. Prereq: Consent of instructor.

3090 History of Dance and the Related Arts (2) A study of the history of dance in relation to other cultural movements. Lab.

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

3150 Tests and Measurements in Physical Education (3) Study of elementary statistics related to measurement. Critical examination of tests used to evaluate strength, sport skills, and physical fitness.

3420 Adaptive Physical Education Laboratory (1) Practical work, including student teaching, supplementing 4110.

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

3880 Social Recreation (3) Theory and practice in social recreation for camps, community centers, clubs, and schools. Course includes folk and square dance, quiet and active games, skits, stunts, other recreational activities, and program planning. Not for graduate credit for physical education majors. (Same as Recreation 3880.)

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

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

4060 Advanced Dance Composition (2) Creation and development of ideas, themes, and dance forms; solo and group work. Prereq: Beginning Dance Composition.

4070 Stagecraft for Dance Production (2) Equipment, light design, properties, sets, and stage management. Prereq: 4110. (Same as Drama 4060.)

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

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

5000 Thesis

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

5110 Administrative Problems in Health and Physical Education (3)

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

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

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

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

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

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

5510 Selected Topics in Anatomy (3) Intensive study of various systems of the human body. Prereq: 5500 and equivalent. May be repeated with consent of instructor. S/NC only.

5550 Physical Rehabilitation (3) Comprehensive study of physical disabilities and rehabilitation techniques. Prereq: 5500 or equivalent.

5580 Physical Activity and Health (5) Research evidence of the relationship of physical activity to health; the role of exercise and control, cardiovascular diseases, low back pain and other disorders, mental health, growth, and aging. Applications for the maintenance of health will be emphasized. Prereq: Course in physiology of exercise or consent of instructor. 4 lectures per week. (Same as Public Health 5580.)

5700 Applied Physiology (6) Principles of physiology with special emphasis on the application of physiological findings to practical problems related to human function. Prereq: 1 yr General Chemistry, or consent of instructor.

5710 Advanced Exercise Physiology (4) Principles of energy transfer in man with special emphasis on the integration of organ systems in adapting to the requirements of muscular exercise. Prereq: 5510 or equivalent. Recommended: one yr of chemistry, physics, and mathematics, 3 hrs and 1 lab.

5720 Experimental Techniques in Applied Physiology (3) Laboratory experimentation with methodology and instrumentation. Topics include respiratory and blood gas analysis, human calorimetry, blood chemistry, and pulmonary function tests. May be repeated with consent of instructor. S/NC only.

5750 Scientific Bases for Physical Education (3) Physiological, psychological, and sociological foundations.

5710-20-30 Seminar in Physical Education (1, 1, 1) Study of current issues and problems in physical education with emphasis on outstanding studies and research in the field.

5710-20-30 Problems and Projects in Physical Education (1-3, 1-3, 1-3) Problems of professional interest and value to the individual student, selected by the student and approved by the major professor. S/NC only.

5900 Doctoral Research and Dissertation

6010 Seminar in Physical Education (1) Research topics in the literature related to physical education. May be repeated with consent of the instructor. S/NC only.

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

6410 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: 5310, 5500 and first quarter Elements in Physicis or equivalent. May be repeated with consent of instructor. S/NC only.

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

6510 Seminar in Exercise Physiology (2) Prereq: 5610. May be repeated with consent of the instructor. S/NC only.

6540 Research Participation in Applied Physiology (1-6) Advanced research techniques are studied under supervision of a faculty member whose research area coincides with interests of the student. Prereq: Consent of instructor. May be repeated with consent of instructor. S/NC only.

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

Division of Recreation

MAJOR

Recreation

DEGREE

M.S.

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

Assistant Professors:
P. A. Boroviak, M.S. Tennessee; C. J. Johnson, M.S. Tennessee; K. L. Krick, Re.D. Indiana.

The Recreation Division offers the following degree program:

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

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

3140 Philosophical Foundations of Recreation (3) Examination of recreation as personal experience; theories of play; philosophies of leisure and relationship to economy, ecology, health, government, culture, and self-realization; history of recreation movement.

3200 Planning Leisure Programs (3) Principles and methods employed in planning effective and well-balanced leisure time programs for varied groups in various settings.

3880 Social Recreation (3) (Same as Physical Education 3880.)

4130 Recreation Administration (3) Introduction to recreation administration, including planning, personnel, areas and facilities, program services, finances, and public relations. Prereq: Orientation to the Recreation Profession, 3160, 3140, or consent of Instructor.

4200 Survey of Recreation for Special Populations (3) Review of specialized recreation services and responsibility of recreation professionals to minority groups whose leisure opportunities and needs may require special servicing.

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

5000 Thesis

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

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

5140 Leisure Service Delivery Systems (3) An in-depth study of the various systems—public, private, and commercial—involved in the provision of leisure services for the community at large. Prereq: Consent of instructor.

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

5240 Therapeutic Recreation (3) Concerned with the role of recreation in the lives and treatment of persons with disabilities—mental, physical, and medical. Considers possibilities for helping the ill and disabled realize their fullest potential. Prereq: Consent of Instructor.

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

5260 Leisure and Mental Health (3) A study of the relationship between leisure activity and mental health, with emphasis on its use in therapeutic recreation. Prereq: Abnormal Psychology or equivalent, and consent of instructor.

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

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

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

5360 Management and Operation of Recreation Facilities (3) Provides students with knowledge and an understanding of the management process as it pertains to the operation of recreation facilities.

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

5450 Specialized Study in Recreation (1-9) Advanced comprehensive study in a selected specialized area within the leisure and recreation field. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science degree, the Master of Engineering degree, and the Doctor of Philosophy degree. For a listing, consult majors and degrees available on page 8.

OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEOTAPE-ELECTROWRITER

Since 1966, the College of Engineering has made use of electronic communication techniques to reach students beyond the confines of Knoxville classrooms. These remotely-taught classes make the specialized talents of engineering college faculty available to students at off-campus centers and industrial sites. This effort makes use of video tapes prepared from a regular on-campus class in a specially-equipped classroom. The tapes contain a visual and audible record of a professor's lecture and discussions with the on-campus class. When the tapes are played back at remote locations, telephone/Electrowriter contact is established between the professor and the off-campus class to allow full discussion and questions before or after a tape is played. Periodic visits by the professor are made to each remote class.

Graduate courses have been offered to students at other campuses and established centers of the UT System (Chattanooga, Kingsport, Martin, Nashville, and Tullahoma). A limited number of graduate courses have also been made available to engineers in industrial plants. Such courses are also offered to students using classroom facilities at Jackson State Community College and Columbia State Community College.

The remotely-taught courses offered by UTK carry full graduate credit toward the master's degree under authorization of the regional accrediting agency, the Southern Association of Colleges and Schools.

YEAR-IN-JAPAN M.S. PROGRAM

This is a unique program allowing American engineering students to develop some understanding, both scientific and cultural, of Japan. It allows an M.S. candidate to obtain a degree from UTK while carrying out research work at a Japanese university. The program requires approximately two years, one year being spent in Japan and the remaining period being spent at UTK to fulfill the course requirements and to write the thesis or project report, as appropriate to the particular department. The program is administered in the framework of each department's regular graduate program except that the research is done in Japan.

Although the language of communication in Japan would be English, cultural understanding is one of the important objectives of the program and as such a participant would be asked to begin Japanese language study. At the option of the department, up to 8 hours of graduate credit may be allowed for language study, either at UTK or in Japan.

Financial support for living expenses in Japan and for the roundtrip transportation can usually be arranged through fellowships from the Japanese Ministry of Education.
portunity for in-depth study of any of the traditional areas of business administration, and students with such interests are advised to consider graduate programs available in the College of Business Administration.

To be admitted to the Graduate School as a potential candidate for a Master's degree with a major in Engineering Administration, the applicant must submit reasonable evidence of ability to pursue graduate studies at an acceptable level of performance. In general, the applicant should have graduated from a recognized undergraduate institution in engineering with a satisfactory grade point average. In addition, applicants must satisfy one of the following experience requirements: (1) at least two years of engineering experience after graduation if a full-time student or (2) current employment in engineering work if a part-time student.

THE MASTER'S PROGRAM

Minimum requirements for the Master's degree are the satisfactory completion of the following courses:

1. An Engineering Core, 27 hours of graduate credit consisting of Engineering Administration 5900, at least three courses chosen from Industrial Engineering 4150, 5110, 5520, and 5710, and a complement of engineering courses normally selected from the student's undergraduate major department or from courses of other departments pertinent to the program.

2. A Business Administration Core, 15 hours of graduate credit consisting of Accounting 5610, Finance 5050, Marketing 5050, Industrial Management 5130 and Transportation 5210.

3. General Electives, 9 hours of graduate credit chosen from computer science, economics, engineering, management science, mathematics, psychology, statistics, and other program-related disciplines.

The program requirement totals 51 hours of graduate course credit. No thesis is required. A major consisting of 18 to 27 quarter hours of graduate credit, which must be in 6000 series courses, is required. A final oral and written examination must be passed on the work offered for the degree. Course prerequisites for the program are Accounting 5030 (or 2110), Computer Science 3150, Industrial Engineering 4520, and Statistics 3450 or their equivalents. None of these prerequisites may be counted as part of the 51 hours of credit offered for the degree. These course prerequisites will be waived upon presentation of evidence of competency in the course subjects. Other prerequisite courses may be required, depending upon the student's background and the electives chosen.

5002 Non-Thesis Graduation Completion (3-15)

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.

5900 Project Engineering Administration (3)

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

Department of Instruction

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

Chemical, Metallurgical, and Polymer Engineering

MAJORS

DEGREES

Chemical Engineering

M.S., Ph.D.

Metallurgical Engineering

M.S., Ph.D.

Polymer Engineering

M.S., Ph.D.

Professors:

H. F. Johnson (Head), D.Eng. Yale;

D. G. Bogue, Ph.D. Delaware;

B. B. Boyle, Ph.D. Massachusetts Institute of Technology; C. R. Brooks, Ph.D. Tennessee;

E. S. Clark, Ph.D. California (Berkeley);

L. W. Crawford, Ph.D. Cincinnati;

O. L. Culberson, Ph.D. Texas; G. C. Frazier, Ph.D. Johns Hopkins; J. M. Holmes, Ph.D. Tennessee;

H. W. Hsu, Ph.D. Wisconsin;

S. H. Jurs, Ph.D. Cincinnati; C. D. Lundin, Ph.D.

R. S. Polasek, 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; J. W. Prados, Ph.D. Tennessee;

J. E. Spruill, Ph.D. Tennessee;

E. E. Stansbury, Ph.D. Cincinnati; C. O. Thomas, Ph.D. Tennessee; R. A. Vandemere, Ph.D. Illinois Institute of Technology;

J. S. Watson, Ph.D. Tennessee; J. L. White, Ph.D. Delaware; M. A. Wright, Ph.D. Wales.

Associate Professors:

W. T. Becker, Ph.D. Illinois; J. F. Fe Iters, Ph.D. Akron.

Assistant Professors:


Lecturers:


D. L. McAfee, Ph.D. Tennessee;

T. D. Parish, Ph.D. Rice; W. H. Seaton, Ph.D. Ohio State;

E. von Halle, Ph.D. Tennessee;

M. S. Whalley, Ph.D. Iowa State.

THE MASTER'S PROGRAM

Minimum departmental requirements include the satisfactory completion of:

1. A major consisting of 18 to 27 quarter hours of graduate work in chemical engineering, metallurgical engineering, or polymer engineering. The polymer engineering major must include Polymer Engineering 4920, 5110, 5230, 5310 and 5520.

2. One or two minors or collateral work, 9 to 18 hours total in engineering, chemistry, mathematics, physics, or other related fields.


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

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

THE DOCTORAL PROGRAM

Students applying for entrance into the doctoral program must display concrete evidence of ability to perform and report independent research to the satisfaction of the department. The Master's thesis may be offered as such evidence.

Department requirements consist essentially of the satisfactory completion of:

1. Graduate courses in chemical engineering, metallurgical engineering, or polymer engineering amounting to approximately 36 quarter hours, at least 12 of which must be in 6000 series courses.

The polymer engineering major must include Polymer Engineering 4920, 5110, 5210, 5230, 5310, 5510, and Chemistry 5140.

2. Supporting courses in related scientific and engineering fields amounting to approximately 36 quarter hours, subject to approval by the student's faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.

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

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

5. Reading knowledge of a foreign language relevant to the candidate's research program; selection and written examination to be made in consultation with the faculty committee. Appropriate languages are French, German, Italian, Japanese, Russian.

PROGRAM OPTIONS IN POLYMER SCIENCE AND ENGINEERING

M.S. and Ph.D. degrees with specialization in polymer science and engineering are possible through two routes—one in the department (through chemical or metallurgical engineering) with an engineering emphasis and a second in a joint program with the Chemistry Department having a chemical emphasis.

The specialization program in this department requires, for the M.S. degree, a thesis in the field, completion of Polymer Engineering 4920, 4923, 5110, 5310, 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 4530, Graduate Chemistry 5511 and 5140, plus active participation in the Polymer Seminar. Ph.D. students must also pass a special written examination as well as complete the above requirements.

Chemical Engineering

4310 Flow of Fluids (4) Differential and overall momentum balances, mechanical energy balances; flow in tubes, piping systems, and packed beds; metering devices; pumps. Prereq: Elementary Linear Algebra and Calculus of Several Variables, and Mass and Energy Relations. 3 hrs and 1 lab.

4320 Heat Transfer (4) Differential and overall energy balances; steady and unsteady state heat conduction in simple geometries; heat transfer mechanisms; principles of conduction, convection and radiation. Prereq: 4310, Thermodynamics of Phase Equilibrium. 3 hrs and 1 lab.

4340 Stagewise Operations (3) Analytical and graphical methods applied to stagewise separatory operations. Prereq: Thermodynamics of Phase Equilibrium.

4350 Diffusional Operations (3) Diffusion, simultaneous heat and mass transfer; design applications involving humidification, gas absorption, extraction. Prereq: 3420.

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 and transfer functions. Mathematical models for several processes are developed and analyzed in detail. Prereq: Introduction to Differential Equations.

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

4110 Chemical Engineering Data Analysis (3) Analysis of chemical and physical data; identification of system extremes; statistical properties of samples and source systems; empirical modeling of processes; statistical process control. Prereq: 3420 and Math 3150.


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


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

4430 Special Problems in Design and Economics (3) The interactions among the line functions of a typical chemical company in the application of modern decision theory and mathematical model to achieve an optimum project investment decision in the face of external competition. Prereq: 5250.

5000 Thesis

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

5050 Engineering Analysis (3) Analytical formulation and solution of chemical, metallurgical and polymer engineering problems involving the deformation of solids, heat transfer and the motion of fluids. (Same as Metallurgical Engineering 5055 and Polymer Engineering 5050.)

5120 Heat Convection (3) Analysis of heat convection in fluids under viscous and turbulent flow conditions,so general view of analytical approach; simultaneous diffusion of momentum and heat. Prereq: 5111.

5130 Methods of Optimization (3) Principles and applications of various mathematical programming techniques to chemical process design and control; variational methods; maximum principle, dynamic programming, and geometric programming. Prereq: 4130.

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


5310 Thermodynamics of Heterogeneous Equilibrium (3) Phase rule; equilibrium between phases; composition relationship between phases; ideal and nonideal solutions. Prereq: Thermodynamics.

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

5410-20-30 Research and Design in Chemical Engineering (3, 3, 3) Selected diffusional operations, industrial unit operations, and design of experiments in chemical engineering research.

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

5610 Stagewise Mass Transfer Operations (3) Equilibrium stage concepts applied to mass transfer operations, emphasizing nonisothermal and multicomponent systems.

5620 Differential Mass Transfer Operations (3) Differential mass transfer operations: falling film, packed tower and bubble contacting devices; nonisothermal and multicomponent systems; current theories of mass transfer; mass heat and momentum transfer analogies. Prereq: Differential Equations.

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

6000 Doctoral Research and Dissertation

6130 Process Optimization (3) Optimization of chemical process equipment and systems by various techniques; static and dynamic systems. Prereq: 5130.

6210 Advanced Diffusional Operations (3) A study of fixed and fluidized bed operations utilizing the stagewise diffusion model and diffusion transfer bed concepts. Prereq: Consent of instructor.

6250 Venture Analysis in the Process Industries (3) The interactions among the line functions of a typical chemical company in the application of modern decision theory and mathematical model to achieve an optimum project investment decision in the face of external competition. Prereq: 5250.
6310 Thermodynamics of Irreversible Processes (3) Development of the treatment of irreversible chemical processes, transport processes, coupling phenomena, with special emphasis on thermodynamics and methods of interest to engineering and bioengineering students. Prereq: 5310.


6410 Stability Phenomena in Chemical Engineering: Discrete Systems (3) Study of instabilities arising in chemical process systems, including elements such as reactors and separation equipment. Emphasis on formulation of models, associated conservation equations, and methods of solution. Prereq: 5510.

6420 Stability Phenomena in Chemical Engineering: Continuous Systems (3) Hydrodynamic instabilities and instabilities in fluids based upon interaction of fluid dynamic phenomena with heat transfer, diffusion and chemical reactions. Emphasis on formulation of problems and methods of solution. Typical applications include stability of jets and formation of emulsions, Benard instability, Maragoni turbulence. Prereq: 5810 and 5620 or equivalent.

6510 Applied Chemical Reaction Kinetics (3) Chemical reaction and gas solid reactions as well as heterogeneous catalysis, catalyst effectiveness and the role of transport in the reaction medium. Development of a phenomenological description although mechanistic models are discussed. Prereq: 5510.

6520 Catalytic Reactor Design (3) Principles of kinetics, heat and mass transfer applied to the design and analysis of heterogeneous catalytic reactors. Prereq: 6510.

6610 Special Topics in Chemical Engineering (3) Advanced problems of current interest to chemical engineers. Prereq: Consent of instructor.

6710 Process Dynamics (3) Development of dynamic models of process equipment from conservation and rate laws; testing of models by frequency, step, and pulse response methods. Prereq: Consent of instructor.

6710 Process Dynamics (3) Development of dynamic models of process equipment from conservation and rate laws; testing of models by frequency, step, and pulse response methods. Prereq: Consent of instructor.

Metallurgical Engineering

3110 Engineering Materials I (4) Introductory course correlating the atomic, crystal, and microstructure of solids with mechanical, physical, and chemical properties of engineering materials. Suggested for mechanical, civil, and industrial engineering students.


3150 Engineering Materials V (3) Extension of 3110 with emphasis on the mechanics and corrosion resistance of engineering materials with aqueous, nonaqueous, and gaseous environments. Prereq: 3110 or Engineering Materials I or Process Principles and Materials III.


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

3230 Phase Transformations (4) Thermodynamic and structural factors governing binary equilibrium. Ternary systems. Kinetics and morphology of phase transformations in simple and complex systems. Prereq: 3220. 3 hrs and 1 lab.

3310 Biomedical Applications of Materials (3) Principles of engineering materials; metals, polymers, ceramics; methods of fabrication of components; corrosion applications of prosthetic devices and dental materials. Prereq: General Chemistry or equivalent.

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

3710 Metallurgical Applications in Manufacturing Technology (6) Fabrication methods and principles of mechanical/thermal processing for finished and semifinished articles; casting, powder metallurgy, plastic forming, joining, heat treatment. Prereq: Engineering Mechanics I or equivalent.

4240-50 Design and Analysis (3, 3) Design and laboratory sessions on the analysis of materials requirements and performance in engineering structures and components. Coreq: 4740. 3 labs.

4510-20 X-Ray Diffraction and Crystallography (3, 3) Lecture and laboratory work in crystallography, projections, x-rays, diffraction phenomena and techniques, introduction to structure determinations. The first quarter serves as an introduction to the subject. 2 hrs and 1 lab.

4540 Fracture-safe Design (3) (Same as Engineering Mechanics 4540.)

4610 Physical Properties of Materials (3) Introduction to electron theory of solids, types of bonding in solids; thermal, electrical and magnetic properties of materials; relationship between metallurgical structure and properties. Prereq: Physical Metallurgy II. 3 hrs or 2 hrs and 1 lab.

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

4730 Mechanical Metallurgy I (3) Elastic behavior. Description of stress, strain, and elastic constitutive relations. Effects of composition, microstructure, and loading on mechanical behavior. Failure by yielding. Prereq: 3110 or Engineering Materials I or Process Principles and Materials III. Suggested for mechanical engineering, engineering mechanics and engineering science students. 3 hrs, or 2 hrs and 1 lab.

4740 Mechanical Metallurgy II (3) Ductile and brittle fracture, creep and stress rupture, fatigue, and residual stresses. Effects of state of stress, loading rate, time, temperature and mechanicalurgical structure. Prereq: 3120 or 3230, and 4730 or Mechanical Engineering 3850 or consent of instructor. Also suggested for mechanical engineering, engineering mechanics, or engineering science students. 3 hrs, or 2 hrs and 1 lab.

4760 Casting and Welding (3) Principles and processes of casting and welding: heat transfer, solidification, gas-metal and slag-metal interactions, thermal treatments, associated stresses. Prereq: 3230. 3 hrs, or 2 hrs and 1 lab.

4770 Mechanical Metallurgy III (3) Finite plastic strain. Plastic stress-strain relations. Principles of fabrication: forging, swaging, extrusion, rolling, deep drawing. Prereq: or consent of instructor. Also suggested for mechanical engineering, mechanical engineering students. 3 hrs, or 2 hrs and 1 lab.

5000 Thesis


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

5130 Plastic Deformation II (3) Plastic deformation of polycrystalline materials; theoretical and experimental analysis of texture formation resulting from deformation and annealing. Prereq: 5120.

5140 Diffusion and Annealing in Solids (3) Analysis of models and experimental observations relating to solid state kinetic, for both simple and complex alloys. Current theories of cold cracking, hot cracking, and pouring techniques are developed. Prereq: Physical Metallurgy.

5150 Phase Transformations I (3) Analysis of models and experimental observations relating to solid state transformation behavior, solidification, precipitation, spinodal decomposition. Prereq: 5140.


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

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

5410-20-30 Advanced X-Ray Diffraction (3, 3, 3) Review of mathematical techniques; generalization of x-ray diffraction analysis of scattered intensity in reciprocal space; relationship of scattered intensity to thermal motion, order-disorder, particle size and lattice faults. Introduction to crystal symmetry, space group theory, and crystal structure problems; some laboratory work. Prereq: Mathematics 4610.

5510-20 Application of Solids (3, 3) Survey course in the properties of solids; crystallography, x-rays, properties of single
and polycrystalline materials, kinetics and thermodynamics of solid reactions, diffusion.

540-50 Electron Microscopy I and II (3, 3)
Kinematical and dynamical diffraction theories are developed and applied to electron diffraction patterns and contrast effect in transmission electron microscopy are discussed. Specimen preparation for metallurgical applications such as plastic deformation, fracture, precipitation, and phase transformations. Prereq: 5010 or consent of instructor.

5810-20 Radiation Effects on Materials (3, 3)
The interaction of radiation with solid matter, radiation-induced changes in physical and mechanical properties, theory and experiment. The effect of radiation on solid state reactions. Phenomena associated with the use of engineering materials in radiation environments. Prereq: Mathematics 4540, Physics 3730 or consent of instructor.

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

5810-20-30 Special Topics in Metallurgy (3, 3, 3)
Study of phases of solid state physics applicable to metallurgy; elasticity, introductory quantum theory, specific heats, electron theory, electrical and thermal conductivity, magnetic properties, theory of alloy formation. Prereq: 4610 or Physics 3750; Mathematics 4550 and consent of instructor.

5910-20 Metallurgical Thermodynamics (3, 3)
Application of thermodynamics and physical methods to metals and metallurgical reactions. Relation of theory and experiment to the structure of liquid and solid solutions, and to alloy systems.

6000 Doctoral Research and Dissertation

6110-20 Theoretical Metallurgy (3, 3, 3)
Study of solubility, solidification, and transformations of rate processes in solids such as diffusion, recrystallization and grain growth, and phase transformations.

6200-30 Solidification and Crystal Growth I and II (3, 3, 3)

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

6810 Mechanical and Physical Properties of Crystals I (3)
The anisotropic behavior of crystalline materials treated by matrix and tensor techniques. Property classification according to orientation behavior. Prereq: Core curriculum in Metallurgical Engineering and Mathematics 4050 or 4710 or consent of instructor.

6820 Mechanical and Physical Properties of Crystals II (3)
Continuation of Metallurgical Engineering 6810 with emphasis on transport properties and thermodynamics. Prereq: 6810 or consent of instructor.

6830 Seminar in Anisotropic Properties of Crystals (3)
Selected topics of current interest in the area of anisotropic behavior of crystalline materials. May be repeated. Prereq: 6810 or 6820, or consent of instructor.

Polymer Engineering

4910 Applied Polymer Science (3)
A first course in the physical properties of polymers. Polymer structure, crystalline and glass transition, physical properties of amorphous and crystalline polymers, crystallization kinetics and mechanical properties are discussed.

4920 Polymer Processing (3)
Rheological properties of polymer melts and solutions, viscosity, unit operations of fiber, plastics and rubber industries: dimensional analysis and scale-up, flow through dies and pipelines, screw extrusion, spinning of fibers, injection molding.

4930 Principles of Fiber and Textile Engineering (3)
Chemical and crystalline structure of important fibers; melt, wet and dry spinning of man-made fibers; drawing and texturizing; preparation of yarn; dyeing; weaving and knitting. Emphasis on quantitative aspects.

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

5000 Thesis

5610 Graduate Seminar (1)
May be repeated. Prereq: Admission to graduate program.

5650 Engineering Analysis (3)
(Same as Chemical Engineering 5500)

5110 Structural Characterization of Polymers (3)
Experimental methods of determining the nature of transitions and structural characteristics of polymers most pertinent to plastics, fibers, and rubber applications. Methods of determination of tacticity, crystalline structure, orientation, morphology, including X-ray diffraction, nuclear magnetic resonance, and electron microscopy. Correq: 4910 or equivalent.

5210 Non-Newtonian Fluid Mechanics (3)
Tensor analysis; generalized equations of motion; survey of non-Newtonian technology. Prereq: 4910 (Same as Engineering Science and Mathematics 5230)

5230 Mechanical Behavior of Solid Polymers (3)
Application of linear viscoelasticity and large deformation plasticity to polymers (especially vulcanized rubber and crystalline polymer) properties. Topics include dynamic modulus and loss tangent, wave propagation, friction, tearing, tensile failure, abrasion. Experimental methods of determining properties. Prereq: Mechanics of Materials.

5310 Polymer Solution Properties and Characterization (3)
Molecular weight determination, chromatography, solution thermodynamics, phase separation; application to synthetic and natural rubber-like and biocompatible behavior of polymers. Prereq: Undergraduate physical chemistry.

5510 Modern Research Tools and Instruments for Polymer Science (3)
Laboratory course in the comprehensive characterization of polymers; includes gel permeation chromatography, intrinsic viscosity, spectral analysis, measurement of melt flow properties, calorimetry, and dynamic mechanical measurements. Coreq: 5310.

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

5910-20-30 Selected Topics in Polymer Science (3, 3, 3)
Advanced problems in modern polymer research of current interest to engineers. Prereq: 4910, 4920 or equivalent.

6000 Doctoral Research and Dissertation

6110 Optical Properties of Polymers (3)
Maxwell's equations and the electromagnet theory of light, optical properties of isotropic and anisotropic dielectrics including theory of birefringence, applications to spherically structured and fibers studies of Stein, light scattering from polymer films.

6150 Advanced X-Ray Diffraction Methods for Characterization of Macromolecules (3)
Classical methods of crystal structure determination; Patterson and Fourier functions; helical nets and Bessel function techniques; levels of order, thermal motions, defects, order-disorder transitions and paracrystallinity. Experimental methods including precision and Weissenberg photography, single crystal and powder diffraction with applications to synthetic and biological macromolecules.

6210 Advanced Continuum Mechanics (3)
A survey of the theoretical foundations of continuum mechanics with special emphasis on comparing the classical mechanics of fluids and of elastic solids; classification and comparison of modern constitutive theories; selected applications, especially in fluid viscoelasticity. Prereq: 5210 or Engineering Science and Mechanics 5410 or Metallurgical Engineering 5840 or consent of instructor. (Same as Engineering Science and Mechanics 6600)

6220 Advanced Methods in Polymer Processing (3)
Application of theories of rheological properties and structures formation to analysis of polymer process operations. Prereq: 5210.

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

6810 Advanced Industrial Polymer Chemistry (3)
Classification of industrial chemistry and properties of new polymer engineering materials; highly integrated engineering and chemical approach is used. Prereq: Consent of instructor.

6910-20-30 Recent Advances in Polymer Science and Engineering (3, 3, 3)
Treatment of latest developments in science and technology of polymers. May include topics of morphology, structure, characterization. Prereq: Consent of instructor.

Civil Engineering

MAJORS

DEGREES

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

Emeritus Professors:
E. G. Shelton, M.E., Brooklyn Polytechnic, P.E.; E. C. Shreve, MSCE Ohio State, P.E.

Professors:
W. L. Grecco (Head), Ph.D., Michigan State, P.E.; J. E. Bortoletti, Ph.D., Illinois, P.E.; J. W. Fortey, Doctorate, Universite de Toulouse (France); F. A. Gillford, Ph.D., Pennsylvania State, P.E.; W. A. Goodwin,* M.S., Kentucky, P.E., On leave.

* On leave.

* On leave.
and 18 quarter hours credit of approved graduate courses. The major shall include a minimum of 6000-level courses.

There are several prerequisite undergraduate courses that must be taken before admission to candidacy for the Master of Science in 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 at least 9 quarter-hour special problems, is required. The special problems may be taken 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 courses 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 courses. The major 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 graduate courses in the field of civil engineering, or certain undergraduate prerequisite courses must be taken before admission to candidacy for the Ph.D. in Civil Engineering.

**THE DOCTORAL PROGRAM**
A graduate program leading to the degree of Doctor of Philosophy is offered in Civil Engineering. Major fields of study include environmental engineering, structural engineering, and transportation planning.

Specific departmental requirements for the Ph.D. degree include the following:

1. A minimum of 108 quarter hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 36 quarter hours credit in Doctoral Research and Dissertation will be required.

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

3. Supporting courses in related scientific and engineering fields, amounting to approximately 36 quarter hours, subject to approval by the student's faculty committee. These related fields will normally include such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields.

4. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.

5. Upon completion of at least one-half of all course work, each student must pass a preliminary examination.

6. After completion of the dissertation, prior to graduation, each student must pass a final examination administered by a faculty committee.

**Civil Engineering**

4120 Concrete Design (3) Reinforced concrete continuous beams and floor slabs; footings, and retaining walls. Prereq: Concrete Design and Deflections and Statically Indeterminate Structures.

4220 Foundations and Substructures (3) Foundation explorations; principles of design of dry and subaqueous foundations. Prereq: Engineering Properties of Soils.

4230 Legal and Ethical Aspects of Engineering (3) Legal principles underlying engineering work; laws of contracts, torts, agency, real property; problems of professional registration and ethics.

4240 Structural Design (3) Plastic theory, ECCP-accredited undergraduate curricula in civil engineering leading to the degree of Master of Engineering are available to qualified graduates of approved graduate programs in Civil Engineering, or certain undergraduate prerequisite courses must be taken before admission to candidacy for the Master of Science in Civil Engineering. A minor may be selected but is not necessarily required.

**THE MASTER'S PROGRAM**
Graduate programs in Civil Engineering and in Environmental Engineering leading to the degree of Master of Science are offered to graduates of recognized undergraduate curricula.

Departmental requirements provide that for a major in Civil Engineering, the Bachelor's degree must be in civil engineering, or graduate prerequisites 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 at least 9 quarter-hour special problems, is required. The special problems may be taken 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 courses 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 courses. The major 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 graduate courses in civil engineering, or certain undergraduate prerequisite undergraduate courses must be taken before admission to candidacy for the Master of Science in Civil Engineering leading to the degree of Master of Engineering are available to qualified graduates of approved graduate programs in Civil Engineering, or certain undergraduate prerequisite courses must be taken before admission to candidacy for the Master of Science in Civil Engineering. A minor may be selected but is not necessarily required.

**Option I or II** must be approved by the department.

Normally, the graduate program of study will be adjusted by the head of the department and the student's committee to suit the individual academic requirements.

**MASTER OF ENGINEERING PROGRAM**
Graduate programs in Civil Engineering and in Environmental Engineering leading to the degree of Master of Engineering are available to qualified graduates of ECCP-accredited undergraduate curricula in civil engineering or environmental engineering. At least one-third of the program of study must be classified as engineering design. The student's advisor will assist in planning the program of study to ensure that it includes the necessary design content. The thesis and non-thesis options noted under the Master of Science Programs are also available under these programs.

**THE DOCTORAL PROGRAM**
A graduate program leading to the degree of Doctor of Philosophy is offered in Civil Engineering. Major fields of study include environmental engineering, structural engineering, and transportation planning.

Specific departmental requirements for the Ph.D. degree include the following:

1. A minimum of 108 quarter hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 36 quarter hours credit in Doctoral Research and Dissertation will be required.

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

3. Supporting courses in related scientific and engineering fields, amounting to approximately 36 quarter hours, subject to approval by the student's faculty committee. These related fields will normally include such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields.

4. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.

5. Upon completion of at least one-half of all course work, each student must pass a preliminary examination.

6. After completion of the dissertation, prior to graduation, each student must pass a final examination administered by a faculty committee.
4660 Airport Planning and Design II (3) Integration and application of the principles of airport planning and design for the purpose of site selection and design of an airport facility through a comprehensive team project, also includes environmental evaluation of design. Prereq: 4620 and 1 hr and 2 lab.

4710 Portland Cement Concrete Mix Design (3) Properties and tests of portland cement concrete, methods of concrete mix design, inclusion and use of admixtures and test results, and use of concrete admixtures. Prereq: Materials of Construction. 2 hrs and 1 lab.

4720 Asphalt and Bituminous Concrete (3) Properties and tests of asphalts and asphaltic mixes, design of bituminous concrete, emphasizing use of asphalt in transportation construction projects. Prereq: Materials of Construction. 2 hrs and 1 lab.

4731-32 Earthquake Resistant Structures I & II (4) (Same as Architecture 4731-32.)

4800 Introduction to Civil Engineering Systems (3) Physical, safety, and environmental considerations of civil engineering systems and their specific application to problems of transportation, environmental, water resources, and materials. Prereq: Senior standing or consent of instructor.

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

5000 Thesis

5010 Non-Thesis Graduation Completion (3-15) Regular for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated, S/NC only.

5110-20 Statically Indeterminate Structures (3, 3) Deflections of beams and trusses; analysis by force methods and by slope-deflection in 5110; analysis by moment distribution and other displacement methods, secondary stresses in 5120.

5140 Statically Indeterminate Structures (3) Analysis of statically indeterminate structures; bending and buckling of plates, practical application of theorems in analysis and design of bridge and building flexural and plate structural components. Prereq: 5110 and 5120.

5150 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, stiffness formulations, and the matrix formulation of structural analysis, and plane trusses, general members and structures composed of general members. Prereq: 4540 or consent of instructor.

5160 Analysis and Design of Plate Structures (3) Fundamental theorems of bending and buckling of plates, practical application of theorems in analysis and design of bridge and building flexural and plate structural components. Prereq: 5110.

5170 Introduction to Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; elastoplastic behavior considered for structural systems; approximate design methods developed. Prereq: 5120, 5150.

5180 Finite Element Structural Analysis (3) Applications of the finite element method to structural analysis; plane stress, plane strain, axisymmetric, and three-dimensional elements; use of typical computer programs. Prereq: 5150, and Engineering Mechanics 5280 or 5860. (Same as Engineering Mechanics 5180.)


5240 Advanced Properties of Materials: Cement and Concrete (3) Permeability and durability; volume changes and creep; elastic and thermal properties of concrete, special types of concrete; causes of failure. Prereq: 4710.

5250 Advanced Properties of Materials: Bituminous Substances and Mixes (3) Serviceability concepts; pavement failures and remedies; bituminous pavement maintenance techniques; other uses of asphalt products. Prereq: 4720.

5270 Planning and Transportation (3) Methods for preparation of transportation elements of community and governmental development plans; analysis of relationships between various transportation modes and between transportation and other community features. (Same as Planning 5270.)

5310 Engineering Practice (3) Valuation and feasibility studies; depreciation and useful life; engineering economics.

5320-30 Engineering Practice Applied to Administration of Engineering Projects (3, 3) Factors of engineering administration; planning of governmental and industrial projects; cost estimates and methods of financing.

5420 Structural Model Analysis (3) Experimental methods of shear, moment, and stress analysis.

5430-40-50 Construction Management I, II, III (3, 3, 3) Management and organization of heavy and building construction projects. Prereq: 4450 or consent of instructor.

5460-70 Construction Estimating I, II (3, 3) Laboratory analysis of projects, costs, estimating techniques; market cost conditions and feasibility of design as they apply to costs. Prereq: 4430 or consent of instructor.

5550 Soil Mechanics—Plastic Equilibrium (2) Review of failure theories; earth pressure analysis, bearing capacity analysis, and slope stability analysis. Prereq: Physical Properties of Soils or consent of instructor.

5560 Soil Mechanics—Elastic Behavior (3) Stress-deformation characteristics, theory of consolidation, theories of settlement analysis. Prereq: Physical Properties of Soils or consent of instructor.

5570 Soil Mechanics—Seepage (3) Saturated flow through embankments, filter design criteria, seepage forces and velocities, subdrains, and embankment analysis. Prereq: Physical Properties of Soils or consent of instructor.

5600 Behavior of Steel Structures (3) Behavior of structural steel members due to static, statistical and experimental research results and current specifications for design. Prereq: Design of Framed Structures.

5730 Prestressed Concrete (3) Properties of prestressing materials and anchorage systems; methods of pretensioning and posttensioning; analysis and design of members and continuous structures.

5740 Behavior of Reinforced Concrete Members (3) Ultimate strength and behavior of reinforced concrete members; relation between research results and current specifications for design. Prereq: 4120.

5800 Urban Systems: Engineering and Management I (3) The management of various urban systems usually under the responsibility of a city manager and/or city engineer. Includes organization and administrative structure; 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.

5805 Urban Systems: Engineering and Management II (3) Continuation of 5800 dealing with the management and engineering of urban streets, including lighting, clearing and snow removal, waste water and wastewater drainage, solid waste, air pollution and regulations. Prereq: 5600.

5810 Traffic Engineering—Characteristics (3) Theoretical and practical concepts of the characteristics of the driver-vehicle-roadway system; level-of-service concept of capacity. Coreq: Statistics 3450 or 5311. 2 hrs and 1 2-hr lab.

5820 Traffic Engineering—Operations (3) Fixed-time and volume-density controllers; progressive systems; one-way operations; reverses flow; hot; on-street parking; channelization; strategies for signalized networks; legal aspects of operational controls. Prereq: 5810. 2 hrs and 1-2 hr lab.

5840 Geometric Design (3) Advanced theory and practice in the geometric design of highways. Prereq: Highway Engineering I.

5850 Functional Design of City Streets and Urban Freeways (3) The effect of street systems upon urban growth and development; classification and function of streets; design features, including cross section, intersections, utility considerations, planning, effect of mass transportation; channelization; marketing; lighting; the freeway, frontage road, surface street system. Prereq: Consent of Instructor.

5860 Urban Transportation Planning (3) The use of various models for the prediction of traffic demands and the required services and use planning; parking needs. Prereq: 5610.

5870 Public Transit Planning (3) The planning process as required for the study of person movement by bus, rapid rail and taxicab transit. Also covers the nature of public transit; its various roles and how they fit the community's need; user preferences; modal split and market cost conditions and feasibility of design as they apply to costs. Prereq: 4430 or consent of instructor.

5890 Traffic Accident Reconstruction (3) The importance of proper traffic accident data collection and analysis is discussed as a basis of designing accident prevention or control programs. Emphasis is on examining the many contributing factors to an accident. Proximate and secondary accident causes will be discussed as they may relate to roadway improvements. Prereq: 4540 or 5810 or consent of instructor.

5900 Special Problems in Civil Engineering (1) Study of a current research topic to fulfill the special problem requirement in the thesis program. Enrolled limited to civil engineering students in non-thesis program between research results and current specifications for design. Prereq: Design of Framed Structures. May be repeated. Maximum 9 hrs. S/NC only. Prereq: Consent of Instructor.

5910-20-30 Special Topics (3, 3, 3) Analysis and design of certain civil engineering structures not included in other courses such as arches, long span and movable bridges, complicated trusses.

6000 Doctoral Research and Dissertation

6110 Behavior of Steel Bridges and Buildings (3) Behavior, analysis, and design of plate girders, columns and composite members subjected to static and dynamic loading. Prereq: 5170 and 5810.

6410 Behavior of Reinforced Concrete Beams and Frames (3) Ultimate strength and behavior of statically indeterminate reinforced concrete structures; application of elastic analysis to framed structures; limit analysis. Prereq: 5120 and 5740.

6750 Behavior of Reinforced Concrete Slabs (3) Behavior, analysis, and design of reinforced concrete slabs; management and control of the design process as required for the study of person movement. Prereq: 5170 and 5800. (Same as Engineering Mechanics 6310.)

6750 Behavior of Reinforced Concrete Slabs (3) Behavior, analysis, and design of reinforced concrete slabs; management and control of the design process as required for the study of person movement. Prereq: 5170 and 5800. (Same as Engineering Mechanics 6310.)
4810 Water Law (3) Survey study in water law, including case studies and water law doctrines. (Same as Water Resources Development 4810.)

4820 Environmental Engineering Law (3) Legal aspects of water and air pollution, drainage, land use controls and environmental impact statements with emphasis upon federal-state relations, recent legislation and court decisions, and enforcement. Prereq: Senior standing.

5000 Thesis

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

5160 Water and Urban Welfare (3) Evaluation of social, economic and environmental impact on planning and management of urban water systems. Emphasis upon conflict and choice, reconciliation of environmental and developmental values, measurement of social well-being and quality of life parameters. Procedures for analyzing multifaceted policy alternatives with selected case studies. Prereq: Consent of instructor.

5160 Planning and Utilities (3) Planning for adequate water supply and sewage waste disposal systems, dam safety control, environmental impact of reservoir projects. Prereq: Consent of instructor.

5200 Water Resources Systems (3) Control, utilization and management of water in water resources engineering. (Same as Water Resources Development 5160.)

5200 Water Resources Systems (3) Control, utilization and management of water in water resources engineering. (Same as Water Resources Development 5200.)

5210 Advanced Water Resources Engineering (3) Complex problems encountered in water resources engineering such as water hammer, surge, wave action, regression analysis to hydraulic design of water resources systems; unsteady surface runoff and streamflow modeling; peak runoff design using kinematic wave theory; evaluation of effects of land use changes on streamflow quantity and quality. Prereq: Elementary Hydrology.


4520 Elements of Water and Wastewater Treatment Systems Design (3) An introduction to the unit operations and processes employed in the physical, chemical, and biological treatment of water and wastewater. Application of unit operations and processes in design of water and wastewater treatment plants. Prereq: 3000 and Hydraulics.

4530 Sanitary Engineering Laboratory (3) Physical, chemical, and bacteriological analysis of water and wastewater. Prereq: 4030. 3 labs.

4600 Solid Waste Management (3) Quantities and characteristics of solid wastes; collection methods and equipment; disposal and recycling techniques; economics; planning and management. Prereq: 3000.

4700 Air Pollution-Air Resources Management (3) An introductory course on the concepts of air pollution; analysis of the relationship among emission sources; meteorology and topographic factors influencing the dispersion of pollutants; engineering approaches for air pollution control.

4810 Water Law (3) Survey study in water law, including case studies and water law doctrines. (Same as Water Resources Development 4810.)

4820 Environmental Engineering Law (3) Legal aspects of water and air pollution, drainage, land use controls and environmental impact statements with emphasis upon federal-state relations, recent legislation and court decisions, and enforcement. Prereq: Senior standing.

5000 Thesis

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

5160 Water and Urban Welfare (3) Evaluation of social, economic and environmental impact on planning and management of urban water systems. Emphasis upon conflict and choice, reconciliation of environmental and developmental values, measurement of social well-being and quality of life parameters. Procedures for analyzing multifaceted policy alternatives with selected case studies. Prereq: Consent of instructor.

5160 Planning and Utilities (3) Planning for adequate water supply and sewage waste disposal systems, dam safety control, environmental impact of reservoir projects. Prereq: Consent of instructor.

5200 Water Resources Systems (3) Control, utilization and management of water in water resources engineering. (Same as Water Resources Development 5160.)

5200 Water Resources Systems (3) Control, utilization and management of water in water resources engineering. (Same as Water Resources Development 5200.)

5210 Advanced Water Resources Engineering (3) Complex problems encountered in water resources engineering such as water hammer, surge, wave action, regression analysis to hydraulic design of water resources systems; unsteady surface runoff and streamflow modeling; peak runoff design using kinematic wave theory; evaluation of effects of land use changes on streamflow quantity and quality. Prereq: Elementary Hydrology.


4520 Elements of Water and Wastewater Treatment Systems Design (3) An introduction to the unit operations and processes employed in the physical, chemical, and biological treatment of water and wastewater. Application of unit operations and processes in design of water and wastewater treatment plants. Prereq: 3000 and Hydraulics.

4530 Sanitary Engineering Laboratory (3) Physical, chemical, and bacteriological analysis of water and wastewater. Prereq: 4030. 3 labs.
5501 Water and Wastewater Treatment Theory (3) Theory of unit operations employed in sanitary engineering. Prereq: 4520.
5502 Water and Wastewater Treatment Theory II (3) Theory of physical, chemical, and biological processes employed in sanitary engineering. Prereq: 5501.
5513 Advanced Water and Wastewater Treatment Systems (3) Theory, operation, and use of advanced water and wastewater treatment systems. Emphasis on those systems used for wastewater reclamation. Prereq: 5502.
5530 Environmental Engineering and Natural System Behavior (3) Course centers about the relationship between environmental engineering and natural system behavior by focusing on eutrophication and the limiting nutrient concept in relation to research on the subject and its translation into law and wastewater engineering practice. Course conduct is in the seminar-open discussion format which actively involves all student participants. Prereq: Graduate standing or consent of instructor.
5551 Water Quality Management (3) Water quality control, objectives, design principles, and philosophies; water quality criteria; effect of various uses on water quality; receiving water characteristics, assimilation capacity; regulatory standards; economic considerations. Prereq: 3000 or consent of instructor.
5551 Environmental Management of Water Quality (3) Water quality management and the control of water pollution; techniques for evaluating the effects of agricultural, domestic and industrial use upon water quality; legal and administrative aspects, waste assimilative capacity and wastewater allocation; and the engineering management of water quality via non-structural and structural means. Prereq: 5551.
5582 Microbiology for Sanitary Engineers (3) A study of microorganisms and microbiological processes which are significant in sanitary engineering, including basic microbiology, detection and identification, enzyme, metabolic reactions, energy transfer, synthesis and growth; aerobic and anaerobic biological treatment processes. Prereq: Graduate standing.
5593 Advanced Sanitary Engineering Laboratory Analysis of physical and chemical techniques employed in the analysis of water and wastewater. Application of modern instrumental procedures for detecting, identifying, and analyzing pollution. Prereq: 4530. 3 labs.
5600 Solid Wastes (3) Magnitude and characteristics of the solid waste problem; methods for disposal and collection and processing of solid wastes, including sanitary landfill, incineration, composting, proposed new technologies, and recycling. Prereq: Graduate engineering major or consent of instructor.
5610 Solid Waste Disposal (3) Engineering design course in solid waste disposal. Problems in the areas of design, cost and design, incinerator design and costing, and special topical areas. Prereq: 5600.
5700 Planning and Air Pollution Control (3) The Pollution and Air Quality Act, air pollution, area development, and urban growth. Social, economic, and political processes involved in air pollution control.
5710 Air Pollution Control Engineering (3) Emission control systems for industrial and power generating processes, stack sampling methods, air pollution monitoring, dispersion of pollutants. Prereq: 4700 and Fluid Mechanics.
5720 Air Pollution Particle Collection Theory (3) The mechanics of particles suspended in a gaseous medium including particle motion, coagulation, and aerodynamic capture of particles. Prereq: 4700 and Fluid Mechanics.
5725 Air Quality Modeling and Impact Assessment (3) Development of techniques to assess the health impact of major trashes, such as industrial, air pollution and urban air pollution sources. Application of atmospheric dispersion modeling, meteorological, and air quality data. Prereq: Graduate standing. Computer Science 3150.
5730 Air Pollution Control Device Design (3) Design and evaluation of systems used to control the emission of hazardous and particle pollutants. Comprehensive design of specific devices and systems. Prereq: 5720.
5735 Industrial Source Sampling (3) Review and application of sampling methods for gaseous and particulate air pollutant emissions from industrial processes. 2 hrs and 1 lab. Prereq: Graduate standing.
5740 Dynamical and Physical Meteorology (3) The theoretical principles of meteorology and the mechanics of particles suspended in a gaseous medium. Prereq: 4700 and Fluid Mechanics or equivalent.
5750 Turbulence in the Atmosphere (3) Present state of our knowledge of turbulence in the atmosphere including boundary layer, mean wind and temperature profiles are derived and related to observations. Models of estimating surface fluxes, energy spectra, and cospectra are outlined. It is shown how the theories can be applied to describe changes in turbulence in air flow over urban areas. Mechanisms of formation of clear air turbulence in shear zones in the free atmosphere are suggested. Prereq: 5740.
5760 Diffusion in the Atmosphere (3) Movement and dilution of natural or man-made material released into the atmosphere. Basic theory is developed and observations reviewed. Specific topics include the rise of buoyant plumes, the relation between Eulerian and Lagrangian spectra, the differences between instantaneous and continuous sources, diffusion in a zone of wind shear and diffusion from urban areas. Prereq: 5740.
5900 Special Problems in Environmental Engineering (1-3) Study of environmental engineering problems to fulfill the special problem requirement in the non-thesis program. Enrollment limited to environmental engineering students in the non-thesis program. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.
5910-20-30 Special Topics (3, 3, 3) Problems and topics related to current developments in the field of environmental engineering not included in other courses.
5990 Environmental Engineering Seminar (1) Discussion on phases of environmental engineering involving 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.
6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) (Same as Engineering Mechanics 6110-20.)
6500 Industrial Waste Treatability and Process Control (6) Sources and characteristics of industrial wastes; treatment alternatives related to ultimate disposal, treatability and process control studies of physical, chemical, and biological processes employed in laborator scale treatment units. Field trips, 2 hrs and 4 labs. Prereq: 5513 and 5593.
6920-20-30 Special Topics in Environmental Engineering (3, 3, 3) Selected advanced problems of current interest in environmental engineering. Prereq: Consent of instructor.

Note: Not all of the above graduate courses will be given in any one year. Prerequisite to all graduate courses: Consent of instructor.

Electrical Engineering

MAJOR

DEGREES

Major Electrical Engineering

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

Professors:
J. M. Gooche (Head), Ph.D, Georgia Institute of Technology, Ph.D, Pittsburgh, P.E.; J. D. Bouldin, Ph.D, Florida; E. L. Hall, Ph.D, Missouri;
H. P. Neff, Ph.D, Auburn, P.E.; M. O. Pace, Ph.D, Georgia Institute of Technology; W. O. Leffell, M.S, Tennessee, P.E.; C. H. Weaver, Ph.D, Wisconsin;
R. W. Rochelle, Ph.D, Maryland; F. M. Sholtter, Ph.D, Tennessee, P.E.; B. Smith, M.S, Illinois, P.E.; J. D. Trim, Ph.D, Auburn; C. H. Weaver, Ph.D, Wisconsin, P.E.

Associate Professors:
A. O. Bishop, Ph.D, Clemson; R. C. Gonzalez, Ph.D, Florida; E. L. Hall, Ph.D, Missouri;
H. P. Neff, Ph.D, Auburn, P.E.; M. O. Pace, Ph.D, Georgia Institute of Technology; W. O. Leffell, M.S, Tennessee, P.E.; C. H. Weaver, Ph.D, Wisconsin;
R. W. Rochelle, Ph.D, Maryland; F. M. Sholtter, Ph.D, Tennessee, P.E.; B. Smith, M.S, Illinois, P.E.; J. D. Trim, Ph.D, Auburn; C. H. Weaver, Ph.D, Wisconsin, P.E.

Dr. John E. Symonds, Ph.D, University of California, Berkeley

Ph.D.

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

Specific departmental requirements include:
1. Electrical Engineering 5070-80 and 5710. Electrical Engineering 5710 is normally available in both fall and spring quarters. Students electing courses such as 5650-60, 5720-30, or 5750-80 which require 5710 as a prerequisite should register for 5710 in the fall quarter.
2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics
of 6000-level course work. At least 3 quarter hours of this work must be in an area other than the student's major area.

b. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in electrical engineering and 9 quarter hours in another approved area.

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

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

MASTER OF ENGINEERING PROGRAM

A graduate program leading to the Master of Engineering degree is available to qualified graduates of ECPD-accredited undergraduate curricula in electrical engineering or its equivalent. Specific degree requirements which must be met include:

a. Electrical Engineering 5070-80 and 5100.

b. Nine quarter hours of graduate credit in mathematics consisting of Mathematics 4710, 4550, and 4250, or 4510-20-30. Other approved 4000-5000 level mathematics courses must be substituted for any of the above course material covered in undergraduate work.

c. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in electrical engineering and 9 quarter hours in another approved area.

The following is one of the many options for fulfilling the above requirements:

- 3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in electrical engineering and 9 quarter hours in another approved area.
- 4. Master's thesis, totaling 9 quarter hours or more.
- 5. A final oral examination covering the thesis and related course work.

THE DOCTORAL PROGRAM

The Ph.D. degree with a major in Electrical Engineering may be pursued in the areas of circuits, system, computer science, and control systems. Specific departmental requirements for the Ph.D. degree include the following:

1. A minimum of 72 quarter hours of course work excluding thesis, research, and dissertation credit.

2. A minimum of 36 quarter hours credit in doctoral dissertation.

3. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.

4. Satisfactory performance on both a written and oral preliminary examination.

5. Participation in department seminars.

The 72 quarter hours of course work must satisfy the following requirements:

a. A minimum of 36 quarter hours of work in electrical engineering at the 5000 and 6000 levels.

b. A minimum of 12 quarter hours of 6000-level course work.
4490 Electro-optics (3) Introduction to Fourier engineering analogies. Consideration of practical aspects based on classical concepts and electrical engineering analogies. The last third of the course will be devoted to selected electro-optic instrumentation techniques. Prereq: 3190.


4410 Power System Components and Control (3) Analysis of power system components and their interconnection. Studies in control of power systems, including voltage, active and reactive power, quality of service, and transient stability. Prereq: 3720. Lab optional.

4290 Power Systems Analysis (3) System studies including load flow, faults, and stability. Prereq: 3980.


4480 Lasers and Masers (3) Introduction to theory and practical applications of laser and maser operation based on classical concepts and electrical engineering analogies. Consideration of practical devices and applications. Prereq: 3190.

4700 Switching Circuits (3) Pulse amplification, gating circuits, multivibrators, wave shaping circuits, trigger circuits. Prereq: 3010 and 3830. 4 labs.

4740 Integrated Circuits (3) Processing and fabricate of active and passive components for monolithic and hybrid circuits. The design of linear and digital monolithic and hybrid circuits packaging, reliability, and large scale integration. Prereq: 3820.

4780 Synchronous Machines (3) Development of 2-phase, 3-phase and 4-phase synchronous machines. Applications to analysis of steady state and transient operation. Excitation and governor control. Prereq: 3960.


4890 Hardware-Software Interface in Microcomputer and Supercomputer System Design (3) Presents microcomputer and microprocessor interface design. Hardware-software interaction and trade-off. Priority interrupt structures are discussed and utilized. Telecommunications are developed. Project-oriented, contract course. Completion of two projects, one utilizing a microcomputer and the other a microprocessor. Prereq: 3190.

4810 Discrete-Data Systems (3) Introduction to the analysis and design of discrete data control systems using frequency domain techniques. Real-time digital filtering techniques; application of digital computers in closed-loop feedback systems.

4820 Introduction to Pattern Recognition (3) Role of pattern recognition within the framework of artificial intelligence. Principal topics dealing with the design of learning and adaptive machines. Typical applications of pattern recognition: biological significance. Computer simulation and elementary pattern recognition problems. Prereq: Either 3100 and Computer Science 3150, or Statistics 3450 and Introduction to Computer Science.


4850 Small Computer Systems (3) Basic structure of small computer systems, input-output techniques, interrupts, microprocessors, computer architecture, system software and assembly language programming. Course is project-oriented. Prereq: 4480. Lab optional.

4910-20 Special Topics in Electrical Engineering (3, 3) Special topics in electrical engineering involving library or laboratory research.

5000 Thesis

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

5070-80 Modern Transform Methods (3, 3) Laplace transform and complex variable theory. 2-transform, difference equations and distributed parameter systems.


5170 Bioengineering Systems I Models, Systems Analysis and Simulation (3) Modeling techniques applied to physiological systems. Systems properties of resistance, impedance, and storage are investigated. Analylog and digital simulation of biological systems. Prereq: 4370 or consent of Instructor.

5180 Bioengineering Systems II Bioelectric Phenomena (3) A study of the electrical phenomena associated with biological systems both as stimuli and responses. Quantitative theories in neurophysiology and electrocardiography are investigated. Prereq: 4600 or consent of instructor.

5190 Bioengineering Systems III Instrumentation and Analysis (3) An investigation of the process by which information is gathered and transmitted from a biological system under test and the process by which this information is treated, as to signal analysis and modeling, in order to maximize the yield of meaningful information about the original biological system. Prereq: 4600 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 machines. Park's transformations for a two-axis model, with emphasis on the transient behavior of isolated and interconnected rotating machines. Prereq: 4780 or equivalent.

5230 Advanced Electrical Machinery Applications (3) 3-phase and 4-wire systems; pole amplitude modulation and other speed control techniques; variable frequency operation. Prereq: 5210.

5240-50-60 Control Systems (3, 3, 3) Analysis and design of continuous and digital control systems using classical and modern techniques. Discussed are feedback theory; system modeling; stability analysis; system response
analysis; design of estimator and observer; system compensation; etc. Emphasis is placed on the mathematical description of control systems.

Coreq: 5070 or equivalent.

5310 Basic Requirements for Plasma Fusion (3) An historical study of fusion systems in nature. The Lawson break-even criterion. Inertial fusion systems—the hydrogen bomb, laser fusion, and electron-beam fusion. Magnetically-confined plasma systems, including the tokamak, mirror systems, and exotic field configurations. Confinement, stability, and heating. The possibility of fusion-fission hybrids. Prereq: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.


5330 Engineering of Fusion (3) Materials in a thermonuclear environment. Magnetic field production and control. Detonation and Breeding of Tritium. Radiological Safety. Cost of Controlled Fusion Power. Prereq: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.


5360 Application of Quantum Electronic Devices (3) Coherence properties of laser radiation. State of the art of lasers and their applications as stimulants in communication and instrumentation systems. Specific application examples: planar waveguides, fiber optic emission microscopy, optical harmonic generation, holography, metal-working, and biological and medical applications. Prereq: 5540 and Mathematics 4710 or equivalent.

5370 Advanced Direct Electrical Energy Conversion I (3) Theory, latest devices and applications for production of electrical energy by the solid state means of thermoelectric and photovoltaic effects. Prereq: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5380 Advanced Direct Electrical Energy Conversion II (3) Theory, latest devices and engineering applications for production of electrical energy by means of thermionic, magnetohydrodynamic, and electro-gas-dynamic effects. Prereq: 4020 or Mechanical Engineering 4150, or equivalent, or consent of instructor.

5390 Advanced Direct Electrical Energy Conversion III (3) Prereq: 5370 and 5380, or equivalent.

5410 Power System Networks (3) Sequence impedances for transmission lines, machines, and networks; the study of system network characteristics such as $Z_{max}$, $Y_{max}$, and others. Computer methods are emphasized. Prereq: Graduate standing or consent of instructor.

5420 Fault and Load Flow Studies (3) Analysis of a power system under both shunt and series fault conditions. Computer methods for fault studies are included. The load flow problem is formulated with computer methods emphasized. Prereq: 5410 or consent of instructor.


5440 Distribution Systems (3) Electric power distribution with particular reference to utility systems. System growth and load factors; optimization and regulation. Prereq: 4410, 4420, 4430 or equivalent.

5460 Selected Topics in Power Systems (3) Courses will be offered to meet special needs of students. Possible topics: (1) power systems reliability, (2) interconnected system theory, (3) power plant operation, (4) electrical, negative-resistance circuits, time-base power system relaying. Prereq: Consent of instructor. May be repeated with consent of department.

5510-30 Linear Active Circuits (1, 3, 3) Analysis and design of linear amplifiers; includes a mathematical treatment of active devices and equivalent circuits; various sources of distortion, wide-band and pulse amplifiers, and a detailed treatment of feedback amplifiers using potentiometers and root-root techniques; types include audio, video, pulse, driver, operational, and distributed amplifiers. Coreq: Mathematics 4510 or 4710.

5540 Thick-Film Hybrid Microcircuits (3) Processing and design of microcircuits for prototype production of hybrid thick-film integrated circuits; all aspects from circuit design through packaging. Covers properties of thick-film pastes; consideration of cost-effective design techniques. Project oriented, includes biweekly laboratory.

5570-89-90 Electronic Switching Circuits (3) Theory and operation of digital switch circuits. Computer design techniques for proto- type production of hybrid thick-filmed integrated circuits; all aspects from circuit design through packaging. Covers properties of thick-film pastes; consideration of cost-effective design techniques. Project oriented, includes biweekly laboratory.

5600 RF Power Amplifiers (3) Linear amplifiers for communications and power transmission systems. Prereq: 5360 or consent of instructor.

5610-25 Introduction to Switching Theory and Logic Design (3) Basic switching circuit elements and Boolean algebra. Combinational switching circuits. Sequential systems. Information structures and sub-systems for computer science majors and those without prior experience in hardware and logic design. Prereq: Elementary linear algebra and calculus of several variables. 4 labs per quarter.


5650-60 Electronic Communication Systems (3, 3) Theory of information transmission in communications systems; mathematical treatment of modulation and demodulation in analog and pulse-type systems. Bandwidth requirements, noise, and interference. All modern systems are considered and compared with emphasis on digital data systems. Prereq: 5710.

5670-80 Pattern Recognition (3, 3) (Same as Computer Science 5640-50).

5690 Artificial Intelligence (3) (Same as Computer Science 5210).

5710 Random Process Theory for Engineers (3) Probability and random variables as applied by set theory set theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral analysis as applied to response of systems to random signals.


5740 Digital Processing of Signals (3) Analysis of discrete signals; sampling theorem and its implication; frequency domain design of digital filters; noise and distortion in digital filters; quantization effects; processing of digital signals; discrete Fourier transform. Prereq: 4100 or equivalent.


5770 System Identification (3) Presentation of various identification schemes including deterministic, stochastic, and hierarchical methods. This course has particular applications in all areas of engineering and science. Prereq: Consent of instructor.

5800 Power Transmission Lines (3) New and unconventional power transmission systems. Transmission lines and network analysis. Introduction to the design of underground lines. Corona and radio interference of high voltage transmission. Insulation coordination and its effects on power transmission. Prereq: 4410-20-30 or equivalent.

5810-20 Electromagnetic Fields (3, 3) Vector analysis, Maxwell's equations, special relativity, plane waves, reflections, waves in anisotropic media, guided waves, rectangular and cylindrical wave guides, radiation from current elements. Coreq: Mathematics 4510 or 4710.

5830 Linear Antennas and Antenna Arrays (3) The Hertzian dipole, linear antennas, impedance loop antennas, receiving antennas, linear arrays. Prereq: 5820.

5840 Aperture Antennas (3) Huygens principle, equivalent current systems, Fourier transform of and optical transformation of electromagnetic fields, application of horn, lens and reflector antennas. Prereq: 5820.

5850 Microwave Electronics (3) Space charge waves on electron beams, coupling between beams and guided waves, Klystrons, magneto-traveling waves, microwave and backward wave oscillators. Prereq: 5820.

5860 Electromagnetic Wave Propagation (3) Supplementary studies in wave propagation in isotropic and anisotropic media, transmitted power, stored energy, non-propagating and non-propagating modes, orthogonality properties,
boundary and radiation conditions, sources. Prereq: 5820.

5870 Introductory Microwave Networks (3) Circuit equivalents for n-port, junctions, obstacles, loading and fillings. One way and two way devices, directional devices, parameter measurements, reflection charts. Prereq: 5810. Coreq: 5820.

5940-50 Advanced Small Computer Systems (3, 3) Real-time applications, memory and CPU organization, interface software, and peripheral devices of minicomputer and microprocessor system are studied. Courses are project-oriented and supported by hardware and software interface design. Prereq: 4850 or equivalent or consent of the Instructor. (Same as Computer Science 5940-50.)

6000 Doctoral Research and Dissertation

6240 Advanced Systems Theory (3) Advanced analytical methods for systems with determininistic inputs; treatment of discrete-data, non-stationary, and nonlinear systems. Prereq: 5070-50 or equivalent.


6260 Modern Control System Design (3) Design of optimum control systems via variational calculus, maximum principles, dynamic programming, and gradient methods. Prereq: 5240-50 or equivalent.

6270-80-90 Special Topics in Control Systems Theory (3, 3, 3) Advanced problems of current interest to control system engineers. Discussion of new developments as found in current literature. Prereq: 5240-50-80 and consent of instructor.


6500-10 Electrical Conduction in Gases and Plasma Physics (3, 3) (Same as Physics 6500-10.)


6660 Electromagnetic Diffraction and Scattering (3) Diffraction of electromagnetic waves by spheres and cylinders, the ground wave problem, and reflection and transmission techniques of modern approximate methods, creeping waves. Prereq: 5810-20 and Mathematics 4250 and 4550.


6760 Coding Theory (3) Presentation of the mathematical structure of error-correcting and error-detecting codes. Included are coding metrics and bounds, linear codes, linear feedback shift registers, convolutional codes, burst-error-correcting codes and decoding methods. Prereq: 5090 or consent of instructor.


Note: All of these courses will not be offered during any one year.

Engineering Science and Mechanics

MAJOR DEGREES

Engineering Science M.S., Ph.D.


Graduate programs leading to the degree of Master of Science and Doctor of Philosophy with a major in Engineering Science are available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. Program options include solid mechanics, fluid mechanics, biomedical engineering, and other engineering sciences. In the biomedical and engineering science option, interdisciplinary programs are arranged to meet individual needs or interests. Each applicant will be advised as to any prerequisite courses before entering a program; the student's program of study must be approved by his/her advisory committee, and must comply with the requirements of the Graduate School. The student's major professor may be selected from any department other than the Department of Engineering Science and Mechanics.

The flexibility and interdisciplinary aspects of the program options are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering, or can best be met by interdisciplinary study in engineering. The department's course offerings and research activities are also intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mechanics, or in related interdisciplinary studies such as biomechanics.

THE MASTER'S PROGRAM

Two M.S. plans are offered: Plan I requires a thesis, while Plan II does not. The second plan is offered to meet the needs of engineers, research professionals in industry, or those who plan to teach in community colleges and technical institutes. It will be available, however, to any student who, in the opinion of his/her advisory committee, can benefit from additional course work more than from work on a thesis.

In Plan I a minimum of 45 quarter hours, including the thesis, is required. In Plan II a minimum of 48 hours is required. The requirements include the following:

<table>
<thead>
<tr>
<th>Hours</th>
<th>Credit</th>
<th>Plan I</th>
<th>Plan II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 209</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Engineering courses (Major 18)</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
</tbody>
</table>

*Engineering courses under Plan II may include additional courses offered by the engineering science and mechanics department.*

Related courses (May Include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.)

| Thesis | 9 | 10 |

The doctoral program requires a minimum of 108 quarter hours of credit beyond the Bachelor's degree, ex-
conclusive of credit for the Master's thesis. These shall include a minimum of 36 quarter hours credit in Doctoral Research and Dissertation and a minimum of 72 quarter hours credit in other courses.

2. A minimum of 36 quarter hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 5000 and above, with at least 12 quarter hours of 6000-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.

3. A minimum of 18 quarter hours in mathematics or computer science in courses numbered 4000 and above, exclusive of a first course in ordinary differential equations.

4. A minimum of 9 quarter hours of courses numbered 5000 and above, offered in departments other than mathematics, computer science, and the student's major department and which are not included in the areas of concentration covered under item 2.

5. Active participation in graduate seminars and colloquia.

6. Preliminary examination consisting of a written qualifying examination and an advanced examination. The qualifying examination covers areas of engineering science and mathematics, for the most part at a level and scope expected of well-qualified recipients of a Bachelor's degree in engineering. The advanced examination requires demonstration of special competence in the areas of concentration selected by each student under item 2.

7. Submission of a written proposal for dissertation research to the student's advisory committee. Oral defense of the proposal is normally required when the student takes the advanced portion of the preliminary examination.

8. Submission of a dissertation which meets the requirements of the Graduate School, the department, and the student's advisory committee.

3311 Mechanics of Materials (4) Concepts of stress and strain; stress-strain relations and Mohr's circle; static analysis of members; area moment of inertia; stress and displacement analysis of axially-loaded members; torsion; bending. Not for departmental graduate credit. Prereq: Basic Mechanics I. Coreq: Multi-variable calculus and linear algebra.

3410 Introduction to Biomedical Engineering (4) Designed to introduce the facets and opportunities of biomedical engineering and to provide basic terminology and background knowledge for further courses in the field. Subjects include anatomy, physiology, biomaterials, mathematical models of body systems. Coreq: Multi-variable calculus and linear algebra or consent of instructor.

3420 Introduction to Clinical Engineering (3) Designed to train students in life sciences, health professions, and engineering in use and instrumentation of medical instruments. Body systems are introduced, and instruments used in care of those systems are explained and demonstrated. Prereq: 3410 or consent of instructor.

3430 Perspectives on Medical Ceramics (3) Details development of implant material from both an engineering and biological point of view. Demonstrates results of combined efforts of physician and biomedical engineer. Audio-visual aids are used to present lecture topics. Prereq: 3410 and Engineering Materials I.

3439 Medical Ceramics Laboratory (1) Surgical and laboratory experiments to illustrate design and application parameters, Design project or paper required. Coreq: 3430.

3520 Materials Behavior and Chemical Process Equipment Design (Same as Metallurgical Engineering 3520.)

3700 Dynamics (4) Kinematics of rigid bodies; mass moments of inertia; coulomb friction; dynamics of rigid bodies using force, mass, acceleration, Newton's laws of motion. Not for departmental graduate credit. Prereq: Elementary Statics and Dynamics or Basic Calculus I. Coreq: Multi-variable calculus and linear algebra.

3710 Intermediate Dynamics (3) Introduction to three dimensional dynamics of particles and rigid bodies with varying mass; kinematics of rotating coordinate systems; LaGrange's equations. Prereq: Dynamics and 2nd quarter Elementary Linear Algebra and Calculus of Several Variables.

4420 Engineering Aspects of Infection Control (3) Biomedical engineer's role in infection control will be related to hospital and clinical activities. Fundamentals, pressures, measurement methods, and basic bacteriological and mycological tests will be demonstrated. Course identifies new and critical role for biomedical engineering in health care systems, and includes analysis of hospital facilities and monitoring systems. Prereq: 3410 or consent of instructor.

4430 Orthopedic Biomechanics (3) Introduction to engineering principles and applications in orthopaedics and rehabilitation. Topics include statics, dynamics, and stresses in simple sections, engineering materials, and biological materials. Prereq: Consent of instructor.

4500 Applied Mechanics for Life Scientists (4) Concise and broad coverage of basic principles and concepts of mechanics. Fundamental concepts of mechanics, simple and complex systems, continuum mechanics and properties of materials. Applications in engineering and medicine. Prereq: Analytical Geometry and Calculus of a Single Variable or consent of instructor.

4520 Biomedical Fluid Mechanics (3) Discuss objectives, review foundations and present developments in biomedical fluid mechanics. Properties of human blood and blood vessels, determinants of cardiac performance, analysis and measurement of flow and pressure in arteries, noninvasive and invasive circulation system mechanics, microcirculation. Applications to areas of hemodynamics, thrombosis, fluid mechanics of heart assist devices. Prereq: 4500 or Fluid Mechanics or consent of instructor.

4529 Biomedical Fluid Mechanics Laboratory (2) Measurement and recording of flow fac- tors in biological systems. Project and/or term paper required. Coreq: 4520.

4530 Biomechanics (3) Discuss objectives, review foundations and present developments in areas of mechanical properties of living tissues, biomechanics of injury and injury protection, material compatibility of prosthetic devices and biomedical problems related to impact. Prereq: 4500 or consent of instructor.

4540 Fracture-Safe Design (3) A critical review of mechanical properties of materials that are indicative of fracture resistance, including transition temperature, R-curves, stress intensity factors, and J-integrals; the use of these properties in design. Prereq: Mechanics of Materials and Engineering Materials I. 3 hrs or 2 hrs and 1 lab.

4610 Experimental Stress Analysis (3) Basic concepts; theory, techniques, and instrumentation of resistance strain gages; theory and techniques of the interferometer. Introduction to other stress analysis methods. Prereq: Mechanics of Materials, Circuits II, or Electric Circuits and Engineering—Circuits and Fields. 2 hrs and a 3-hr lab.

4620 Dynamic Data Acquisition (4) Instrumentation of measuring systems for dynamic events and responses; signal conditioning; oscilloscopes, oscillographs, and magnetic tape recording; telemetry and data transmission; data processing. Prereq: 3311, 3700, Electrical Engineering 3120. 3 hrs and a 3-hr lab.

4630 Introductory Photonics (3) Introduction to photobiology, photoelastic coating method, Moiré method, interferometry, and holography. Prereq: Mechanics of Materials and Fundamentals of Physics: Electricity, Waves and Optics, Modern Physics. 2 hrs and a 3-hr lab.

4710 Fundamentals of Vibrations (3) Free and forced vibrations; lumped parameter systems; energy methods. Prereq: Dynamics and 3rd quarter Elementary Linear Algebra and Calculus of Several Variables.


4810-20 Engineering Analysis (4, 3) Integration of fundamental methods of analysis with emphasis on application to realistic engineering problems. Prereq: 3311. Fluid Mechanics and Computer Science 3150.

4850 Elementary Structural Matrix Methods (4) Prereq: Mechanics of Materials, Deflections and Statically Indeterminate Structures, Mathematics 3150. (Same as Civil Engineering 4850 and Architecture 4850.)

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

5000 Thesis

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

5110-20 Fluid Dynamics (3, 3) Kinematics of fluids, vorticity, rate deformation, plane and axisymmetric boundary-layer approximations; nonviscous flow, potential theory, complex potentials, conformal mapping. Prereq: 5800.

5130 Introduction to Turbulence (3) Macroscopic effects, analogies, statistical treatment, correlation function, integral scaling; application of the Navier-Stokes equations; emphasis on...
numerical methods of solutions; introduction to stress-optic methods of laminar flow analysis. Prereq: Mathematics 4610. (Same as Chemical Engineering 5810.)

5320 Non-Newtonian Fluid Mechanics (3)
(Same as Polymer Engineering 5230.)


5410-20 Theory of Elasticity (3, 3, 3) Stress, strain, and deformation of prismatical bars; axisymmetric stress distribution; stress concentration; plane stress, plane strain. Prereq: 5080.

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

5440 Theory of Linear Viscoelasticity (3) Introduction to the concepts of linear viscoelasticity; stress concentration; plane stress, plane strain. Prereq: 5080 or 5310-20-30.


5630-40 Photelasticity (3, 3) Introduction to physical optics, wave motion, polarized light; basic principles of photelasticity, equipment and techniques, application to two-dimensional elasticity and stress concentration, numerical methods in photelastic stress analysis, photelastic coating methods, Introduction of three-dimensional photelasticity. Prereq: Mechanics of Materials, Mathematics 4610, and consent of Instructor. 5040, 2 hrs and 3 labs.

5710-20 Advanced Dynamics (3, 3) Physical laws relative to translating and rotating reference frames; rigid body dynamics; variational methods; Lagrange's equations; Hamilton's principle. Prereq: 3710 or 4710, 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 components to applied dynamic loads; approximate methods of solution. Prereq: 5710-20 and 4850.

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

5800 Introduction to Continuum Mechanics (3) An integrated approach to the fundamentals of mechanics of solids and fluids; introduction to Cartesian tensors; stress, deformation, and flow in a continuous medium; constitutive equations, applications to solids and fluids. Prereq: Fluid Mechanics and Mechanics of Materials or equivalents. Mathematics 4610.


5860 Introductory Finite Element Methods (3) Introduction to the general finite element process; computer programs; programming concepts. Applications to 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. Prereq: Consent of Instructor. May be repeated with consent of department.

6000 Doctoral Research and Dissertation

6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) Critical survey of literature on advanced convective momentum, heat, and mass transfer; boundary layer theory based on the Navier-Stokes equations; boundary layer stability analysis; phenomenological theories of turbulence; turbulent boundary layer flow; high speed flow of phenomena in nonreacting and reacting systems. Prereq: 5110-20-30 or equivalent; Mathematics 4610, 4540-50, 4710. (Same as Environmental Engineering and Mechanical Engineering 6110-20.)


6310 Theory of Plates (3) The classical theory of bending of plates of various shapes; thick plates; plates of variable thickness; buckling and large deflection problems. Prereq: 5310-20-30.


6340 Theory of Plasticity (3) Yield conditions; strain hardening; rate-dependent plastic and viscoelastic deformations; piecewise linear plasticity. Prereq: 5410 and Mathematics 4550.

6610 Photoelasticity (3) The stress-optic law in three dimensions and index ellipsoid, rotational effects in three-dimensional photelasticity, techniques and applications of three-dimensional photoelasticity, scattered light method, dynamic photoelasticity, photothermoelasticity, photoelastic and photochromatic effects, recent developments in photoelasticity. Prereq: 5640, 5420 and consent of Instructor. 2 hrs and 3 labs.

6710 Impact and Stress Waves in Solids (3) Mechanical waves in solids; wave propagation in elastic solids; impact and waves in elastic rods, beams, and plates; contact problems in impact of elastic bodies; dynamic loading in viscoelastic and plastic materials; dynamic properties and materials. Prereq: 5410. Coreq: Mathematics 5630.

6800 Advanced Continuum Mechanics (3) Prereq: Chemical or Mechanical Engineering 5410, or Metallurgical Engineering 5840 or equivalent. (Same as Polymer Engineering 6210.)


6910 Special Topics in Engineering Mechanics (3) Selected advanced problems of current interest in mechanics, worked either as a group or individually. Prereq: Consent of Instructor. May be repeated with consent of department.

Note: Not all of the above graduate courses will be offered in any one year.
College of Engineering


4170 Automatic Process Control (3) Characteristic of human-machine systems; controllers; elementary open and closed loop analysis, and applications to industrial control systems. Comparison to Differential Equations, and Dynamics.

4230 Scheduling Systems (3) Performance measures for job shop and flow shop scheduling, including both static and dynamic conditions. Techniques for generating production schedules. Deterministic and probabilistic dispatching conditions. Prereq: industrial Operations Research II.

4240 Predetermined Time Systems (3) Work design and measuring using a predetermined time system such as methods time measurement, basic motion time-study, or work factor. Theory and application. Prereq: Work Measurement.

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

4280 Engineering Economy (3) Methods and principles of economic decision making, selection of optimal equipment. Decisions among engineering alternatives, involving capital recovery, economic life, and the time 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 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, etc. Prereq: 4520.

4540 Industrial Development (3) Factors other than mechanical or chemical which enter into the successful establishment of manufacturing enterprise. Cost and location studies and market determination, the commercial feasibility of new plants or projects.

4590 Simulation (3) Generation of outcome of a complex random process by computer. Models of complex systems using available simulation languages, performance analysis, design principles for a design tool in industrial systems. Prereq: Computer Science 3150.

4830 Health Systems Engineering (3) A study of the health system as an integrated system, and the means by which they may be improved through the application of modern industrial engineering principles and techniques. Prereq: Work Methods and Design.


510-20-30 Special Industrial Engineering Topics (3, 3, 3) Open with consent of instructor. May be repeated.

5499 Industrial Safety (3) Development of organization and techniques for control of accidents with emphasis on OSHA Rules and Regulations.

5000 Thesis

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

5110 Work Design (3) Advanced methods analysis embodying the design and improvement of the total health system. Worker and management participation. Prereq: Motion and Time Study or Work Methods and Design.

5210 Advanced Work Measurement (3) Characteristics of some of the better known preconditions of time and motion study in system design, application to formula construction, and practise in application. Prereq: Motion and Time Study or Work Methods and Design.

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


5260 Information Systems Design (3) Systems engineering, systems design. Topics include the system model, analysis and evaluation of information systems, information objectives and design criteria. Use of optimization and simulation in system design will be emphasized.

5340 Applied Decision Theory (3) Application of the theory of decision making to problems in industrial engineering. Approaches to decision making under conditions of incomplete information. Bayesian and Neyman-Pearson statistical decision models, utility functions, value of information, linear and quadratic loss analysis and parallel and sequential decision processes. Prereq: 4520.


5560 Human Factors Engineering (3) Study of characteristics of man which influence the design of tools, equipment, environments and products. Particular attention given to the modeling of man as a process or system controller. Prereq: Consent of instructor.

5610 Human Factors Engineering (3) The human operator, his performance characteristics, and his environment. Emphasis is given to the formal description of the human operator's transfer characteristics through both quasilinear models and models describing the operator as an information processor. Prereq: 4810 or 5660.

5700 Optimization Methods in Industrial Engineering (3) An introductory course in operations research. Development of mathematical techniques required in 5710, 5720, and 5730 are presented. Applications of classical optimization theory, N-dimensional geometry, optimality criteria, to selected areas of operations research. Prereq: Computer Science 3150 and Matrix Algebra.

5710 Linear, Quadratic and Dynamic Programming (3) An introduction to mathematical programming. Topic includes linear programming, quadratic programming, and dynamic programming. Applications include computer solutions to programming problems. Prereq: Computer Science 3150 and Matrix Algebra.

5720 Queuing Models, Inventory, and Simulation (3) Waiting line models and the analysis of inventory systems. Development of simulation methods and computer simulations applied to queuing, inventory models and decision making. Prereq: 5360.


5830 Health Systems Engineering II (3) Specific functions of health systems are analyzed for analysis, control and improvement of the function and the total health system. Prereq: 4830.


5860 Industrial Systems Engineering (3) Static variables and use of computer simulation techniques of continuous and discrete systems. Computer methods for systems analysis. Introduction to system optimization techniques. Case studies in systems design. Prereq: 4860 or equivalent.
**Mechanical and Aerospace Engineering**

### MAJORS

<table>
<thead>
<tr>
<th>Aerospace Engineering</th>
<th>M.E., M.S., Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering</td>
<td>M.E., M.S., Ph.D.</td>
</tr>
</tbody>
</table>

### DEGREES

<table>
<thead>
<tr>
<th>Aerospace Engineering</th>
<th>M.E., M.S., Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering</td>
<td>M.E., M.S., Ph.D.</td>
</tr>
</tbody>
</table>

### Professors:

- M. W. E., Milligan (Head), Ph.D. (69 years of age), 1000 W. 100th St, Ph.D. Tennessse, P.E.
- J. F. Bailey, Ph.D. (70 years of age), 1000 W. 100th St, Ph.D. Lehigh, P.E.
- A. J. Edmondson, Ph.D. (71 years of age), 1000 W. 100th St, Ph.D. Texas A. & M. P.E.
- J. W. Hodgson, Ph.D. (72 years of age), 1000 W. 100th St, Ph.D. Iowa, P.E.
- W. P. Holland, Ph.D. (73 years of age), 1000 W. 100th St, Ph.D. Tennessse, P.E.
- J. W. Hodgson, Ph.D. (74 years of age), 1000 W. 100th St, Ph.D. Georgia Institute of Technology, P.E.
- J. F. Bailey, Ph.D. (75 years of age), 1000 W. 100th St, Ph.D. Tennessse, P.E.
- E. Lumsdaine, Ph.D. (76 years of age), 1000 W. 100th St, Ph.D. New Mexico State, R. L. Maxwell, M.S. Case, P.E.
- H. Speckhart, Ph.D. (77 years of age), 1000 W. 100th St, Ph.D. Georgia Institute of Technology, P.E.

**Associate Professors:**

- S. E. Becker, Ph.D. (60 years of age), 1000 W. 100th St, Ph.D. North Carolina State, P.E.
- C. W. Brown, M.S. Tennessse, P.E.
- S. N. Chaudhuri*, Ph.D. Indian Inst.; W. Frost*, Ph.D. Washington (Seattle); G. G. Keeshan, Ph.D. Oklahoma; R. J. Krane, Ph.D. Oklahoma; C. D. Nelson, Ph.D. Clemson, Ph.D.

**Assistant Professors:**


---

**GRADUATE STUDY PROGRAMS**

Graduate programs in Mechanical Engineering or Aerospace Engineering are available which lead to the degrees of Master of Engineering, Master of Science, and Doctor of Philosophy. In addition to the general policies and requirements of the Graduate School each student must satisfactorily complete a program of study which has been approved by the student's committee. Eligible program requirements are given below.

**MASTER OF ENGINEERING PROGRAMS**

Entrance into the Master of Engineering program is restricted to qualified graduates of ECPD-accredited undergraduate curricula in mechanical or aerospace engineering. At least one-third of the program of study must be classified as engineering design. The student's advisor will assist in planning the program of study to ensure that it includes the necessary design content.

Three program options (thesis, course, and problems) are described below. Note that some students may not be eligible for the course option.

**THE MASTER'S PROGRAMS**

Entrance into the Master of Science program is available to qualified graduates of recognized undergraduate curricula in mechanical or aerospace engineering and to qualified graduate students. The student's program of study will be of sufficient size to include all the course areas reflected in the course program.

### 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 credit in Selected Engineering Problems (5900). A written report must be presented for each problem investigated.
3. Participation in the departmental seminar program.
4. Passing a comprehensive written final examination on all course work submitted for the degree and an oral examination on all work (including problems) submitted for the degree.

**THE DOCTORAL PROGRAM**

Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds. The student must satisfactorily complete an approved program of study which normally includes:

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or problems.
2. A minimum of 36 quarter hours 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

---

* Space Institute, Tullahoma.
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-technical or non-aerospace engineering majors, if approved by the student's major department. Mechanical or aerospace engineering majors may not normally use more than one 4000-level engineering course to meet their advanced degree requirements. Non-technical 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; renewable technologies including conservation schemes; emphasis on the resources-environment-man interaction associated with energy, primarily for non-engineering students.

3110 Applied Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties; applications to engineering problems. Prereq: College physics and calculus.

3311 Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties.

3330 Engineering Thermodynamics (3) Properties of gases and gas mixtures; chemical reactions; equilibrium; applications to mechanical engineering problems.

3410 Fluid Flow (3) Development of continuity, momentum and energy principles for fluid systems; applications to mechanical and aerospace engineering problems.

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

3520-30-40 Thermal Sciences (3, 3, 3) Fundamental principles of thermodynamics and transport phenomena as applied to engineering design. To be taken in sequence.

3610 Mechanics of Machinery—Kinematics (3) Motion in space and time; instantaneous centers; velocities; accelerations.

3620 Mechanics of Machinery—Dynamics (3) Newton's laws; work, energy, impact; single degree vibrating systems.


3650 Introduction to Machine Design (3) Ductile-brittle behavior of materials under static and cyclic loading. Stress concentration, design factors and theories of failure. Changes in material behavior in processing and fabrication. 2 hrs and 1-2 hr lab.

3660 Manufacturing Processes (3) Selection of processes as related to the design of machine parts. Castings, forging, hot and cold forming, metal removal and welding. Manufacturing tolerances and surface finishes. 2 hrs and 1-2 hr lab.

3910 Engineering Analysis (3) Advanced analysis techniques for problems of aerospace and mechanical engineering. Emphasis on approximate methods.

4140 Energy Conversion Systems (3) Laws governing energy transformations and their application to mechanical and aerospace systems.

4150 Energy Conversion Systems (3) Operating and design characteristics of new technology energy conversion systems, selected direct conversion techniques.

4160 Energy Conversion Systems (3) Economic and technical design parameters as applied to power plants for public utilities or industrial applications. Selected design and layout problems for energy conversion systems; lecture and laboratory participation.

4170 Turbomachinery (3) Basic principles of turbomachinery; systematic methods or analysis, design performance evaluation.

4180 Energy Production and Utilization (3) Thermodynamic constraints on energy production; comparison of power generation methods; evaluation of new energy sources and concepts; energy conservation schemes.

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

4240 Heat Transfer (3) Heat transfer by free and forced convection, heat transfer in phase change, heat transfer in high speed flow, heat exchanger applications.

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, dynamic 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; plastics production; meterology.

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 cell and manufacturing systems for a particular product; manufacturing planning, tool and fixture design, selection of manufacturing operations, redesign of production system to reduce cost.

4625 Manufacturing Process Engineering I (3) Product specification; dimensional analysis of size and form; true position tolerance theory; tolerance analysis; and workplace control for product on to tolerance.

4631 Energy Methods in Mechanical Design (3) Application of strain energy principles in complex beams and structures.

4652 Application of Lagrangian Mechanics in Vibration Problems (3) Generalized coordinates and multiple degree of freedom vibrating systems.

4660 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design of machine elements, springs and shafting; selection of sleeves and rolling element bearings.

4680 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design of machine elements, shafts and gears; selection 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 analysis of air washers, cooling towers and extended surface coils; solar radiation; building heat transmission; physiological effects.

4730 Thermal Environmental Systems (3) Design of heating ventilation and air conditioning systems.

4740 Solar Energy Utilization (3) Nature and availability of solar radiation; review of selected heat transfer topics relevant to solar energy collection and use; design analysis of solar energy collectors and methods of storage selected application. Prereq: Engineering Thermodynamics 3440 or consent of instructor.

4810 Internal Combustion Engines (3) Thermomechanical phenomena in internal combustion and propulsion engines. Combustion, detonation, equilibrium, dissociation. Analysis of internal combustion engines using ideal and real fluids.

4830 Propulsion Systems (3) Design of propulsion units for ground and airborne vehicles.

4830-20-30 Selected Topics in Mechanical Engineering (3, 3, 3) Problems related to developments and practice in mechanical engineering.

5000 Thesis

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

5110 Conduction Heat Transfer (3) Analysis of steady state and transient heat conduction by analytical and numerical techniques. Prereq: Undergraduate heat transfer, Engineering Analysis, and Mathematics 3155.

5120 Convection Heat Transfer (3) Equations of free and forced convection, convection analysis of internal and external flows including the effects of variable heat flux, surface temperature, and fluid properties. Prereq: 5310 or equivalent.


5140 Phase Change Heat Transfer (3) Prereq: 5120.
5210 Classical Thermodynamics (3) A thorough study of macroscopic thermodynamics with emphasis on First and Second Law analysis, equilibrium criteria, and the thermodynamics of phase relationships. Prereq: Undergraduate thermodynamics.


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

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

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

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


5610-20-30 Experimental Stress Analysis (3, 3, 3) Theory of elasticity; experimental methods; photoelasticity, strain gages, lacquer coatings.

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

5670-80-90 Dynamics of Machinery (3, 3, 3) Dynamics of machinery; vibrations; balancing; flywheels and governors.

5710 Metal Machining (3) Analytical approach to the mechanics of machining. Detailed treatment of basic phenomena-plastic flow, fracture, friction and wear. Prereq: Undergraduate metallurgy and materials behavior, and heat transfer.

5800 Transfer Matrix Methods in Elastomechanics (3) Application of transfer matrix methods to static and dynamic lumped parameter elastic systems which occur in mechanical engineering. Calculation of forced response, mode shapes, and natural frequencies of systems. Applications to preventive maintenance and rotating machine behavior. Prereq: Consent of instructor.


5840-50-60 Turbomachinery Systems (3, 3, 3) Theory and practice of design, development and systems integration of turbomachinery components. Prereq: Failure to pass grade and consent of instructor.

5870 Dynamic Modeling and Simulation (3) Methods of modeling physical systems including mechanical, thermal, hydraulic, pneumatic and electromechanical systems. Techniques for experimentally determining system parameters. Analog and digital computer simulation techniques. Prereq: Undergraduate dynamics, heat transfer, and fluid mechanics.

5900 Selected Engineering Problems (3-9) Selected problems in mechanical engineering to fulfill the requirements of the Problems Program. Enrollment limited to students in the Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.

5950 Seminars (1) Discussions on all phases of mechanical engineering, including reports on current research at The University of Tennessee. Knoxville. May be repeated. S/NC only.

5990 Special Topics in Mechanical Engineering (1-3) May be repeated.

6000 Doctoral Research and Dissertation

5110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) (Same as Engineering Science and Mechanics 6110-20.)

5130-40 Advanced Radiation Heat Transfer (3, 3) Radiation heat transfer in absorbing, emitting, and scattering media; interaction of thermal radiation with conduction and convection heat transfer; radiation heat transfer in hypersonic flow; radiative characteristics of luminous flames and nonuniform gases; scattering by planetary atmosphere. Prereq: 5110-20-30; Mathematics 4550.

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

5630 Selected Topics in Thermodynamics (3) Current problems in aerospace science: topics in science and engineering required for an understanding of the several areas of aerospace science.

5500 Thesis

5502 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: Consent of advisor.

5610 Magneto-hydrodynamics (3) Review of electromagnetic field theory; chemical kinetics, thermodynamic and thermophysical properties of electrically conducting fluids. Prereq: 5250.

5620 Selected Topics in Aerodynamics (3) Further study of transonic, supersonic and hypersonic flow theories.

5700-90-90 Aerospace Ground Test Facilities (3, 3, 3) Atmospheric models and similarity considerations. Aerodynamic test facilities including wind tunnels, shock tubes, hotshots and ballistic ranges; propulsion test facilities for rocket, jet, ramjet and space environment. Theoretical and practical considerations of space environmental test facilities. Prereq: 5240, Mechanical Engineering 5250 and 5510.

5700 Rocket Propulsion (3) Introduction to airfoil and wing characteristics, drag; propellers; static performance and maneuvers; theory and design of control surfaces; stability.

5810 Selected Topics in Aerospace Science (3) Current problems in aerospace science; topics in science and engineering required for an understanding of the several areas of aerospace science.

5850 System Dynamics (3) Analytical models for physical systems, linearization and use of computer position and stability. Statics, kinematic and dynamic mechanics. Prereq: 4220.

5870 Dynamic Materials and Structures (3) Applications of transfer matrix methods to static and dynamic lumped parameter elastic systems which occur in mechanical engineering. Calculation of forced response, mode shapes, and natural frequencies of systems. Applications to preventive maintenance and rotating machinery behavior. Prereq: Consent of instructor.


5920-30-40 Experimental Stress Analysis (3, 3, 3) Theory of elasticity; experimental methods; photoelasticity, strain gages, lacquer coatings.

5930-50-60 Advanced Design Machine Design (3, 3, 3) Design of bearings, gears, shafting; lubrication.

5940-50-60 Dynamics of Machinery (3, 3, 3) Dynamics of machinery; vibrations; balancing; flywheels and governors.

5950-60-70 Dynamics of Machinery (3, 3, 3) Dynamics of machinery; vibrations; balancing; flywheels and governors.

5960 Metal Machining (3) Analytical approach to the mechanics of machining. Detailed treatment of basic phenomena-plastic flow, fracture, friction and wear. Prereq: Undergraduate metallurgy and materials behavior, and heat transfer.

5970 Transfer Matrix Methods in Elastomechanics (3) Application of transfer matrix methods to static and dynamic lumped parameter elastic systems which occur in mechanical engineering. Calculation of forced response, mode shapes, and natural frequencies of systems. Applications to preventive maintenance and rotating machine behavior. Prereq: Consent of instructor.

5980 Rocket Propulsion Systems (3, 3, 3) Rocket propulsion fundamentals. Topics in chemical, electrical and nuclear propulsion systems.

5990 Selected Engineering Problems (3-9) Selected problems in mechanical engineering to fulfill the requirements of the Problems Program. Enrollment limited to students in the Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.

6000 Doctoral Research and Dissertation

6420 System Dynamics (3) Analytical models for physical systems, linearization and use of computer position and stability. Statics, kinematic and dynamic mechanics. Prereq: 4220.
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 of aerospace vehicle systems. Prereq: 5220. Recommended: 5240.


5540-50 Aerospace Vehicle Stability and Control (3, 3) Introduction to aircraft stability and control. Static and dynamic longitudinal, directional, and lateral stability and control. Coupled modes. Motion with free and fixed control surfaces throughout the flight speed range. Automatic stability and control. Application to missiles. Prereq: 4230 and 5530.


5570 Aerospace Vehicle Flutter and Vibration (3) Aeromechanics and aeroelastic phenomena. Development of the structural and aerodynamic operators. Stability criteria for airfoils operating at supersonic speeds. The study of two and three-dimensional wings of control surfaces, and empennages over a wide flight speed range. Prereq: 4250 and 5530.


5610 Applied Acoustics (3) Energy flow in acoustics, general equations of sound propagation in a nonhomogeneous moving medium, sound waves due to turbulence, vertical sound, pseudosound, propagation and absorption of sound in ducts, instrumentation and measuring techniques. Prereq: Consent of instructor.

5620 Aerocoustics I (3) Special topics and recent research results in the field of aeroacoustics. Topics to be covered include: turbulence, boundary layer, jet noise, and empirical and theoretical developments, as well as engineering problems. Prereq: 5610.

5810 Aviation Systems: An Overview (3) Aviation systems present and future, analyzed with emphasis upon the systems approach. Consideration of the socioeconomic base, aerospace and propulsion technology, meteorology, air traffic control, airport-community interface and technological trends and developments pertinent to the present status and future development of aircraft. Prereq: Aircraft Propulsion & Performance.

5820 Air Vehicles (3) Current capabilities and future requirements for air transport vehicles. Consideration of parameters significant for air vehicle type selection. Integration of the vehicle into the aviation system. For non-aerospace and non-mechanical engineering majors only. Prereq: 5810.

5900 Selected Engineering Problems (3-9) Selected problems in aerospace engineering to fulfill the requirement of the Problems Program; solution of selected Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.

5950 Seminars (1) Discussions on all phases of aerospace engineering, including reports on current research at The University of Tennessee, Knoxville. May be repeated. S/NC only.

5990 Special Topics in Aerospace Engineering Credit to be arranged; 3 hrs maximum each quarter. Prereq: Consent of instructor. May be repeated. S/NC only.

6000 Doctoral Research and Dissertation

6310 Magnetohydrodynamics I (3) Electromagnetic field equations, motion of a single charged particle, statistical description of a plasma, the Boltzmann equation, conduction and diffusion in ionized gases. Prereq: 5240 or registration therein. Mathematics 5610, Physics 4220.

6320 Magnetohydrodynamics II (3) Continuum magnetohydrodynamic equations. Alfven, shock waves, exact solutions for magnetohydrodynamic channel flows; one-dimensional model of channel flow, the magnetohydrodynamic boundary layer. Prereq: 6310, Mathematics 5620.

6330 Magnetohydrodynamics III (3) Engineering applications of magnetohydrodynamics with particular emphasis on propulsion and power generation. Prereq: 6320, Mathematics 5630.

6410 Physical Gasdynamics (3) The fundamentals of high-speed, high temperature flow of a gas from the molecular point of view; molecular theory of heat conduction and simple kinetic theory; equilibrium properties of gases and mixtures as obtained from steady-state kinetic theory, statistical thermodynamics, and statistical mechanics. Prereq: 5220 and Mechanical Engineering 5220.

6420 Physical Gasdynamics (3) Continuation of 6410; flows of gas mixtures in local thermodynamic and chemical equilibrium; physical and chemical basis of rate equations; flow with vibrational and chemical nonequilibrium. Prereq: 6410.

6810 Advanced Boundary Layer Theory (3) Derivation and critical review of the governing equations. Asymptotic solutions; similarity methods; boundary layer transformations. Approximate integral methods to include compressibility and heat transfer. Application to attached and separated flows; shock-wave-boundary layer interaction. Prereq: 5220, Mechanical Engineering 5120, and Physics 5630.

6910 Advanced Topics in Gasdynamics (3) Selected advanced topics in gasdynamics. The selection of topics will be based on the particular interests of the student and the instructor. Representative topics may include nonequilibrium transport phenomena, radiation transport, magnetohydrodynamic flows, advanced kinetic theory, perturbation techniques. Prereq: Consent of instructor.

Nuclear Engineering

MAJOR

DEGREES

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

Professors:

- P. F. Sasuga (Head), Ph.D. Northwestern, P.E.
- W. H. Jordan, Ph.D. California Institute of Technology, P. P. Ritz, Ph.D. D. Minnesota
- T. W. Kerlin, Ph.D. Tennessee
- J. E. Mott, Ph.D. Minnesota
- J. C. Robinson, Ph.D. Tennessee
- P. N. Stevens, Ph.D. Northwestern, P.E.

Associate Professors:

- H. L. Dodd, Ph.D. Tennessee
- J. B. Fussell, Ph.D. Georgia Institute of Technology (1962), Ph.D. D. Tennessee
- O. L. Smith, Ph.D. Missouri

Assistant Professors:

- E. M. Katz, Ph.D. Tennessee
- L. Miller, Ph.D.
- Texas A & M, P.E.

THE MASTER'S PROGRAM

A graduate program leading to a degree of Master of Science is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary prerequisite courses before he/she enters the program.

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

1. A major consisting of a minimum of 18 quarter hours of graduate courses in nuclear engineering.
2. A minor of 9 quarter hours in mathematics.
4. Final examination covering the thesis and graduate course work.

An alternate program is available for the Master of Science degree which involves engineering practice rather than a thesis. The student must complete a program of study which includes the following:

1. Thirty-six quarter hours of course work similar to the requirements for the regular Master of Science program (see above).
2. Twenty-four quarter hours of Nuclear Engineering 5980, Nuclear Engineering Practice. A student usually registers for 6 hours of Nuclear Engineering 5980 each quarter and investigates problems assigned by a member of the faculty. At the end of each quarter the student submits a written report and makes an oral presentation of the work.
3. Final examination covering graduate course work and practice school problems.

MASTER OF ENGINEERING PROGRAM

A graduate program in Nuclear Engineering leading to the degree of Master of Engineering is available to those graduates with an accredited engineering degree or one which satisfies EPAC basic level criteria.

In addition to Graduate School requirements the following degree requirements must be met:

1. A minimum of 9 hours of design project, thesis, or 24 hours of Nuclear Engineering Practice (5980). Documentary proof of significant engineering experience may be submitted in lieu of the design project, thesis or Nuclear Engineering Practice, but in this case 45 hours of course work are required.
2. Nine hours of course work submitted must be from out of department.
3. 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.
4. A candidate must pass a final oral examination on all work presented for the degree.

THE DOCTORAL PROGRAM

Students in the field of nuclear engineering desiring to study for the degree of Doctor of Philosophy must have a Bachelor
of Science or Master of Science degree from a recognized university, with a major in engineering or physics, and present at least a B average. All candidates will be required to demonstrate competence in the preliminary examination in the areas of engineering science, mathematics, and physics. At the same time, all candidates will be required to demonstrate completion of a minor in nuclear engineering.

Specific course requirements for the Ph.D. degree in Nuclear Engineering include:

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.
2. A minimum of 36 quarter hours of credit in doctoral research.
3. A minimum of 45 quarter hours in nuclear engineering courses numbered 5000 and above (or the equivalent), with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.
4. A minimum of 18 quarter hours in mathematics or computer science in courses beyond the Bachelor's in 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 outside 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 equations; multigroup diffusion theory, neutron moderation; reactivity coefficients; perturbation theory. Prereq: Physics 3730 or consent of instructor.


4210-20-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation, counting statistics, half-life and decay schemes, gamma spectrometry, cross-section measurements, analog computation, diffusion properties of neutrons, critical loading experiments, control rod evaluation, statistical weight, shielding, xenon poisoning, prompt critical reactor behavior, fission density and adjoint flux. Prereq or coreq: 4110 or equivalent.

4550 Reactor Simulation Laboratory (3) Simulation of reactor design and operation with analog computer; reactor kinetics; single and multifast neutron therapy coefficients, poisoning, control rod calibration; power reactor; subcritical assembly. Prereq: 4120.

4610-20-30 Reactor Power Systems (3, 3, 3) Nuclear structure, decay laws, neutron diffusion, time behavior of reactors, heat removal, analysis of reactor power plants; economic, safety, and environmental aspects of nuclear power. Prereq: Mathematics 410, non-nuclear engineering students only.

4710 Energy Transport (3) Development of differential and Integral energy conservation equations, conduction, convection, and radiation heat transfer; applications to nuclear reactor fuel elements and heat exchangers. Prereq: Momentum mass and energy transport.

4720 Reactor Thermal Design (3) Hydrodynamics and heat transfer in engineering systems; boiling crises; fuel element thermal design, steam generator design. Prereq: 4710.

4730 Nuclear Reactor Design (3) First order reactor design, integration with non-nuclear heat transfer and power conversion system, economic evaluation; optimization procedures, description of typical systems. Coreq: 4130.

4810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation, shield design. Prereq: Physics 3730, Mathematics 4550.

4820 Reactor Kinetics and Controls (3) Derivation of kinetic equations; basic kinetic parameters; transient response with feedback; control and protective systems. Prereq: 4110.

4840 Nuclear Reactor Safety (3) Presentation of reactor safety concepts and criteria; credible accidents; fission product release and transport; containment; reactor accident analysis; engineering safeguards. Prereq: 4120, Coreq: 4730 or consent of instructor.

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

5000 Thesis

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

5110-20-30 Transport Processes in Nuclear Engineering (3, 3, 3) Momentum and heat transport; development of conservation equations; elementary theory of turbulence; heat transfer and flow through conduits; conduction; radiation; reactor core thermal analysis. Prereq: 4720 or equivalent, Mathematics 4710, 4550.

5210 System Dynamics (3) Transient analysis, Laplace transforms, frequency response, stability (linear and nonlinear), and sensitivity analysis by simulation. Dynamic analysis of distributed systems. Prereq: Consent of instructor.

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


5240 Reactor Instrumentation (3) Principles and applications of instrument components and systems for the operation, control, and safety of nuclear reactors; role of instrumentation in public health and safety; engineered safeguards for nuclear power plants. Prereq: 4550, or consent of instructor.

5310-20-30 Nuclear Systems Reliability (3, 3, 3) Principles of system reliability analysis as applied to nuclear systems. Both qualitative and quantitative methods are included. Coreq: Statistics 3450.

5510-20 Nuclear Systems (3, 3, 3) Detailed study of nuclear power systems including various reactor types; flow diagrams, thermo-
College of Home Economics

Lura M. Odland, Dean
Grayce E. Goertz, Associate Dean
Virginia S. Anagnost, Assistant Dean

Graduate study programs lead to the degree of Master of Science in Child and Family Studies; Consumer Studies and Housing: Public Policy; Crafts, Interior Design, and Housing; Food Science; Food Systems Administration; Home Economics Education; Nutrition; and Textiles and Clothing. Graduate study programs lead to the degree of Doctor of Philosophy in Home Economics with three options: interdisciplinary, food science, and nutrition. Graduate programs provide advanced specialized training needed for college and university teaching, for leadership positions in governmental and professional agencies, in the various professions in business, for secondary school and adult teaching, for research and for extended services.

GENERAL REQUIREMENTS FOR GRADUATE STUDENTS

Requirements for graduate study are prescribed by the Graduate School and by the student's major department. Students lacking adequate preparation may be required to take additional courses at the undergraduate level as prerequisites to graduate study. A student deficient in English may be required to take courses as necessary to remove the deficiency.

APPLICATIONS FOR ADMISSION

Two copies of the student's transcript and an application for admission are submitted directly to the Graduate School. In addition, a College of Home Economics application and three letters of reference are sent to the Associate Dean of the College of Home Economics. (Forms may be obtained from the college.)

The Graduate Record Examination scores for the aptitude test including the quantitative, verbal and analytical sections are required for the application for admission in the interdisciplinary doctoral program and the Master's program in Child and Family Studies.

In submitting applications for admission to graduate study in home economics, students are requested to indicate their choice of major area of study.

GRADUATE ASSISTANTSHIPS AND FELLOWSHIPS

Information and application forms regarding graduate assistantships, fellowships and general requirements for admission to graduate study may be obtained from the department head in the area of the student's major interest or from the Associate Dean of the College of Home Economics for the interdisciplinary doctoral program.

PROGRAMS LEADING TO THE DEGREE OF MASTER OF SCIENCE

Thesis Option:
Majors and minors are offered in the following areas:

Child and Family Studies

Consumer Studies and Housing:
  - Public Policy*

  * Requirements include Crafts, Interior Design, and Housing 5615 or Child and Family Studies 5170; Child and Family Studies 5700 or Planning 6100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5600. Three-hour course in research methods or statistics. Twenty-four hours in consumer studies or housing to include 9 hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5600.

Consumer Studies courses to be selected from Child and Family Studies 5140, 5170, 5180, 5700, 5800, 5900; Crafts, Interior Design, and Housing 5120; Food Science 4040; Textiles and Clothing 5180; Agricultural Economics 4710; Economics 4340, 5300-60; Finance 5210-20; Political Science 5641, 5670-80, 5910; Library and Information Science 5250.

Housing courses to be selected from Agricultural Mechanization 5110, 5610; Crafts, Interior Design, and Housing 4320, 5615, 5510-20-30; Planning 5360-80, 5450; Geography 9250.

Non-Thesis Option:

The non-thesis option is available for all majors listed under the thesis option and is the only option available for public health nutrition.

In addition to the regulations of the Graduate School, the non-thesis program of study for all majors except Consumer Studies and Housing: Public Policy** requires:

- Twelve hours in an area of home economics other than the area (consumer studies or housing) chosen above.
- Minimum 27 hours in and 9 hours outside College of Home Economics. Minimum of 27 hours 5000-6000 level courses and total minimum of 45 hours. Courses may be used to meet more than one requirement but all minimum requirements will need to be met.

** Requirements include those listed under the thesis option for the major in Consumer Studies and Housing: Public Policy except that 21 hours are needed in consumer studies or housing to include Home Economics 5000 (6 hours), or Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5060.
Home Economics requires:

- available in all departments in the College.
- department head not later than the end of one collateral area.
- 9 courses is required in the program of study.

DOCTORAL PROGRAMS

The doctoral program in Home Economics provides three options for study:

- Interdisciplinary, food science, and nutrition.
- The interdisciplinary option is available in all departments in the College.

The doctoral program with a major in Home Economics requires:

1. A minimum of 96 quarter hours in courses beyond the Bachelor's degree, exclusive of credit hours for the Master's thesis to include a minimum of 12 quarter hours of 6000-level courses.
2. Selection of an option and fulfillment of the requirements as supervised by the faculty committee.
3. The faculty committee for each doctoral student shall determine whether a reading knowledge of a foreign language is required.
4. Written preliminary examinations.
5. Doctoral research and dissertation (minimum 36 hours; maximum 48 hours) may be included in the 96 hours presented for the degree.
6. A final examination.

Option Requirements:

- Interdisciplinary option:
  1. Home Economics 6110-20, 6210.
  2. Twenty-four to 36 hours from at least two departments in the College of Home Economics representing one of the concentrations in the Interdisciplinary Option.

- Individual and Family Behavior as related to development and change throughout the human life cycle.

- Emphasis may be on:
  - Normal developmental processes, in individuals and families;
  - Socialization through 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 in humans throughout the life cycle. Emphasis for particular age groups may be on:
  - Physiological response to nutrient intake; improvement of nutritional status through informed community action; cultural, economic and technological influences on food selection.

Environmental Factors in design, housing, food service systems, clothing, textiles, and crafts as they relate to human needs. Emphasis may be on the impact of:

- cultural, sociological, psychological, and economic change;
- technological developments;
- aesthetics in improving the quality of the environment.

Consumers' Economic and Social Well-being throughout the life cycle. Emphasis may be on the relationship between family structure and decision-making processes in the use of human resources; the effects of social, macro- and microeconomics and political development on consumption patterns and other behavior; community programs to meet the socioeconomic needs of consumers.

- Fifteen to 24 hours in cognitive or supporting courses (mainly from departments in other colleges in the University) including courses to give sufficient competence in statistics or research methods needed for dissertation research. Additional courses will complement the option emphasis and dissertation research area.

- Doctoral research and dissertation will be based on a problem within the interdisciplinary option concentration.

- Food science option and food science with concentration in food systems administration:
  1. Three hours in research methods from Food Science 5510 or 5520 or Food Systems Administration 5210; 6 hours from Food Science 5610-20-30-40, 6110, Food Systems Administration 6110; and Zoology 5350 (Biometry) or equivalent.
  2. Twenty-four hours in 5000- and 6000-level courses in food science or in food systems administration.
  3. Nine hours in a collateral area (upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area may be substituted for 5000 and 6000 courses in food science or in food systems administration).
  4. Minimum of 4 hours of credit in doctoral seminar.

- Nutrition option:
  1. Thirty hours of 5000 or 6000 courses in nutrition exclusive of research and Zoology 5350 (Biometry) or equivalent.
  2. Nine hours in a collateral area (upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area may be substituted for 5000 and 6000 courses in food science or in food systems administration).
  3. Minimum of 4 hours of credit in doctoral seminar.

SPECIAL WORKSHOPS

Workshops on special topics of current interest are offered periodically by the different departments in the College of Home Economics. These are of special interest to those desiring to work for advanced degrees. Announcements are sent upon request.

Each quarter the craft workshop program in Gatlinburg, Tennessee, is made possible through cooperative efforts between the Crafts, Interior Design, and Housing Department and the Pi Beta Phi Arrowmont School of Crafts. The program provides advanced instruction in designer-created crafts through classes taught by nationally known craftsmen. Cooperation with national and local craft organizations has so stimulated the work of craftspeople throughout the area that their work has gained national recognition. See also page 92.

GRADUATE PROGRAMS FOR HOME ECONOMICS EXTENSION

Graduate programs at both the doctoral and Master's levels are available for students interested in home economics extension. At the doctoral degree level, programs of study may be planned in the interdisciplinary or in the food science or the nutrition options. A Master's degree major in Consumer Studies and Housing: Public Policy is particularly suitable for students interested in home economics extension, although Master's programs may be planned in any subject matter area of home economics with agricultural extension education as a collateral area. Additionally, four-week courses are offered in February each year for students particularly interested in home economics extension. Students interested in a graduate program and/or the four-week course should contact the Associate Dean of the College of Home Economics.

Departments of Instruction

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

Child and Family Studies

MAJORS

- Degree
- Consumer Studies
- Housing: Public Policy

Professors:

- R. L. Hightower, Ph.D. Iowa; J. L. Kuipers (Head), Ph.D. Michigan State.

Associate Professors:

- J. L. Cunningham, Ph.D. Michigan State;
- D. B. Eastwood, Ph.D. Tufts;
- V. M. Nordquist, Ph.D. Tennessee;
- R. M. Swagler, Ph.D. Ohio State;

Assistant Professors:

- M. F. Kainowski, Ed.D. Massachusetts;
- B. C. Miller, Ph.D. Minnesota;
- M. L. Rawlings, Ph.D. Pennsylvania State;
- D. B. Eastwood, Ph.D. Tennessee;
- L. Southworth, Ed.S. Tennessee;
- S. Twardosz, Ph.D. Kansas.

4110 Student Teaching in Preschool Settings (6) Increasing responsibility for planning and guiding groups of young children under supervision of head teacher; includes 2 hr weekly seminar. Prereq: Introduction to Early Education, Program Planning for Preschool Children, Creative Experiences for Preschool Children,
Child Development I. Coreq. Student Teaching of Preschool Children.

4210 Family Finance (3) Analysis of alternate ways of solving financial problems encountered during the family life cycle.

4220 Conserving Time and Energy in the Home (3) Application of management principles to the total evaluation of employment, work centers and work procedures in terms of time and energy demands. Adaptations for the handicapped.

4230 Infant Development (3) Development during prenatal period and during first 2 years of life. Prereq: Human Socialization or Family Systems: Human Development, physiology or equivalent.

4250 Adult Development and Aging (3) Adult life in our society. Adjustment to internal and environmental changes through middle and aging years. Prereq: Human Socialization or Family Systems: Human Development or equivalent or consent of instructor.

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

4420 Learning Experiences with Parents (3) Dynamics of parent-teacher interaction. Emphasis on a variety of techniques for developing communication and working relationships between parents and educators through experiences in a variety of settings. Prereq: Observation and Experience in Preschool Programs or 4110 or equivalent.

4430 Family Relationships (3) Interpersonal relationships among family members and societal roles. Prereq: Intimate Relationships or Family Development.

4610 Child in the Community (3) Needs of children; community agencies meeting these needs; visits to agencies contributing to the welfare of children. Prereq: Human Socialization, Family Systems: Human Development or equivalent.

4620 Administration of Programs for Young Children (3) Planning for the staff, housing, feeding, scheduling, and financing for day care of infants and young children, nursery school programs, and specialized programs for exceptional young children. Prereq: Program Planning for Preschool Children, Music and Literature for Preschool Children, or 4110.

4630 Field Work in Child, Family and Consumer Studies (3) Opportunity for students to become acquainted with related agencies; focus on children, families, and/or consumer concerns. Hrs arranged. May be repeated. Maximum 15 hrs.

4710 Contemporary Developments (1-3) A student or staff initiated course for study of a special topic or topics pertinent to the field; topics selected for study to be determined by students and instructor with departmental approval. Elective credit only. Prereq: Consent of Instructor. May be repeated with consent of department head. Maximum 9 hrs.

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

4830 Consumers and the Market (3) Factors important to homemakers as family purchasing agents; standardization of goods; grading, branding, labeling; advertising; consumer practices affecting costs; specific household commodity information. Prereq: Principles of Economics.

5000 Thesis

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

5060 Practicum (1-12) Field experience in selected agencies that will provide exposure to the role and function of the professional on solutions to problems in consumer studies.

5110 Field Work in Family Life (3) School and community programs concerned with education for family living. Prereq: Consent of department head. May be repeated. Maximum 9 hrs.

5140 Consumption and Standards of Living (3) Economic and welfare aspects of consumption. Analysis of factors associated with changes in the standards of living. Review of major consumption studies. Prereq: Crafts, Interior Design & Housing 4320 or consent of instructor.

5150 Assessment of Family Behavior (3) Use and interpretation of methods of measurement related to the study of the family. Current methodological issues in the study of the family. Prereq: 5410 and 5530 or consent of instructor.


5170 Consumer Economics (3) Consumer functions in the economy; structure of consumer markets; government action relating to consumers; factors affecting prices of consumer goods.

5180 Family Financial Consultation (3) Analysis of family expenditure patterns, consideration of common financial difficulties, and avenues by which families are assisted. Field experience in family counseling and counseling services. Prereq: 4210 or 4630 or 5170.

5190 Standards in Consumer Protection (3) Product and performance standards in consumer protection. Theoretical and practical questions relating to standards including analysis of costs and benefits to consumers. Prereq: 4830, 5170 or consent of instructor.

5210 Theories of Child Development (3) Major theories of child development. Prereq: 4350 or equivalent.

5220 Family Life Programs (3) School and community programs in family life; survey and evaluation; students concentrate on type best suited to their experience and future professional orientation. Prereq: 3 hrs child development, 3 hrs family relationships, 3 hrs sociol. 2 hrs and 1 lab.

5310 Theory and Research on Human Sexuality (3) Cultural, social, and psychological dimensions of human sexuality. Review of major contributions from anthropological, sociological, and personality theory and research.

5410 Advanced Family Relationships (3) Problems in modern family life; individual adjustment, group relationships. Prereq: Family Development, 4430, or consent of instructor.

5420 Parents and Children (3) Discussion of common problems of young children faced by parents and teachers with particular emphasis on methods available to modify problem behavior.

5430 Families in Crisis (3) Interpersonal transactions in disordered family behavior. Prereq: 5410 or equivalent.

5510 Survey of Research in Child and Family Studies (3) Review, evaluation, discussion of research literature; locating, abstracting, reporting research studies. Prereq: 5530 or equivalent.

5530 Research Methods in Child and Family Studies (3) Selection of theoretical and methodological issues in the field of child and family studies. Prereq: Basic courses in beginning statistics and advanced statistical methods.

5540 Research and Preparation of Course Program (1-3) Design and preparation of course program for advanced study in the field of child and family studies or preschool education.

5550 Supervision in Child Care Courses (3) Emphasis on student supervision of students working in nursery schools and day care centers. Guiding students through seminar discussion, individual conferences and various evaluation techniques. Prereq: 5540. 3 hrs and 1 lab (2 hrs).

5610 Theories of Management in the Family Environment (3) Examination of fundamental management concepts, their development and application to current family situations.

5620 Nursery School Administration (3) Organization and operating schools and play groups for preschool children. Housing, staff, schedules, programs, financing. Prereq: 4110 or equivalent.

5630 Seminar in Infant Development (3) Theory and research relating to development during infancy. Prereq: 4330.

5640 Teaching Child and Family Studies (5) Seminar and practicum in techniques for teaching child and family studies in nursery schools and family development and family relationships. Prereq: Consent of instructor. S/NC only.


5800 Problems in Child, Family and Consumer Studies (1-3) Advanced study selected from the field of child development and family living and implications of recent developments and research relating to children and families. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5900 Seminar in Child and Family Studies (1-3) Prereq: Consent of Instructor. May be repeated. Maximum 9 hrs.


6250 Advanced Topics (3) Comprehensive individual study and group discussion of topics related to current problems in the area. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6310 Individual and Family Development—Physiological Determinants (3) Selected aspects of family members’ physiological potential, development, and status. The family’s contribution to members’ physiological potential for growth and development and to the realization of human potential. Prereq: 6 hrs in advanced child and family studies, 4 hrs nutrition, 3 hrs physiology, or equivalent.

6320 Individual and Family Development: Cognition (3) Processes through which the individual learns to recognize his world. Emphasis on cognitive processes involved in development across the life span with focus on research findings and methodology. Prereq: 5210, 5530, 5550, or equivalent.
6320 Individual and Family Development: Socialization (3) Processes of socialization throughout the life cycle. Focus on the family as a primary socializing agent. Prereq: 5210, 5410 or equivalent.

6410 Theories of Family Interaction (3) Review of theories and concepts of family interaction. Emphasis on critical evaluation of theoretical formulations of contemporary research on family behavior. Prereq: 5410 or equivalent.

6450 Conceptual Frameworks for the Family (3) Theoretical perspectives for understanding families. Exploration and applications of frameworks both historical and research levels. Historical to contemporary development of family studies. Prereq: 5410 or consent of instructor.

6540 Seminar in Programs for Infants and Preschool Children (3) Exploration of research related to programs for infants and young children. Evaluation of various program models for education of infants and young children. Methods of working with parents, and student training programs. Prereq: 5210, 5540 or equivalent.

6510-20 Applied Behavior Analysis in Natural Settings (6) Individual supervision in the application of applied behavior analysis in natural settings. Prereq: 5210 or consent of instructor.

6710 Elements of Consumer Choice (3) Analysis of consumer decision making, beginning with the theory of consumer choice. Impact of affluence on consumers and consideration of dynamic aspects of consumer behavior, including the roles of aspirations, expectations, uncertainty and information. Prereq: 5170 or consent of instructor.

6720 Consumer Protection (3) Consumer protection, including regulatory agencies, standards, information disclosure and other consumer protection legislation. Assumptions involved in these efforts and relative success of different strategies. Prereq: 5170, 5190 or consent of instructor.

Crafts, Interior Design, and Housing

MAJORS DEGREES
Crafts, Interior Design, and Housing M.S.

Consumer Studies and Housing: Public Policy Ph.D.

Home Economics

Professors:
- R. G. Blakemore (Head), Ph.D. Florida State; J. Falmes, M.A. Utah State

Associate Professors:
- W. Moran, M.S. Wisconsin; R. Pierotti (Director, Pi Beta Phi Arrowmont School of Crafts), M.F.A. Utah

Assistant Professors:
- S. Blain, M.F.A. Wisconsin; R. Daehnert, M.F.A. Wisconsin; J. Darrow, Ed.D. Illinois State; A. K. Farkas, Ph.D. Minnesota

Lecturers:


To be admitted to the Graduate School in the craft program a student must have a professional knowledge of media and technique. Work with creative design concepts is emphasized at the graduate level; media and technique are important only in so far as the experimentation with these contributions to the concept and creative orientation of the designer-craftsperson. Courses are, therefore, based on theory or philosophical concepts in order to facilitate the development of visual sensitivity in relation to design. Major emphasis will be on the visual image as a personal interpretation of the media. Because the philosophical orientation of the student varies widely, progression from one level to another is based on the understanding and communication of visual concepts.

A student's course of study includes intensive training in the chosen areas of specialization such as metalwork, ceramics, weaving, textile design, or interior design as well as courses dealing with the broader aspects of design. All student programs include: Seminar in Design (5040), Advanced Design Studio (5050), and research methods; in addition, craft majors include Exhibition Design (4140). An interdisciplinary program in Consumer Studies and Housing: Public Policy is available to students with interest in the social science approach to housing. Courses dealing with the design aspects of housing may be elected.

PI BETA PHI ARROWMONT SCHOOL OF CRAFTS

Graduate students in the area of crafts have an unique opportunity to participate in summer program at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee; credit is granted through the University of Tennessee, Knoxville. Instructions at the school are national and internationally recognized designers-craftspersons who offer, in many instances, different approaches to those of the resident faculty; this further enriches the student's program of study. Craft courses are not offered on the Knoxville campus in the summer quarter. Therefore, students attending UT during the summer for crafts study are required to attend the Pi Beta Phi Arrowmont School of Crafts and to pay the additional registration, tuition, and laboratory materials fees required by that school.

ACQUISITIONS AND EXHIBITIONS

For crafts and interior design majors, the department reserves the right of acquisition and exhibition of work completed in its studios under the guidance of the faculty. Prospective graduate students should submit a portfolio of their undergraduate studio work to the department. This portfolio may include slides or original work.

4110 Home Wiring and Lighting Requirements (3) Service of electricity in modern homes; evaluation of lighting and wiring plans in terms of family needs and need for equipment. 1 hr and 2 labs.

4130 Contemporary Design (3) Furnishings and interiors; economic, technological and sociological influences on the development of design; changing living conditions; interrelation of architecture and furnishings. Significant designers and their work.

4140 Exhibition Design (4) Display of craft and interior design problems in relation to materials, props and special exhibition areas. Emphasis on knowledge and application of the design principles and techniques; the planning, design construction, display and evaluation for two- and three-dimensional displays. Annual student exhibition. Credit is granted through the summer quarter. Prereq: Introduction to Related Arts or equivalent.

4155 Interior Space Planning I (6) Analysis, planning and design of the office environment; includes contract specifications.

4156 Interior Space Planning II (6) Studio problems involving large scale nonresidential interior spaces such as restaurants, transportation facilities, stores, institutions. Prereq: 4155 or consent of instructor.

4310 Crafts in America (3) Craft movement; factors that contributed to growth and development. Educational, social, economic, recreational and therapeutic values of crafts. Place of craftsperson in society as producer, teacher, designer for industry.

4320 Family Housing Problems (3) Housing requirements of families. Reading and judging house plans; effective use of space; maintenance problems; housing regulations and restrictions; site selection and neighborhood development; financing procedures. Prereq: Principles of Economics.

4330 Care and Repair of Household Equipment (3) Care of equipment to give maximum service in relation to operation and service cost; understanding of common repair problems. Prereq: Equipment in the Home. 1 hr and 2 labs.

4410 Craft Media (4) Possibilities and limitations of craft media; understanding educational and social values of craft work. Designing and executing craft problems using inexpensive materials and tools. 3 labs.

4420 Leather Design (4) Relationship of design to function, techniques and materials. Creating leather objects of original design. 1 hr and 2 labs.

4430 Plastics (4) Possibilities and limitations of various plastics; methods of fabrication; relation of design to function, processes, types of material and use of tools. 1 hr and 2 labs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) 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.
of aesthetic concepts in two- and three-dimensional forms in enameling. 5365—Experimentation in experimentation using aesthetic concepts in the development of two- and three-dimensional forms in plastic. 5366—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in plastics and consent of department head. Each course may be repeated one time.

5347-57-67 Ceramics I, II, III, (4, 4, 4) 5347—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in ceramics. 5357—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in ceramics. 5367—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in ceramics and consent of department head. Each course may be repeated one time.

5350-60-70 Fabric Structures I, II, III, (4, 4, 4) 5350—Initial development of theory for investigation of aesthetic concepts nonwovens weaving processes. 5360—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in metal design. 5370—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5341-52-62 Weaving I, II, III, (4, 4, 4) 5342—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in fiber constructions. 5352—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in weaving. 5362—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in weaving and consent of department head. Each course may be repeated one time.

5343-53-63 Textile Design I, II, III, (4, 4, 4) 5343—Initial development of theory for investigation of aesthetic concepts for the surface decoration of textiles. 5353—Advanced experimentation in unifying aesthetic concepts in the surface decoration of textiles. 5363—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in textile design and consent of department head. Each course may be repeated one time.

5344-54-64 Wood Design I, II, III, (4, 4, 4) 5344—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in wood design. 5354—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in wood design. 5364—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in wood design and consent of department head. Each course may be repeated one time.

5345-55-56 Enameling I, II, III, (4, 4, 4) 5345—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in enameling. 5355—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in enameling. 5365—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in enameling and consent of department head. Each course may be repeated one time.

5346-56-66 Plastics I, II, III, (4, 4, 4) 5346—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in plastic. 5356—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in plastic. 5366—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in plastics and consent of department head. Each course may be repeated one time.

5350-60-70 Fabric Structures I, II, III, (4, 4, 4) 5350—Initial development of theory for investigation of aesthetic concepts nonwovens weaving processes. 5360—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in metal design. 5370—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5357—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in ceramics. 5367—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in ceramics and consent of department head. Each course may be repeated one time.

5368 Ceramics—Glaze Calculation (4) Experimentation with various types of clay bodies and glazes for reduction and oxidation firing atmospheres. Prereq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5369 Ceramics—Kiln Construction (4) Investigation of various sizes and types of kilns and burner systems which promote reduction and oxidation firing atmospheres. Prereq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5410 Advanced Problems (3) Individual development of techniques and preparation. Prereq: 8 hrs related art or equivalent.

5510 Environmental Factors in Interior Design (3) Examination of various concepts, theories and techniques used in determining performance of microenvironments. Prereq: Consent of instructor.

5520 Experimental Methods in Household Economics (3) Research methods and techniques used in determining performance of household equipment. Prereq: Equipment in the Home or consent of instructor. 1 hr and 2 labs.

5530 Environmental Requirements for Family Work Centers (3) Trends in planning work centers areas such as for kitchens and laundry; evaluation in terms of adequacy, convenience, surface treatment, facilities and costs; problems of installation and remodeling.

5540 Bank Credit and Management (3) Principles of credit and financing for various types of business. Prereq: 5510-20-30.

5550 Advanced Design Studio (4) Studio experience planned to explore strengths, structural and formal characteristics. Prereq: Consent of instructor.

5560 Practicum (1-12) Field experience in making design decisions. Prereq: Consent of instructor. 6 hrs science, and 6 hrs natural science or consent of instructor.

5580 Perspectives in Crafts and Interior Design (3) Examination of various concepts, theories and techniques used in determining performance of microenvironments. Prereq: Consent of instructor.

5590 Advanced Design Studio (4) Studio experience planned to explore strengths, structural and formal characteristics. Prereq: Consent of instructor.

6420 Perspectives in Crafts and Interior Design (3) Historical influences as related to handcrafted objects. Prereq: 5510-20-30.

6510 Environmental Design Analysis (3) Advanced methodology in the psychology of environmental design with particular attention to multidisciplinary research data and methods. Prereq: 5510-20-30.

6520 Role of Crafts in Society (3) Comprehensive individual study and group discussion of advanced concepts and current problems in crafts. Prereq: 4310, 5040, 6 hrs of graduate level sociology, or consent of instructor.

6530 Advanced Topics in Housing Research (3) Examination of various concepts, theories and techniques used in determining performance of microenvironments. Prereq: Consent of instructor.

6540 Bank Credit and Management (3) Principles of credit and financing for various types of business. Prereq: 5510-20-30.

6550 Advanced Design Studio (4) Studio experience planned to explore strengths, structural and formal characteristics. Prereq: Consent of instructor.

6560 Practicum (1-12) Field experience in making design decisions. Prereq: Consent of instructor. 6 hrs science, and 6 hrs natural science or consent of instructor.

6590 Introduction to Interior Design (3) Study of design methodology applied to the design of environments. Prereq: Consent of instructor.

6610 Environmental Design Analysis (3) Advanced methodology in the psychology of environmental design with particular attention to multidisciplinary research data and methods. Prereq: 5510-20-30.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td>Origin of Food and Foodways (3) Traction of food and the development of individual and group food habits. Prereq: 6 hrs social science or humanities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4010</td>
<td>Introductory Experimental Food Science (3) Use of physical and sensory evaluation in experimentation with fats, high protein foods, and batter and dough systems. Prereq: Nature of Foods II.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4040</td>
<td>Food in Contemporary Society (3) Consumer's options, responsibility and potential influence with respect to food supply.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5000</td>
<td>Thesis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5310</td>
<td>Seminar in Related Art, Crafts and Interior Design (1-4, 1-4, 1-4)</td>
<td>(Same as 5910)</td>
<td></td>
</tr>
<tr>
<td>5331</td>
<td>Studio Problems in Leather Design (1-4)</td>
<td>(Same as 4651)</td>
<td></td>
</tr>
<tr>
<td>5342</td>
<td>Studio Problems in Weaving (1-4)</td>
<td>(Same as 4661)</td>
<td></td>
</tr>
<tr>
<td>5345</td>
<td>Studio Problems in Textile Design (1-4)</td>
<td>(Same as 4671)</td>
<td></td>
</tr>
<tr>
<td>5346</td>
<td>Studio Problems in Wood Design (1-4)</td>
<td>(Same as 4681)</td>
<td></td>
</tr>
<tr>
<td>5347</td>
<td>Studio Problems in Plastics (1-4)</td>
<td>(Same as 4691)</td>
<td></td>
</tr>
<tr>
<td>5348</td>
<td>Studio Problems in Ceramics (1-4)</td>
<td>(Same as 4691)</td>
<td></td>
</tr>
<tr>
<td>5351</td>
<td>Studio Problems in Leather Design (1-4)</td>
<td>(Same as 4651)</td>
<td></td>
</tr>
<tr>
<td>5352</td>
<td>Studio Problems in Weaving (1-4)</td>
<td>(Same as 4661)</td>
<td></td>
</tr>
<tr>
<td>5353</td>
<td>Studio Problems in Textile Design (1-4)</td>
<td>(Same as 4671)</td>
<td></td>
</tr>
<tr>
<td>5354</td>
<td>Studio Problems in Wood Design (1-4)</td>
<td>(Same as 4681)</td>
<td></td>
</tr>
<tr>
<td>5355</td>
<td>Studio Problems in Plastics (1-4)</td>
<td>(Same as 4691)</td>
<td></td>
</tr>
<tr>
<td>5356</td>
<td>Studio Problems in Ceramics (1-4)</td>
<td>(Same as 4691)</td>
<td></td>
</tr>
<tr>
<td>5370</td>
<td>Food and Sociocultural Change (3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5550 or 5560; or consent of instructor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5900</td>
<td>Seminar (1-3) May be repeated. S/NC only.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5700</td>
<td>Current Programs and Trends in Food Science (3) Recent advances in food science, their impact on curricular considerations, and their implications for teachers, extension workers, and dietitians. Prereq: Consent of instructor. May be repeated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6000</td>
<td>Doctoral Research and Dissertation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6110</td>
<td>Advanced Topics in Food Science (3) Recent advances in food science, nutrition and food systems administration majors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6310</td>
<td>Structure of Food Plants and Animal Tissues (3, 3) Histological structure of food plants and animal tissues as related to physical characteristics and chemical properties of their components. Prereq: 5630-40.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6510</td>
<td>Food and Sociocultural Change (3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5550 or 5560; or consent of instructor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6900</td>
<td>Seminar (1-3) May be repeated. S/NC only.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Nutrition**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>3310</td>
<td>Organic Chemistry (4) Emphasis on subjects leading to 3320-30 and Textiles and Clothing 3520. Prereq: General Chemistry. 3 hrs and 1 lab. Not for graduate credit for food science, nutrition and food systems administration majors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3320</td>
<td>Food Analysis (4) Elementary quantitative analysis; typical food analyses. Prereq: 3310 or equivalent. 3 hrs and 1 lab. Not for graduate credit for food science, nutrition and food systems administration majors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3330</td>
<td>Physiological Chemistry (3) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Prereq: 3320 or equivalent. Not for graduate credit for food science, nutrition and food systems administration majors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3339</td>
<td>Physiological Chemistry Laboratory (1) Prereq: 3320. Coreq: 3330. 1 lab. Not for graduate credit for food science, nutrition and food systems administration majors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4010</td>
<td>Reproductive and Developmental Nutrition (3) Nutritional requirements for expectant mothers, infants, and preschool children. Prereq: 6 hrs of nutrition. 2 hrs and 1 lab.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4020</td>
<td>Nutrition for Children, Adolescents and Adults (3) Application of basic principles and research findings to good nutrition for children, adolescents and adults. Prereq: 6 hrs of nutrition. 2 hrs and 1 lab.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4030</td>
<td>Community Nutrition (3) Introduction to nutrition problems and services in the community; supervised field experiences are an integral part of the course. Prereq: 6 hrs of nutrition.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4110</td>
<td>Introduction to Nutrition Research (3) Discussion of principles and laboratory experiences. Prereq: 6 hours of nutrition. 2 hrs and 1 lab.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4230</td>
<td>Nutrition in Disease (4) Nutrition problems in diseases influenced by diet. Prereq: 5 hrs Science of Nutrition. 3 hrs and 1 lab.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4231</td>
<td>Clinical Experience in Dietetics (1) Planned clinical experiences applying principles of nutrition in disease. Coreq: 4230.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4240 Nutrition in Disease II (3) Interdisciplin ary lectures and discussions on the metabolic processes of normal and diseased organs and/or tissues and the dietary or behavior modifications required. Prereq: 4230. Designed for senior students in the coordinated undergraduate program in dietetics.

4430 Diet and Drug Therapy (3) Effect of drug therapy on absorption and utilization of nutrients, and effect of diet on absorption, utilization and toxicity of drugs. Prereq: Science of Nutrition or consent of instructor.

5000 Thesis

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

5110 Advanced Physiological Chemistry (4) Bioenergetics and related metabolism of nutrients. Prereq: 3330 or equivalent. 3 hrs and 1 lab.

5120 Advanced Physiological Chemistry (3) Nutritional factors in relation to body fluids, gas transport and endocrine function. Prereq: 3330.

5140 Foods and Nutrition: Physicochemical Principles (3) Introduction to thermodynamics; physicochemical properties of proteins, carbohydrates and lipids; chemistry of the colloidal state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: Nutrition 3350 and College Algebra or equivalent.


5310 Community Nutrition (3) Nutrition problems and practices in the community; supervisory field experience. Prereq: 5 hrs Science of Nutrition; consent of instructor. 3 labs.

5320 Community Nutrition (3) Observations and participation in nutrition programs of local and state agencies. Prereq: 5310 and consent of instructor. 3 labs.

5330 Community Nutrition (3) Nutrition programs of state and federal agencies; preparation of material for nutrition education; supervised field work. Prereq: Consent of instructor. 3 labs.

5340 Field Study in Community Nutrition (1-12) Personal participation in and analysis of a state or regional community nutrition program. Location of the in-depth study to be selected in consultation with the instructor. Prereq: 5320 and consent of instructor. S/NC only.

5350 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students in training at the Child Development Center, UT Center for the Health Sciences, Memphis. Prereq: Consent of the department head.

5410-20 Human Nutrition (3, 3) Functions of carbohydrates, proteins, fats, minerals and vitamins. Nutritional requirements of man throughout the life span and practical problems in meeting requirements. Prereq: 5 hrs Science of Nutrition; 5110.

5430 Physiological Bases for Diets in Disease (3) Developments in the dietary treatment of disease in which nutrition plays a major role. Prereq: Consent of instructor.


5450 Survey Methods in Human Nutrition (3) Food consumption, food practices and nutritional status of population groups. Prereq: 5210 or 5410-20. 2 hrs and 1 lab.

5460 World Food Supply and Human Nutrition (3) Food supplies and food practices as related to human nutrition throughout the world. Regional, national and international agencies concerned with food and nutrition problems. Prereq: 5210 or 5410-20.

5470 Nutrition and Aging (3) Nutritional problems of the aging individual. Emphasis on nutritional requirements, dietary intakes and the effect of nutrition on the rate of biological aging. Prereq: 5210 or consent of instructor.

5610 Nutrition in Mental Retardation and Developmental Disorders (1-12) Orientation to, observation of and participation in the interdisciplinary diagnosis and treatment of the developmentally-handicapped child. Emphasis on the role of nutrition in treatment; includes clinical experience and lectures at the Child Development Center, Center for the Health Sciences, Memphis. Prereq: Consent of department head.

5700 Current Programs and Trends in Nutrition (1-3) Discussion of selected recent developments in field of nutrition and their implications for the functions of health professionals, public health nutritionists, and others in related fields. May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

5800 Problems in Nutrition (1-3) Advanced study selected from the field of nutrition. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5950-60 Seminar (1, 1) May be repeated.

6000 Doctoral Research and Dissertation

6110 Proteins and Amino Acids (3) Lectures, reports and discussions. Prereq: 5410-20.

6120 Mineral Metabolism (3) Lectures, reports and discussions of functions of minerals in physiological processes. Prereq: 5410-20.

6130 Lipid Metabolism (3) Lectures, reports, and discussions. Prereq: 5410-20.

6140 Vitamin Metabolism (3) Lectures, reports, and discussions. Prereq: 5410-20.

6210 Advanced Topics in Nutrition (1-3) Discussion of recent advances, concepts, research techniques and current problems. Prereq: 5410-20 or consent of instructor.

6900 Seminar (1-3) May be repeated. Maximum 9 hrs. S/NC only.

Food Systems Administration

4130 Food Systems Administration (3) Functions of management applied to food service systems. Prereq: Quantity Food Procurement, Production and Service.

4140 Food Systems Personnel Development (3) Development of training programs for food systems personnel. Prereq: 4130 or consent of instructor.

4150 Design and Layout of Food Service Systems (3) Physical facilities equipment for food service systems based on needs of the system. Procedures for purchasing equipment. Prereq: Quantity Food Procurement, Production and Service, or consent of instructor.

4250 Food and Lodging Managerial Cost Control (3) Cost analysis for control. Use of financial statements for decision making for food and lodging operations. Prereq: 4150; Fundamentals of Accounting.

4260 Food and Lodging Physical Plant, Planning and Maintenance (4) Feasibility, planning, development and construction of food and lodging physical plant and maintenance. Electrical, mechanical, heating, plumbing, air conditioning and ventilation systems. Types of building materials and construction. Interdisciplinary with home economics and architecture. Prereq: Quantity Food Procurement, Production and Service; 4150; or consent of instructor, 3 hrs and 1 lab. (Same as Architecture 4260.)

4270 Food and Lodging Information Systems (3) Qualitative and quantitative analysis of information systems for decision making in food and lodging operations. Prereq: 4150, 4250, and Electronic Data Processing.

5000 Thesis

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

5110 Experimental Quantity Food Study (3, 3) Analysis of food cost, revenue, environment, and service systems based on needs of the system. May not be used toward degree requirements. May be repeated. S/NC only.

5120 Experimental Quantity Food Study (3, 3) Analysis of cost, revenue, environment, and service problems related to quality of food prepared in volume. Use of management resources. Prereq: 4130, Quantity Food Procurement, Production and Service, or consent of instructor.

5120 Experimental Design of Food System Facilities (3) Experimental approach to environment in which food is prepared, held, and served in volume. Prereq: 4150.

5230 Food Systems Evaluation (3) Evaluation of management resources in food systems. Standards for control. Prereq: 4130, or consent of instructor.


5310 Administration of Food Service Delivery Systems (3) The role and responsibilities of the administrator in maintaining desired qualitative and quantitative standards in a food service delivery system. Prereq: Quantity Food Procurement, Production and Service or consent of instructor.

5500 Clinical Training in Health Care Agencies (3) Instructional and supervisory techniques utilized in clinical settings by nurses and dietitians for the training of entry-level health care providers. Prereq: Management of Health Care or 4140 or consent of instructor.

5700 Current Programs and Trends in Food Systems Administration (3) Recent advances in food systems administration and their implications for dietitians, school food service directors and others in related fields. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Systems Administration (1-3) May be repeated.

5850 Field Experience (3-9) Planned administrative experience in a food service system. Prereq: Consent of instructor.

5900 Seminar in Food Systems Administration (1-3) May be repeated.
Home Economics

MAJOR

Home Economics

DEGREE

Ph.D.

Professors:

L. M. Odland (Dean), Ph.D. Wisconsin, D.Sc.
Rhode Island; G. E. Goertzen (Associate Dean), Ph.D. Kansas State.

Assistant Professor:

J. L. Cunningham, Ph.D. Michigan State.

Assistant Professor:

V. S. Anagnost (Assistant Dean), M.S. Tennessee.

Textiles and Clothing

MAJORS

Textiles and Clothing

DEGREES

M.S.

Home Economics

Ph.D.

Major

A. J. Treese (Head), Ph.D. Ohio State.

Associate Professors:

M. Fox, Ph.D. Pennsylvania State;
B. C. Goswami, Ph.D. Manchester (England);
C. J. Noél, Ph.D. Notre Dame.

Faculty Associate:

T. L. Vigo, Ph.D. Tulane.

Assistant Professors:

R. P. Dowlen, M.S. Tennessee; M. F. Miller, Ph.D. Pennsylvania State.

Lecturer:

A. L. Bullock, B.S. Mississippi College.

Textile Microscopy (3) Introduction to microscopic techniques as applied to the study of textile fibers and fabrics. Prereq: Textiles II; Textile Chemistry. 1 hr and 2 labs.

Design Analysis II (3) Creative interpretation of design terminologies in finished garments developed through the media of draping. 1 hr and 2 labs.

Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise prescribed. Prereq: Consent of instructor. May be repeated. S/NC only.

Textile Testing and Methods of Research in Textiles (3) Physical and chemical testing. Research methods. 3 labs.

Advanced Problems in Textiles and Clothing (3) Refresher course; emphasis on new developments in textiles. Aids in selecting fabrics, agencies aiding consumer, and individual problems which students have met in the textile field. 2 hrs and 1 lab.

Advanced Tailoring (3) Comparison of hand and machine methods used in making suits, coats, or costumes. 3 labs.

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.

Review of Literature (3) Intensive survey and evaluation of recent literature; implications for further research.

Social, Psychological and Economic Aspects of Clothing (3) Clothing as it relates to human behavior. Prereq: 6 hrs or equivalent from one of the following areas: sociology, psychology, economics.

Advanced Textile Economics (3) Economic problems or problem areas of current importance in the textile and apparel industries—production, consumption, and government policy. Prereq: 3420, 6 hours of economics or consent of instructor.

Evaluation of Instructional Materials in the Field of Textiles and Clothing (3) Evaluating instructional materials to use in communicating information in the various areas of textiles and clothing. 1 hr and 2 labs.

Historic Textiles (3) Development of the textile industry in the world with emphasis on fibers used, design and color.

Practicum (1-9) Off-campus experience with business, industry, governmental agencies and civic groups; preplanned; supervised. Prereq: Consent of major advisor and department head. May be repeated. Maximum 9 hrs. S/NC only.

Problems in Textiles and Clothing (1-3) Advanced study selected from the field of textiles and clothing. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
5900 Seminar in Textiles and Clothing (1-3)
Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6110 Selected Issues in Textiles and Clothing (3) In-depth investigation of advanced topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

6140 Selected Behavioral Theories in Clothing (3) Role of clothing in the functioning of people, utilizing behavioral theories. Prereq: 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6150 Social-Psychological Theories of Clothing Consumption (3) Analysis and evaluation of social science theories of consumer behavior in relation to the areas of textiles and apparel. Prereq: Child and Family Studies 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6160 Textile Flammability (3) Factors affecting textile flammability as a consumer issue. Standards, regulations, test methods, economic impact. Prereq: 5120, 5160, 5250, or consent of instructor.

6170 Physical Performance Behavior of Textile Structures I (3) Fundamentals of yarns and fabric structures; relationship of structure to physical characteristics of textile materials. Prereq: 5120, or consent of instructor.

6910 Seminar in Textiles and Clothing (1-3)
May be repeated. Maximum 6 hrs.
Aviation Systems

MAJOR
Aviation Systems

DEGREE
M.S.

Requirements:

1. Eighteen quarter-hour credits in the major field of aviation systems.
2. For the research and development area, six quarter hours in Industrial Engineering 5700 and Industrial Engineering 5710 and for the administration area, six quarter hours in Economics 5070 and Accounting 5810, for a total of 12 quarter hours.
3. Six quarter hours of electives selected from the major field, engineering and/or the areas in item 2.
4. Nine quarter hours in Aviation Systems 5000, Thesis, hence demonstrating the ability to conduct and report on an independent investigation.

The non-thesis program will be permitted in special circumstances and involves satisfactory completion of the following minimum requirements:

1. Eighteen quarter-hour credits in the major field of aviation systems.
2. For the research and development area, nine quarter hours in Industrial Engineering 5700, Industrial Engineering 5710, and Industrial Engineering 5720 and for the administration area, nine quarter hours in Economics 5070, Accounting 5810, and Finance 5510, for a total of 18 quarter hours.
3. Six quarter hours of electives in one of the areas in item 2.
4. Six quarter hours of electives in the major field, engineering and/or the areas of item 2.
5. Satisfactory completion of 3 quarter hours in Aviation Systems 5100, Project in Aviation Systems.
6. Satisfactory completion of a comprehensive final written examination on all course work submitted for the degree and defense of the project course paper.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.


Electives typical of those suitable for credit in the area of Aviation Systems, Research and Development include: Aerospace Engineering 5150-60-70; Computer Science 3150 or equivalent, a background in statistics as represented by Statistics 3450 or equivalent, a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance as represented by Aerospace Engineering 4110 and Aerospace Engineering 4120 or equivalent, a background in accounting as represented by Accounting 5710 or equivalent basic accounting courses, a basic knowledge of economics as represented by Introductory Economics or equivalent.

The University of Tennessee Space Institute offers this program leading to the Master of Science with a major in Aviation Systems. The Aviation Systems program is designed for those who possess Bachelor's degrees in engineering or science and who wish to study under a "systems philosophy" toward careers in research and development or administration in various phases pertinent to aviation.

The program features 18 quarter hours major field credit in various aspects of aviation systems, 6 or more quarter hours credit in each of the areas of research, development and administration, and electives which permit further specialization in either area.

To qualify for admission to this program, the applicant must possess a Bachelor's degree in engineering or science from a recognized institution, show evidence of ability to pursue and benefit from the program, and fulfill The University of Tennessee Graduate School admission procedures and grade point standards. Subject matter prerequisite to the program includes basic knowledge of computer utilization as represented by Computer Science 3150 or equivalent, a background in statistics as represented by Statistics 3450 or equivalent, a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance as represented by Aerospace Engineering 4110 and Aerospace Engineering 4120 or equivalent, a background in accounting as represented by Accounting 5710 or equivalent basic accounting courses, a basic knowledge of economics as represented by Introductory Economics or equivalent.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.


Electives typical of those suitable for credit in the area of Aviation Systems, Research and Development include: Aerospace Engineering 5150-60-70; Computer Science 3150 or equivalent, a background in statistics as represented by Statistics 3450 or equivalent, a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance as represented by Aerospace Engineering 4110 and Aerospace Engineering 4120 or equivalent, a background in accounting as represented by Accounting 5710 or equivalent basic accounting courses, a basic knowledge of economics as represented by Introductory Economics or equivalent.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.


Electives typical of those suitable for credit in the area of Aviation Systems, Research and Development include: Aerospace Engineering 5150-60-70; Computer Science 3150 or equivalent, a background in statistics as represented by Statistics 3450 or equivalent, a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance as represented by Aerospace Engineering 4110 and Aerospace Engineering 4120 or equivalent, a background in accounting as represented by Accounting 5710 or equivalent basic accounting courses, a basic knowledge of economics as represented by Introductory Economics or equivalent.
munity, collection and distribution, demand requirement analyses, types of developments and their projections. Prereq: Aerospace Engineering 5810.

5080 Collection and Distribution (3) Capabilities of hydrologic and meteorological data, programs and development methods for collecting and distributing passengers and freight to and from various types of shipping facilities, including air, water, and mixed transportation modes, present and future; requirements analysis, and model analysis of the system. Prereq: Aerospace Engineering 5810.

5090 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure and administrative and enforcement procedures. Prereq: Aerospace Engineering 5810.

5100 Project in Aviation Systems (3) In-depth study and formal report on an aviation systems topic, normally performed during the last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.

5210-20 Experimental Flight Mechanics (3, 3) Consideration of flight mechanics with emphasis on experimental techniques. Specialized, equipped airborne laboratory allows active student participation in a series of experiments demonstrating the acquisition of flight test data. Tests will be conducted covering a broad range of aircraft performance, stability and control characteristics. Students will be expected to evaluate and develop the theory necessary to support the class experiments, test techniques, instrumentation and data reduction methods, and to develop the analysis of the series of lectures included in the course. 5210 emphasizes performance and 5220 emphasizes stability and control. Prereq: Aerospace Engineering 4120.

5970 Special Topics in Aviation Systems (3) Current problems in aviation systems. Prereq: Consent of instructor. May be repeated with consent. See also course descriptions for Aerospace Engineering 5810, 5820, and Industrial Engineering 5840.

Cybernetics and Bionics

Professors: T. C. Halvey (Emeritus), D.Sc., University of the Atlantic*; R. S. Sleeper, M.A. Harvard.*

5110 General Systems and Cybernetics Fundamentals (3) Fundamentals of the theories of cybernetics and bionics. Applications of cybernetics and bionics to complex systems are presented with a review of the theories of information, automatic control, and communication. Courses in cybernetics may be necessary for the understanding of the main topics.

5120 Cybernetic Biophysics (3) Interdisciplinary and systems aspects of the mechanism of the human body are presented which include the topology, chemistry, physics, and mental functions. Course presents primarily the engineering aspects of man; useful elective of all engineering programs.

5130 Applied Cybernetics and Bionics (3) Utilization of cybernetics and bionics for communication and control in large human systems and in the approach to man-machine symbiosis. Recommended for those having participated in 5110 and 5120; persons primarily interested in an overview of systems dynamics may take with the instructor's consent.

5140 Cybernetics of Human Behavior (3) Aspects of human behavior with emphasis upon open and closed feedback loop interactions with the environment. Systems aspect of cognition and mental functions, second order interaction in interpersonal communication. Recommended for engineers and persons interested in man-machine interactions.

5990 Cybernetics Seminar (3) The Graduate Program in Cybernetics offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary cybernetics for students from undergraduate programs in basic and applied biology, social sciences, mathematics and engineering. Research opportunities in both fundamental and applied ecology are intended to prepare students for academic careers as well as professional positions in industry or government. The Environmental Sciences Division of the Oak Ridge National Laboratory and the Tennessee Valley Authority provide advisors and research facilities. The Great Smoky Mountains, Cumberland Plateau, valley and ridge topography, the southeast, and rivers provide locally a spectrum of natural habitats and consequent biological diversity which is truly unique. In addition, faculty research programs provide opportunities for those interested in the development of the theory necessary to support the class experiments, test techniques, instrumentation and data reduction methods, and the analysis of the series of lectures included in the course. 5110 emphasizes performance and 5220 emphasizes stability and control. Prereq: Aerospace Engineering 4120.

ADMISSION REQUIREMENTS

Requirements for admission to this program are: (1) admission to the Graduate School; (2) at least 12 quarter hours of college chemistry, 9 quarter hours of college mathematics, and 4 quarter hours of ecology at the upper division level. Candidates for the doctoral degree are expected to take the Graduate Record Examination.

Application forms for admission should be obtained from the Graduate Admissions Office. Inquiries concerning the admission requirements should be addressed to the Director, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37916.

ADVISORS

Advisors are selected from ecologists in several departments of the University who have competence in the area in which the student expects to work. Entering students should consult early with the Director of the program on the choice of a faculty advisor who will become the chairman of the student's faculty committee.

THE MASTER'S PROGRAM

The minimum 45 quarter hours of graduate credit shall include 18 hours of ecology courses (exclusive of thesis), of which 6 hours shall be in Ecology 5210-20-30 and at least 8 additional hours in ecology courses numbered above 5100; 9 hours of thesis in Ecology 5000, and 18 additional hours in ecology or supporting courses. To insure an inter-departmental program, the required minimum of 45 hours shall include no more than 18 hours of non-thesis courses from any one department of Instruction.

The general requirements for this Master's degree are listed on page 19.

A minor in ecology shall include Ecology 5210-20-30 (6 hours) and at least 3 additional hours in approved ecology courses.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of the Graduate School with the following two exceptions: (1) each student's faculty committee shall consist of at least two members from the department in which the dissertation is being supervised and at least two from outside this department; (2) this doctoral program must include Ecology 5210-20-30 and a minimum of 9 quarter hours of courses numbered above 6000. A student for doctoral selection until the research proposal has been discussed and approved by the doctoral committee.

Shared Faculty


Courses

The following courses are those offered directly by the Ecology Program and those which, although listed in other departments, have been approved to satisfy Master's degree requirements. Additional ecology
courses are described elsewhere in the catalog under the departments identified in the following list.

Agricultural Biology
4010 Biology of Soil Microorganisms (4)
4510 Freshwater Fishery Biology (4)
4520 Management of Lakes and Ponds (4)

Agricultural Economics and Rural Sociology
4330 Land Economics (3)
5420 Advanced Land Economics (3)
5490 Rural Population Analysis (3)

Anthropology
4360 Field Work in Physical Anthropology (3-6)
4640 Zooarcheology (3)
4960 Primate Paleontology (3)
4970 Human Paleontology (3)
5970 Emergence and Early Evolution of Man (3)

Botany
4310 Plant Ecology (4)
5340 Plant Geography (4)
5350 Analysis of Plant Communities (4)
5510-30 Systems Ecology (3, 3, 3)
5830 Field Methods in Plant Ecology (4)
6320 Ecosystems of the World (3)

Ecology
5000 Thesis

5100 Special Problems in Ecology (1-3) Individual investigations in ecology. Prerequisite: May be repeated with consent of instructor. Maximum 3 hrs.

5210-20-30 Principles of Ecology (2, 2, 2) An interdisciplinary study of theories and problems in ecology. Comparisons between land, freshwater, and marine environments, including man's roles in the world's ecosystems. Must be taken in sequence. Prerequisite: 4 hrs of ecology at the upper division level.

5310 Ecology for Planners and Engineers (3) Ecological principles and the effects that man-caused changes have on living organisms, including man. Lectures and field trips. Designed for students in the Graduate School of Planning and Environmental Engineering.

5320 Implementation of Environmental Policy (3) The goals and problems of environmental legislation, especially the National Environmental Policy Act; the purpose, preparation, and evaluation of environmental impact statements and similar multidisciplinary studies. Prerequisite: 5210 or 5310, or Environmental Law.

5330 Marine Ecology (3) Relationships of marine organisms to the environment and their interactions with each other will be studied. Topics included are: trophic relationships in neritic, coastal, and estuarine ecosystems; succession; deep-sea ecology; stability. Prerequisite: One previous ecology course.

6000 Doctoral Research and Dissertation

6100 Special Topics in Ecology (3) Seminars on advanced topics and recent developments in ecology. Prerequisite: Consent of instructor. May be repeated.

6110 Seminar in Animal Behavior (2)
6120 Seminar in Aquatic Ecology (2)

6130 Seminar in Physiological Ecology (2)
6140 Seminar in Community Ecology (2)
6150 Seminar in Radiation Ecology (2)
6160 Seminar in Systems Ecology (2)

Economics
4260 Economics of Resources (3)

Environmental Engineering
4530 Sanitary Engineering Laboratory (3)
4600 Solid Waste Management (3)
4700 Air Pollution-Air Resources Management (3)
5561 Aquatic Environment Pollution (3)
5593 Advanced Sanitary Engineering (3)
5700 Planning and Air Pollution Control (3)
5710 Air Control Engineering (3)

Forestry, Wildlife, and Fisheries
4005 Forest Ecosystems (3)
4450 Game Mammals (4)
4460 Game Birds (4)
5210 Seminar in Wildlife Conservation (3)
5220 Seminar in Forest Tree Biology (3)
5240 Seminar in Forest Genetics (3)
5460 Predator Ecology (3)

Geography
4720 Data Mapping (4)
4740 Remote Sensing: Types and Applications (4)

Geology
4230 Paleocology (4)
4240 Paleobotany (4)
4510 Principles of Geomorphology (4)
5290 Quaternary Problems (4)
5915 Regional Geomorphology (4)

Microbiology
4950 Microbial Ecology (3)
5829 Experimental Microbial Ecology (3)

Nuclear Engineering
5210 System Dynamics (3)

Philosophy
4710 Philosophy of Nature Science (4)
5550-60 Philosophy of Science (4, 4)
6550 Seminar in Philosophy of Science (4)

Plant and Soil Science
4320 Soil Formation, Morphology and Classification (4)
5240 Soil Productivity and Management (3)
5260 Pedology (4)
5810 Crop Climatology (4)
5820 Advanced Crop Physiology and Ecology (4)

Psychology
4900 Aspects of Urban Environment (4) S/NC only.
5750 Ethological Psychology (3)

Sociology
4110 Population Problems (4)
4330 Urban Ecology (4)
6190 Theory and Method of Human Ecology (3)

Zoology
4200 Ichthyology (5)
4240 Animal Ecology (4)
4560-70 Limnology (4, 4)
4700 Arachnology (4)
5570 Animal Populations (3)
5860 Geographic Distribution of Animals (4)

Industrial and Organizational Psychology

MAJOR
Organizational Psychology M.S., Ph.D.

Committee:

(For complete Faculty Listing, see Departments of Industrial Management and Psychology)

The Master's and Doctoral programs are offered jointly by the Department of Psychology and the Department of Industrial and Personnel Management. They are designed to prepare students for personnel, managerial, and organizational research, for university teaching, and for consulting relationships with industry. The emphasis is upon applied research utilizing a thorough theoretical background, including classical and modern organization theory, organizational behavior, psychology, and industrial management. The programs are administered by a joint committee of the two departments, appointed by the Vice Chancellor for Graduate Studies and Research on recommendations from the two department heads.

It is intended that students entering the program will represent widely different undergraduate and graduate backgrounds, including psychology, business administration, engineering, science, and liberal arts. The first-year program provides the opportunity to take courses which will assist the student to attain a reasonable level of sophistication in areas of deficiency (Psychology 5550-60).

ADMISSION PROCEDURE
Applicants for admission should request forms and materials from both the Graduate Office and the Chairperson, Industrial and Organizational Psychology Program, 413 Stokely Center for Management Studies.