tional and international development. Communications and change in developing countries. Problems in international and cross-cultural communications. Prereq: 4950 or consent of instructor.

5970 Independent Study (3)
Administration and Supervision, in Educational Psychology and Guidance, in Curriculum and Instruction, in Safety Education and Service, or in Vocational-Technical Education.

DOCTORAL DEGREES

The College of Education offers programs of advanced study leading to the Doctor of Education degree in the major areas listed on page 6, and to the Doctor of Philosophy degree in Health Education.

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

The Program

Research Area 21 hours

Foreign or Computer Language (demonstrate proficiency) 0-9 Hours

General Core Requirements

Courses in history of education, philosophy of education (two areas must be represented) 6 Hours Minimum

Courses in learning theory, curriculum theory, and administrative theory (three areas must be represented) 9 Hours Minimum

Trans-college seminar—four consecutive quarters 4 Hours Minimum

Specialization:

Major Option—A minimum of 24 hours normally selected from one or two emphases within the major option. 24 Hours Minimum

Supporting Emphasis—A minimum of 12 hours selected from an emphasis other than those emphases selected in the major option. (May be selected from any one of the five options but not a combination of options.) 12 Hours Minimum

Cognate—A minimum of nine hours selected from outside the College in addition to the designated research courses. 9 Hours Minimum

Dissertation 36 Hours Minimum

Options and Emphases

Option I. Administration Theory and Practice

The Administration of Higher Education

Contemporary Economics and Educational Finance

Educational Planning

Facility Planning

Maintenance of School Plants

Organizational Theory

Personnel Administration

The Politics of Education

The Principalship

School Law

The Superintendency

Option II. Theories of Curriculum Development and Foundations of Education

Anthropological, Historical, Philosophical, and Sociological Bases for Educational Planning and Curriculum

Principles and Models for Planning, Developing, and Evaluating Educational Programs

Research Design for Educational Programs

Option III. Instructional Theory and Practice

Principles and Models for Instructional Improvement

Subject Areas of Instruction and Practice: i.e., English, Foreign Languages, Mathematics, Science, Social Studies, etc.

Elementary and Early Childhood Instruction and Practice

Learning Media Services

Physical Education Instruction and Practice

Vocational-Technical Fields of Instruction and Practice

Option IV. Theories of Educational and Personal Adjustment

Assessment (Educational, Vocational, Personality)
curriculum offerings with architectural designs, organizing regional institutes to promote innovative construction concepts, encouraging full staff utilization to secure an optimal learning environment, facilitating renovative projects within existing buildings, and conducting custodial clinics on proper maintenance techniques. Course work relating specifically to school planning is offered through the Department of Educational Planning and Supervision, while two-year graduate assistantships are under the administrative auspices of the Laboratory.

Departments of Instruction

Art and Music Education

C. H. Ball, Head

Art Education

MAJOR DEGREE M.S.


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

The thesis option requires 45 quarter hours as follows:

<table>
<thead>
<tr>
<th>Quarter hours</th>
<th>Art Education 5310, 5320 and electives</th>
<th>18</th>
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<tbody>
<tr>
<td></td>
<td>Education Curriculum and Instruction 5710, and electives</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Minor (selected with committee)</td>
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<tr>
<td></td>
<td>Thesis (Art Education 5000)</td>
<td>9</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Quarter hours</th>
<th>Art Education 5210, 5310, 5320, and electives</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Education Curriculum and Instruction 5800, and electives</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Minor (selected with committee)</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

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

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

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

5320 Clay in School Program (3) Exploring methods of hand-built forming and firing procedures. Prereq: 2100. 1 hr and 2 labs. F, Sp

5330 Textiles in School Program (3) Exploration of processes of weaving, stitching, batik, and silk screens. Prereq: 2100. 1 hr and 2 labs.

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

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

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

4180 Appreciation of the Arts in the School Program (3) Prereq: 2100 or consent of instructor. 1 hr and 2 labs. Su

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

5000 Thesis (1-15) E

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

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

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

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

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

Music Education

MAJOR DEGREE M.S.

Assistant Professor: M. C. Moore, Ph.D. Michigan.

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

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

Requirements for thesis program: 45 quarter hours including thesis (9 hours), the student should plan his or her program carefully with a faculty advisor.

SCHOOL PLANNING LABORATORY

The School Planning Laboratory (SPL), located in Claxton Education Building, assists schools and colleges in integrating
work with a minimum of 26 hours at the 5000 level.

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

3. Curriculum:
   a. Major: At least 27 quarter hours in music education.
   b. A minor: At least 15 quarter hours in music.
   c. 9 quarter hours in professional education (with Curriculum and Instruction 5610 and Educational Psychology 4760 or equivalents and a 3-hour elective.

4. Specific course requirements:
   a. Music Education Foundation (15 quarter hours) including: Or 5710 (3 hours), 5210, 5240, 5250, 5710.
   b. Music: Six quarter hours in applied music (piano; voice; a band or orchestra instrument; or theory and composition).
   c. Education (limited elective of 6 quarter hours): Educational Psychology 4760 or 5050, 5320, or other appropriate course in educational psychology with 3 hours credit.
   d. 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. Major and Minor fields.
   e. The Talent Education Program of School Music (3) Development of understandings regarding growth patterns and processes through music experiences; cultural and community influences on secondary school music, problems in administration and teaching of music in school administration; relationship of music with humanities in curriculum. Sequel to 3150.

5. 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. Major and Minor fields.
   f. The Talent Education Program of School Music (3) Development of understandings regarding growth patterns and processes through music experiences; cultural and community influences on secondary school music, problems in administration and teaching of music in school administration; relationship of music with humanities in curriculum. Sequel to 3150.

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

5220 The Administration and Supervision of School Music (3) Improvement of teacher-learning, child-learning process in music education. Problems of supervision, personnel, supervision of students, and relationship of music with humanities in curriculum. Fall.

5230 Comparative Teaching Procedures in Music Education (3) Modern teaching theories and their implications. A review of classic and current experimental studies. Prerequisite: consent of instructor. Fall.

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. Uses of musical aptitude and achievement tests. Statistical measures applied to learning music. Prerequisite: General psychology, educational psychology, and elementary statistics.

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

5260 Music for Early Childhood (3) Prerequisites: 3120 or 3130 or consent of instructor.

5270 Studies of Music for Children in the Primary Grades (3) Children's growth processes in music for Grades 1-3, and musical experiences. For major in education; 4450, 4510 or equivalent.

5300-570 Special Problems in Music Education (3, 3, 3) Current problems in music education at all levels of instruction and in various specialized areas of music curriculum. Prerequisite: 5710 or equivalent and consent of instructor. E.

5410 Advanced Instrumentation and Conducting (3) Reading, conducting, and interpreting band scores suitable for school, college, and community bands; emphasis on contemporary and standard major band literature. Prerequisite: Undergraduate degree with a major in music or music education; 4430 or equivalent.

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

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

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

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

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

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

Continuing and Higher Education

DEGREE

MAJOR

Adult Education

College Student Personnel

DEGREE

M.S.

M.S.

Professors:

M. C. McElhinney, Jr., (Head), Ph.D. Florida State.
E. M. Ramer (Emeritus), Ed.D. Columbia.

Assistant Professors:

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

Associate Professor:


The Master of Science degree in Adult Education is offered for teachers, administrators, counselors, and community specialists. The degree program has two options: a thesis option requiring a minimum of 45 hours, and a non-thesis option requiring a minimum of 51 hours. For each option, 9 hours must be completed in the behavioral sciences.

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

For further information write the Department of Continuing and Higher Education.

5454-55-56 Student Leadership Workshops (1, 1, 1) Small group, individually experienced opportunities to develop knowledge and skills in leadership roles; for residents assistants, student government leaders, student activities, other student organizations. Prerequisite: Consent of instructor. S/NC only.

5500 Thesis (1-15) E.

5602 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5606 Adult Education: A General Survey (3) Historical development, philosophies of adult education, agencies, programs, current issues, and literature of adult education. F, S.

5710 Seminar in College Teaching (3) Effective college teaching; testing and measurement; recent research in college instruction; major problems and issues in higher education. Required of candidates for the MACT degree; S/NC only. SP

5860-70-80 Problems in Continuing and Higher Education (1, 1, 1, 1, 1, 1) Independent study of problems and special institutes. S/NC only. E.
Departments of Curriculum and Instruction, equivalent.

6450 Advanced Seminar in Program Planning (3) Problems and issues confronting continuing or higher education programs. S/NC.

5960-70-80 Seminar in Continuing and Higher Education (1-3, 1-3, 1-3) Supervised practice in higher education. Student personnel services in public higher education. Student discipline, housing, dress, organizations, activities, fees, tuition, and related federal regulations.

5430 College and University Law—Tort Liability and Risk Management (3) Legal precedent concerning liability exposure of public institutions of higher education. Personal and institutional liability. Basic principles of risk management and liability insurance. Prereq: 5410 and 5420, or consent of instructor.

5440 American Higher Education (3) Purposes, functions, organizations, 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.

5470 The Curriculum of Undergraduate Higher Education (3) Background, content, and organization of instructional programs, trends, and evaluation processes, including accreditation activities.

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

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

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

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

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

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

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

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

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

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

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

**Curriculum and Instruction**

**DEGREES**

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<tr>
<th>MAJORS</th>
<th>CURRICULUM</th>
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<tbody>
<tr>
<td>Curriculum</td>
<td>M.S.</td>
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<td>Child Development and Growth</td>
<td>Ed.S.</td>
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<tr>
<td>Elementary Education</td>
<td>M.S.</td>
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<tr>
<td>Foreign Language Education</td>
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<tr>
<td>Instructional Media and Technology</td>
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<td>Mathematics Education</td>
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<tr>
<td>Reading Education</td>
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Science Education

Social Science Education

M.S. Education

Ph.D.

**PROFESSORS**


Associate Professors:


Assistant Professors:


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

THE MASTER'S PROGRAM

For the Master of Science degree, thesis and non-thesis options are available in the following areas: Curriculum, Elementary Education, English Education, Foreign Language Education, Instructional Media and Technology, Mathematics Education, Reading Education, Science Education, or Social Science Education. The non-thesis option requires the completion of 51 quarter hours of coursework.

THE SPECIALIST PROGRAM

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

THE DOCTORAL PROGRAM

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

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

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

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

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

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

4216 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 courses or background in teaching elementary school science.

4216 Teaching Elementary School Mathematics (3) Methods and materials used in teaching mathematics in elementary school. Developmental and diagnostic/ corrective programs. Not open to students with recent courses 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 relationships with other curriculum areas, diagnostic programs, and corrective work. Not open to students with recent courses or background in teaching elementary language arts.

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

4240 Classroom Instructional Organization (3) Developing understandings and skills relating to grouping, individualization, space utilization, organization, grading, integration, and achieving an effective social environment for elementary classroom teacher. Prereq: Psychology 2420.

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

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

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

4280 Diagnosis and Correction of Classroom Reading Problems (3) Prereq: 3390 or equivalent.

4300 Developmental Reading in Secondary School and Community College (3) Approaches and materials for teaching reading and correcting reading deficiencies in reading classrooms and/or laboratories at middle school, secondary school, and community college level. Prereq: Consultation.

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

4303 Language Development of Children: Birth-Preschoolage (3) In-depth view of language development from birth through preschool age; application of research findings to development of instructional programs for early and middle childhood.
6250 Seminar in History of Education (3) May be repeated with consent of instructor.

6282 Advanced Studies in Elementary School Science (3) Critical analysis of current research in elementary school science. Prereq: Undergraduate course and one graduate course in science, or equivalent.

6350 The Professional Education of Teachers (3) Basic theories, programs, and practices.

6400 The Dynamics of Educational Change (3) Critical analysis of changes that take place between educational theory and practice; factors useful in reducing this lag.

6500 Advanced Studies in Early Childhood Education (3) May be repeated. Maximum 6 hrs.

6510 Advanced Studies in Elementary School Language Arts (3) Critical research analysis of selected issues in elementary school language arts. Prereq: 5280 or equivalent and consent of instructor. 30 workshops sponsored by College of Education; evaluation of workshop approaches to teacher education and instructional improvement.

6710 Advanced Educational Statistics (3)

6720 Interpretation of Data (3) Types of data in published materials in education; principles of sound interpretation.

6730 Theory and Evaluation in Curriculum Planning (3) Application of principles of evaluation to curriculum programs in elementary and secondary schools. Prereq: 5270 or 5410 or equivalent.

6731 Studies in Curriculum Theory and the Structure of Knowledge (3) Major curriculum theories, models, and designs; structures of knowledge and structures of disciplines in elementary and secondary school programs. Prereq: 5270 or 5410 or equivalent.

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

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

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

6850 Principles of Educational Leadership (3) Conflict concepts, with application to major problem areas of instruction, supervision, and administration.

6899 Internship (1-6) Advanced level experiences in application of principles and practices of curriculum development and instructional improvement. Program prerequisites must be met and consent of instructor required. May be repeated. Maximum 12 hrs. S/N/C only.

*May not be used toward meeting 6000 requirements.

**Education**

**MAJOR**

Degree: Ph.D.

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

**Educational Administration and Supervision**

**MAJOR**

Degrees: M.S., Ed.S.

6280 Seminar in History of Education (3) May be repeated with consent of instructor.

6282 Advanced Studies in Elementary School Science (3) Critical analysis of current research in elementary school science. Prereq: Undergraduate course and one graduate course in science, or equivalent.

6350 The Professional Education of Teachers (3) Basic theories, programs, and practices.

6400 The Dynamics of Educational Change (3) Critical analysis of changes that take place between educational theory and practice; factors useful in reducing this lag.

6500 Advanced Studies in Early Childhood Education (3) May be repeated. Maximum 6 hrs.

6510 Advanced Studies in Elementary School Language Arts (3) Critical research analysis of selected issues in elementary school language arts. Prereq: 5280 or equivalent and consent of instructor. 30 workshops sponsored by College of Education; evaluation of workshop approaches to teacher education and instructional improvement.

6710 Advanced Educational Statistics (3)

6720 Interpretation of Data (3) Types of data in published materials in education; principles of sound interpretation.

6730 Theory and Evaluation in Curriculum Planning (3) Application of principles of evaluation to curriculum programs in elementary and secondary schools. Prereq: 5270 or 5410 or equivalent.

6731 Studies in Curriculum Theory and the Structure of Knowledge (3) Major curriculum theories, models, and designs; structures of knowledge and structures of disciplines in elementary and secondary school programs. Prereq: 5270 or 5410 or equivalent.

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

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

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6899 Internship (1-6) Advanced level experiences in application of principles and practices of curriculum development and instructional improvement. Program prerequisites must be met and consent of instructor required. May be repeated. Maximum 12 hrs. S/N/C only.

*May not be used toward meeting 6000 requirements.*
5757 Problems in Educational Administration and Supervision: Organization and Structure (3) May be repeated. E
5758 Problems in Educational Administration and Supervision: School Law (3) May be repeated. E
5759 Problems in Educational Administration and Supervision: Supervision (3) May be repeated. E
5770 Maintenance of School Plants (3) Skills in operating school custodial and maintenance programs. Sp
5810 Survey Research Methods (3) Overview of descriptive studies, data collection, analysis, and interpretive findings and school survey strategies for descriptive research in education. W, Sp, Su
5850-60-70 Independent Study in Educational Administration (3, 3, 3) Prereq: Consent of instructor. E
5890 Decision Making and Decision Theory in Educational Organizations (3) Theoretical constructs underlying executive decision making; direct application of decision theory problem-solving activities for preservice and practicing administrators. Executive decision making at several administrative levels in complex educational organization. SNC only. A
5900 Special Topics (3) May be repeated. E
5910-20-30 Problems in Lieu of Thesis (3, 3, 3) E
5950 Elementary Administrators Seminar (3) For in-service training of elementary school administrators. Developments, problems, programs, and trends of elementary schools and management skills of elementary school administrators. Prereq: Presently an elementary school administrator or consent of instructor. May be repeated. SNC only. F
5960 Middle School Administrators Seminar (3) For in-service training of middle school administrators. Developments, problems, programs, and trends of middle schools and management skills of middle school administrators. Prereq: Presently a middle school administrator or consent of instructor. May be repeated. SNC only. F
5970 Secondary Administrators Seminar (3) For in-service training of secondary school administrators. Developments, programs, problems, and trends of secondary schools and management skills of secondary school administrators. Prereq: Presently a secondary school administrator or consent of instructor. May be repeated. SNC only. F
6000 Doctoral Research and Dissertation (3-15) E
6040 Seminar in Educational Administration and Supervision (3) Required three consecutive quarters. SNC only. C
6100 Internship in Educational Administration (3) May be taken as an option to satisfy student's commitment to opportunity for doctoral students and advanced graduate students to gain experience in performance of administrative tasks of educational administration under supervision of practitioner and university representative. E
6110 Administrator Update (3) Current topics of concern to practicing school administrators; selected each quarter and presented by a specialist. Prereq: Presently a school supervisor or administrator, or consent of instructor. May be repeated. SNC only. E
6190 Administration in Higher Education (3) Developing conceptual understanding of administrative theory and practice in higher education. F, Sp
6220 Programs for the Professional Preparation of Educational Administrators and Supervisors (3) 6340 Current Trends in School Law (3) Logical arrangement of case and statutory material for public school administration; in-depth examination of problems concerning the law and public education. W, Su
6350 Instructional Supervision—School District (3) Definition and analysis of instructional supervision at the school district level. Supervisory operations including goal development; curriculum development; instructional support, help, and service for teachers and administrators; personnel development; program evaluation. W, Su
6420 School Board-Superintendency Relationships (3) The local unit of school administration, school board and its governing body, board of education or school board. Sp
6440 School Business Management (3) Emphasizes superintendency team concept; planning, procurement and utilization of fiscal resources. F, Su
6450 Grant and Contract Proposal Preparation (3) Grants and contracts processes in education. Basic concepts applicable to other special agencies. Sp
6460 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. F, W, Su
6480 Special Topics in School Personnel Administration (3) Human problems in school personnel administration; staff planning, record systems, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. F, W, Su
6530 Futuristic Educational Planning Methods (3) Methods for describing alternative futures. W
6540 Contemporary Economics and Educational Finance (3) Contemporary educational finance policies and their influence on educational service and program development and role of individual and total welfare of the nation. F, Su
6550 State-Federal Relations in Education (3) Purposes and functions of federal, state/localeducational administration and political variables. Major education laws, rule and regulation-making process, grants and contracts as inter-level policy instruments. W
6560 Legal Foundations of Public Education (3) Legal framework and theoretical concepts that impinge on operation of schools within present legal structure of the United States. Sp
6580 Seminar in Managing Conflict (3) Learning about and experiencing various forms of conflict. W, Su
6750-60-70 Independent Studies in Educational Administration and Supervision (3, 3, 3) Prereq: Consent of instructor. May be repeated. E
6800 Administration of Complex Educational Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational organizations. W
6870 Advanced Study in School Facility Planning (3) In-depth experiences in development of educational specifications and techniques of leadership in treatment of physical facilities. W, Su
6900 Special Topics (3) May be repeated. E
6981 Specialized Seminar: School Operation (3) E
6982 Specialized Seminar: Higher Education (3) Current policy development, organizational relationships, and administrative issues in higher education. W, Su
6983 Specialized Seminar: State School Administration (3) E
6984 Specialized Seminar: Program Preparations (3) E
6990 Specialized Seminar in Politics of Education (3) Political theories and practices as they affect operation of public school system. Appropriate interdisciplinary discussions based on literature and research from education, sociology, and political science. One field inquiry. F, W, Su
6991 Specialized Seminar: Theory of Education (3) E
6992 Specialized Seminar: Finance (3) E
6994 Specialized Seminar: Business Management (3) E
6995 Specialized Seminar: Personnel (3) E
6996 Specialized Seminar: School Plant (3) Theory and practice in planning and operating educational facilities: related research in education and other disciplines; implications for further research, application, existing knowledge to known school facility settings. Prereq: Consent of instructor. A
6997 Specialized Seminar in Organization and Structure (3) Organizational theories in education including systematic review of status of organizational and leadership research in education and related disciplines; implications for further research; application of existing theory and research to known educational settings. Prereq: Consent of instructor. A
6998 Specialized Seminar: School Law (3) E
6999 Specialized Seminar: Supervision (3) Sp

Educational and Counseling Psychology

MAJORS
DEGREES
Guidance
M.S.
M.S.
M.S.
M.S.
M.S.

Educational Psychology
Ph.D.
Ph.D.
Ph.D.
Ph.D.
Ph.D.

Educational and Guidance
Ph.D.
Ph.D.
Ph.D.
Ph.D.
Ph.D.

Education
Ph.D.
Ph.D.
Ph.D.
Ph.D.
Ph.D.

Ph.D.
Ph.D.
Ph.D.
Ph.D.
Ph.D.

DEGREES
Graduate programs (thesis or non-thesis option) lead to the Master of Science degree with majors in Educational Psychology (with concentrations in school psychology or community agency counseling), or Guidance, (with concentrations in elementary or secondary guidance), to the Specialist in Education degree, and to the Doctor of Education degree, both with concentrations in educational psychology, guidance, school psychology, counseling in community agencies, and counseling psychology. Professional emphases are available in educational measurement and research, career development, and sex-fair counseling and teaching. The Doctor of Philosophy degree with a major in Education includes options and emphases as listed on page 8.

Appropriate courses taken in this department and in the Department of Psychology will satisfy requirements for certification as a school psychologist. Write the department for information concerning the program requirements. Application deadlines to Ed.D./Ph.D. are February 1 and May 1; Ed.S. and M.S. deadlines are October 15, February 1, May 1, and July 15.

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

*Part-time
**Adjunct
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 Special Topics and Problems (1-6, 1-6, 1-6) May be repeated. S/NC or letter grade.


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


4760 Advanced Child Study (3) Prereq: 2430 or 3610 or consent of instructor. W, Su.

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

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


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

4910 Diagnostic and Corrective Teaching (3) Practical procedure for improving pupil's learning. F.

5000 Thesis (1-15) E.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5220 Interpreting Published Articles: Research Design (3) For students not concentrating on specific research projects; interpret and evaluate statistical tables and statistical tests as reported in journals. Prereq: S210 or consent of instructor. W, Sp, Su.

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

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

5330 Theory and Research in Human Learning (3) Contemporary theories and implications for education. Related theories such as Bruner and Ausubel. E.

5331 Current Developments in Learning (3) Sp.

5340 Group Dynamics (3) Principles of group dynamics as they apply to a variety of group settings. Group communication, group leadership, and group decision-making. S/NC only. E.

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

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

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

5760 Career Development: Theory and Research (3) F, Su.

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

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

5800 Career Development: Student Appraisal (3) Gathering, interpreting, and using data for development of guidance programs and individual counseling. Prereq: Educational Psychology or Psychological 5640 or equivalent in standardized testing. (Same as Psychology 5840.) W.

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

5880 Career Development: Occupational and Educational Resources (3) Gathering, interpreting, and using data for educational, occupational, and community information in the guidance program; sources, types of materials, and occupational filing plans. For use both in group and individual guidance programs. W, Su.

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

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

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


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

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

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

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

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

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

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


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

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

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

6550-60-70 Seminar in College Student Personnel (2, 2, 1) Issues in college student personnel, college counseling, student development, etc. Prereq: Consent of instructor, admission to the doctoral program. S/NC only. E.


6560-60 Systems Approaches in Psychological Services (3, 3) (Same as Psychology 6560-60.) W.

6569 Practicum in School Psychology III (2) (Same as Psychology 6569.) S/NC only.

6570-60-70 Problems in Educational Psychology and Guidance (3, 3, 3) S/NC only. E.

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

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

6910 Special Topics Seminar (3) Exploration of special research and/or topical topics with students who have necessary background. Topic will vary from quarter to quarter, depending upon instructor.
Special Education and Rehabilitation

MAJORS

Special Education

Vocational Rehabilitation Counseling

DEGREES

M.S.

M.S.

Professors:


The Department of Special Education and Rehabilitation provides competency-based programs and experiences to prepare regular, special education, and rehabilitation personnel to work with exceptional persons: children and adults. Specialized courses may be offered in 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; (9) general education and rehabilitation.

Programs lead to the Master of Science degree in Special Education with an emphasis in one of the specialized areas. 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 and preparing rehabilitation prognosis. Prereq: 4230. F, Sp

4100 Speech Development of Hearing Impaired (3) Anatomy and physiology of speech system. Relations of language development, theories and techniques of speech development and improvement; for hearing impaired children. Prereq: Audiology Speech Pathology 4140. (Same as Audiology and Speech Pathology 4140.) F, Su

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

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

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

4230 Communication Processes for the Hearing Impaired (3) Evaluation of various communicative skills required by hearing impaired person; speech and language development; auditory training, speech reading, manual communication in relation to other forms of communication. Observations and practicum. (Student must acquire a degree of proficiency in use of manual language.) Prereq: Consent of instructor.

4231 Communication Processes for Hearing Impaired II (3) Intermediate course in manual communications skills and techniques with emphasis on vocabulary development with receptive and expressive fluency. Prereq: 4230 or consent of instructor.

4240 Nature of Hearing Impairments (3) Basic principles of audiology; anatomy and physiology of hearing; nature and causes of hearing loss; methods and instrumentation for assessment of hearing level; interpretation of audiograms; selection and use of hearing aids; relation of audiologic services to medical and other rehabilitation disciplines. Observations and practicum. F, Sp

4250 Introduction to the Psychology and Education of the Hearing Impaired (3) For those planning to enter field of teaching deaf and hard-of-hearing: Review of history of education of deaf. Research studies relating to psychology, social adjustment, and learning of deaf; teaching of deaf. Survey of professional literature in area of deaf child and adult. (Same as Audiology and Speech Pathology 4250.) E

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

4290 The Teaching of Reading to Hearing Impaired Children (3) Readiness activities, developmental approaches, theories, and specialized materials for curriculum in teaching reading. Prereq: 4870. F

4870 Student Teaching with Hearing Impaired Children (9) Supervised practicum with preschool, day school, and residential pupils. S/NC only. F, W, Sp

4871 Practicum with Hearing Impaired Children (6) S/NC only. F, W, Sp

5220 Linguistics in the Education of the Hearing Impaired (3) Recent research and developments in linguistics related to speech and hearing impaired. F, Su

5240 Seminar in Language Remediation for the Hearing Impaired (3) Current and recent developments in educational methodologies and to research pertaining to teaching language to hearing impaired. Research and materials current in use of various sign language systems and adaptations. Emphasis on approaches which accommodate and assist integration of hearing impaired children in regular classrooms. W, Su

5280 Seminar on Educational Implications of Language Deficiency (3) Readings, discussion, and projects on impact of language deficiency on educational programming for children with language deficiency. Sp, Su

5310-30-30 Manual Communication (2, 2, 2) Basic and advanced signs, finger-spelled and signed forms of communication. Emphasis on ability to express and receive the manual forms. Prereq: Consent of instructor. Must be taken in sequence. F, W; F, Su

5400 Educational and Vocational Guidance of the Deaf and the Hard of Hearing (3) Evaluation; test techniques for diagnosis and guidance; social and personality adjustment; occupational opportunities. F, Sp

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

5820 Curriculum Development Applied to Programs for the Hearing Impaired (3) Current curriculum trends adapted for hearing impaired individuals. New curriculum options in education of these children. Current education theories for programs for hearing-impaired children. Prereq: Curriculum and Instruction 5580 or equivalent and consent of instructor. Sp

EDUCATION OF THE MENTALLY RETARDED

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

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

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

4810 Student Teaching Mental Retardation (3) Prereq: Major in education of mental retardation. S/NC only. F, W, Sp

4811 Student Teaching Mental Retardation (9) Prereq: Major in education of mental retardation. S/NC only. F, W, Sp

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

5111 Psychology of Mental Retardation (3) Intelectual functioning, psychological theories and learning disabilities as they relate to the educational implications of retardation. Prereq: 4110. F, Su

5112 Psychology of the Severe Mentally Retarded (3) Program and curriculum development for training education of severely retarded in public schools, institutions and privately operated schools and workshops.

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

MUTIPLE DISABILITIES

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

4150 Education of Children with Crippling and Special Health Conditions (3) Medical and educational characteristics; appropriate educational modifications and associated services. Prereq or coreq: 3933 or consent of instructor.

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

4921 Student Teaching in Crippling and Special Health Conditions (3-15) Observation and super-
EDUCATION OF THE EMOTIONALLY DISTURBED

4610 Nature and Characteristics of Learning and Behavior Disorders (3) Forms of academic and socially disturbing behavior, degrees of severity, possible causes, and techniques for reaching children within the regular classroom setting. Discussion and evaluation of relevant academic curriculum and reinforcement techniques. Prerequisite: 4610, Su.

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

4630 Practicum in Residential Settings Serving Children with Disturbing Behavior (3) Practice in scientific, clinical reasoning, interpersonal judgment, and physical and psychological disturbing behaviors. Initiating behavior changes regarding academic and social behaviors. To perform in a tutorial capacity within the residential classroom; and to take part in discussion and evaluation of relevant academic curriculum and reinforcement techniques. Prerequisite: 4610 and 4620 or consent of instructor. A.

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

4924 Student Teaching of the Emotionally Disturbed (3) Individual tutoring and classroom observation for teacher education. Prerequisite: Consent of instructor. W; Sp; Su.

5150 Internship in Rehabilitation (9, 9) W

5170 Systematic Human Relations Training (3) Active listening, observing verbal and nonverbal behavior, communication and interpersonal skills. Prerequisite: Consent of instructor. W, Sp.

5180 Approaches to Rehabilitation Counseling (3) Approaches and techniques in individual and group counseling with handicapped adults to further develop student's counseling skills. Prerequisite: Consent of instructor. W, Sp.

5144-46-47 Practicum in Rehabilitation (3, 3, 3) Supervised experience in area of rehabilitation with emphasis on application of concepts, principles, and skills acquired in previous or concurrent course work. Prerequisite: Consent of instructor. W; Sp; Su.

5150-50 Internship in Rehabilitation (9, 9) W

5760 Seminar: Functional Capacity Assessment (3) Criteria for residual functional capacity assessment in disability insurance claims evaluation; problems in achievement or acquisition of residual functional capacity assessments. Prerequisite: 5710-20 or consent of instructor. W.

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

5800 School Speech and Hearing Programs (3) Organization, administration, and procedures. F, Sp.

5900 Appraisal of Speech and Language Disorders (4) (Same as Audiology and Speech Pathology 5400.)

5910 Student Teaching of Speech and Language Disorders (3) W

5920 Audiology (1) (Same as Audiology and Speech Pathology 5200.)

5930 Aural Rehabilitation: Speechreading and Auditory Training (3) (Same as Audiology and Speech Pathology 5450.)

5940 Introduction to the Verbo-Tonal System (4) (Same as Audiology and Speech Pathology 5450.)

5940 Advanced Clinical Practice in Audiology Study and Practice (1-6) (Same as Audiology and Speech Pathology 5450.)

5980 Cerebral Palsy (3) (Same as Audiology and Speech Pathology 5450.)

5960 Observation and Supervised Practicum in Special and Regular Classes (3) (Same as Audiology and Speech Pathology 5450.)

EDUCATION OF THE VISUALLY HANDICAPPED

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

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

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

GENERAL COURSES

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

3520 Language-Speech Handicapped Child in the
Vocational-Technical Education

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

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


THE MASTER'S PROGRAM
Each vocational service area (agricultural education, business education, distributive education, industrial education and vocational education) offers a similar program leading to the Master's degree. Both thesis and non-thesis options are available. Details regarding the Master's programs of each of the service areas may be obtained from the chairpersons of the different services.

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

Requirements are:

Concentration 1  18 hrs
Research  6 hrs
Electives  12 hrs
Thesis Option  9 hrs
Problems in Lieu  9 hrs
Course Option  15 hrs

Total 45-51 hrs

All course work must be approved by the student's committee. The MACT is also available in the business education area.

THE SPECIALIST PROGRAM

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

THE DOCTORAL PROGRAM

The comprehensive Ed.D. program in Vocational-Technical Education is designed to provide for achieving professional objectives, developing needed competencies, and gaining desirable experiences and understanding of vocational-technical areas.

The Vocational-Technical Education doctoral curriculum consists of the following: professional education core, 9 hours; service area, 18 hours; vocational-technical education, 18-27 hours; cognate fields, 9-16 hours; research techniques, 15 hours (consult advisor for details); and dissertation, 36 hours. A minimum of 120 hours above the baccalaureate is required.

The Doctor of Philosophy degree with a major in Education includes options and emphases as listed on page 8.

4750 Utilization of Instructional Media (3) (Same as Curriculum and Instruction 4750 and Library and Information Science 4765).

5000 Thesis (1-15) E

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

5010 History and Organization of Vocational-Technical Education (3) Vocational and technical education in public schools through analysis of social forces, legislation, and organization models.

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

5020 Competency Based Vocational Education (3) Introductory, comparative, and practical approaches to competency-based curricula and materials in vocational and technical education.

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

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

1Student must meet the service area entrance requirements for the concentration selected. General vocational-technical education requires 6 hrs.

2Ph.D. students must have completed at least one course in a particular area of emphasis outside of area of concentration.

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

5270 Placement, Follow-up and Evaluation Procedures in Occupational Education (3) Methods and procedures in establishing placement programs, follow-up procedures, evaluation, and curriculum revision in occupational education.

5300 Occupational Program Development for Disadvantaged Persons (3) Problems of the academic, socioeconomic, cultural, and other handicaps that prevent individuals from succeeding in regular vocational education programs.

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

5810 Principles and Objectives of Vocational-Technical Education (3) Fundamental principles and objectives for vocational-technical education.

5850-50-70 Problems in Vocational-Technical Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation (3-18) E

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

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

6220 Program Planning and Development in Vocational-Technical Education (3) Planning vocational-technical and work force state, local, and institutional programs; research in planning, advisory committees, planned change, administrative structures, and evaluation procedures.

6320 Evaluation of Vocational-Technical Education Programs (3)

6310 Administration of Vocational-Technical Education (3) Administrative principles and relationship to vocational and technical training.

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

Agricultural Education

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

4710-20-30 Seminar in Agricultural Education (1, 1, 1) Prereq: 4350 or consent of department head.

5000 Thesis (1-15) E

5012 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

5011 Problems in Lieu of Thesis (3)

5110 Graduate Seminar in Current Problems (3)


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 5440.)

5140-20-30 Practicum in Business Education (2, 2, 2)

5150 Evaluation of Research in Business Education (3) Prereq: Curriculum and instruction 5610 or equivalent.

5161-18-22 Problems in Business Education: Typing (3, 3, 3)

5162-22-32 Problems in Business Education: Bookkeeping and Accounting (3, 3)

5164 Methods and Materials for Vocational Office Education (3) Methods and materials for vocational office education programs. Development of instructional aids, related instructional activities (clubs), enrollee, instructor and advisory committees.

5168 Problems in Business Education: Clerical Practice (3)

5169-25-35 Problems in Business Education: General Business (3, 3, 3)

5180 Organization and Management of Vocational Office Education Program (3) Developing office occupations, guidelines in cooperatives, laboratory, and model office programs. Physical facilities, instructional aids, related instructional activities (clubs), enrollee, instructor and advisory committees.

5185 Problems in Business Education: Administration (3)

5210-20-30 Current Issues in Business Education (3, 3, 3)

5210-20-30 Advanced Studies in Business Education (3, 3, 3)

6410 Higher Education for Business (3)

Distributive Education

4130 Areas of Distribution (2) Marketing, product or service technology, social skills, basic skills, and distribution as these areas affect the distributive education curriculum in secondary and postsecondary programs.

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

4310 Organization and Operation of Distributive Education Programs (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 training supervisors; committee chairmen; adult and other community services. Prereq: 4310, 4320.

4510-20-30 Problems in Distributive Education (1-3, 1-3, 1-3) Research projects and conditions of co-ordinating distributive education programs. May be repeated. Maximum 18 hrs.

5000 Thesis (1-15) E

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

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

5120 Organizing and Teaching Adult Distributive Education (3) Planning, organizing, promoting, teaching, and evaluating adult and postsecondary education programs in distributive education; utilizing trade associations, employment agencies, business groups, and advisory committees.

5121-20-30 Special Problems in Distributive Education (3, 3, 3) Individual research, conferences, and/or workshops in teaching and supervising high school, postsecondary, and adult programs.

5161-26-36 Problems in Distributive Education: Retailing (3, 3, 3)

Home Economics Education

4500 Thesis (1-15) E

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

5110 Advanced Methods of Teaching Homemaking Classes for Adults (3)

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

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

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

5440 Curriculum Development and Implementation in Family Relationships Instruction (3) Content for developing family relationships. Selected materials and methods, preparing and using curricula objectives in family relationships.

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

5530 Organization of the Homemaking Curriculum in Secondary Schools (3) Recent advances in home economics education. Development of teaching material in relation to total homemaking program in secondary schools; teaching methods, courses, home economics education, and Future Homemakers of America.
School of Health, Physical Education, and Recreation

Madge M. Phillips, Director

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

THE MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: Physical Education, Recreation, Safety Education and Service, and School Health Education. Forty-five quarter hours are required for the M.S. Approximately 23 quarter hours of work selected from courses numbered 5000 and above are included in the M.S. requirement. Course selection shall be made according to each student's professional interests in health, physical education, safety, or recreation with the approval of the major professor. Non-thesis options are available in all M.S. degree programs. A 3 quarter-hour course in research techniques and/or statistics and/or a seminar in research will be required. Each non-thesis degree candidate will take a final comprehensive examination.

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

DOCTORAL PROGRAM

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

The Doctor of Education degree is offered with a major in Physical Education and two collateral areas of study. Concentrations are available in exercise physiology, motor behavior, adapted physical education, and philosophical and sociological foundations. The curriculum to be pursued will be determined by the student and a doctoral committee. Selection of this curriculum will be based on the past training, experience, and interest of the student.

The basic requirements for admission are:

a. A minimum of 40 (physical education) or 50 (health education) quarter hours.

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

c. A superior grade point average.

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

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

The Doctor of Philosophy degree with a major in Education includes options and emphases as listed on page 8.

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

Assistantships are made available by local schools, agencies, and the School of Health, Physical Education, and Recreation in return for part-time services rendered. The services may consist of teaching physical education classes, teaching health classes, teaching safety classes and recreation classes, 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.
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. F

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

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

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

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

4410 Consumer Health and Safety Education (3) Survey of major consumer health and safety problems; selection in consumption, and financing of safety and medical services. E

4411 Instructor's Advanced First Aid and Emergency Care (3) Designed to teach first aid. Satisfaction of completion qualifies one for American National Red Cross Certification as an Advanced First Aid and Emergency Care Instructor. (Applicant must be at least 21 years of age.) Prereq: 3210 or valid Advanced First Aid and Emergency Care Certificate. F, W, Sp

4420 Drug Abuse Education (3) Drug abuse problem and suspected causes; pharmacology of drugs and their effect on society and methods of drug abuse education. F, Sp

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

4730 Workshop in Public Health Education (3-6) For teachers, nurses, case workers, sanitarians, and other voluntary and public health agency personnel. Emphasizes the problem-solving approach through small group interaction, case method, and critical incident technique. May be repeated. Su

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

5002 Non-Thesis Graduation Completion (1, 1, 1) Individual study of current problems in public health education. Extensive reading of literature required. E


5070-80-90 Field Practice and Seminar In Public Health (3-5, 3-5, 3-5) Internship or field experience in selected areas. F, W, Sp

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

5120-30 Occupational Health and Safety (5, 5) Occupational health and safety theory and practice related to overall improvement of community health and safety. Lab, lecture, and field practice. Prereq: Consent of instructor. F, W

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

5220 Health and Sickness (3) Formulation of models of positive health within life cycle and within community: types of sickness afflicting individuals and groups. Su

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

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

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

5440 Methods and Materials in Public Health Education (4) Theory and practice in use of communication techniques and materials in community health education. 3 hrs and 2 labs. W

5540 Factors in Problem Solving for Community Health (5) Text skills in communications and group process in route to problem identification, objective setting, problem solving and planning for health education. 4 hrs and 2 labs. W

5550 The Public Health Educator in Community Organization and Development (4) Overview of health organizations and agencies in the community, exploration of conflicting theories and divergent styles of practice in community organization and development. Laboratory to delineate a community near campus and to practice. 2 hrs and 4 labs. F

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

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

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

5730 Dental Health Education (3-5)

5735 Emergency Medical Services (3-5) Sp

5745 Family Health Unit (3-5)

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

5755 Health Facilities Administration (3-5) W

5750 Health Services Administration (3-5) F

5758 Occupational Health Unit (3-5) Sp

5790 Self-Care Unit (3-5) Sp

5795 The Training of Paramedical Personnel (3-5)


6000 Doctoral Research and Dissertation (3-15) E

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

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

6210 Health Aspects of Gerontology (3) Su

6220 Seminar on the Nation's Health (3) F

6230 International Health (3) W

Safety

3820 Principles of General Safety (3) Deals with principles, practices, and procedures in general safety. Covers safety problems in school, traffic, recreation, industry, home, and other public areas. E

4010-20-30 Problems in Safety (1-3, 1-3, 1-3) Individual identification and study of current problems in safety. E
4410 Driver and Traffic Safety Education (3) Preparation and teachers of driver education in schools and colleges. Students are required to teach at least one one-quarter. Valid driver's license required. 3 hrs and 2 labs. E

4420 Advanced Driver and Traffic Safety Education (5) Development of competence in teaching of driver education programs including simulation and multi-car driving range. Emphasis placed on teaching skills and supervision. Prereq: 4410. E

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

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. Su

5000 Thesis (1-15) E

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

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

5330 Problems and Research in Accident Prevention (3) Analysis of safety problems found in wide variety of accidents that occur in community; findings of current research in behavioral sciences as related to variation incidence of accidents. Sp

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

5350 Civil and Defense Education (3) Civil and defense problems: tornadoes, floods, fires, mass civil disorders, and nuclear and personnel attack by alien countries. Sp

5790-30-40 Graduate Workshop in Safety (3-6, 3-6, 3-6) Deals with specific safety problems. Special safety problems in a concentrated period of time. Su

5810-20-30 Problems in Safety (1.3-1, 3-1, 3-1) Individual identification and study of problems in safety. Extended reading and critical analysis of safety literature. E

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

6010-20-30 Internship and Research in Safety (3, 3, 3) Includes supervised participation in safety field experience so that a significant problem in that experience will be identified, researched, and reported on in acceptable form. E

School Health

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

3410 School Health Instruction (3) Selection of health content in the curriculum. Emphasis on implementation of the health education process. Prereq: 3420. E

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

3510 The School in Community Health (3) Role of teacher in community health education; school's responsibilities through use of simulation, multimedia, and the place of existing media and agencies in program. Not open to health and physical education majors. E

3610 Methods in Elementary Health Instruction (3) Preparation and teaching of health topics. Teaching method emphasized and student participation stressed. Required for elementary teachers.

Prereq: 3510 or Public Health 1110 or Nutrition 1230. E

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

3850 Methods in Secondary Health Instruction (3) Preparation and presentation of health topics. Teaching method emphasized and student participation stressed. E

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

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

5000 Thesis (1-15) E

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

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

5200 Teaching of Sex Education and Human Sexuality (3) Analysis and explanation of theory, methods and materials for planning, organizing and teaching sex education. Involves sex education in schools and other community settings. Sp

5510 Curriculum Construction in School Health Instruction (3) Analysis of school health instruction programs in elementary and secondary schools. Planning and construction of health curricula to meet needs, interests, and abilities of pupils. W

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

5530 School Health Program Surveys (3) Techniques and standards for surveying total school health program; relative contribution of health instruction, health services, and healthful environment as each contributes to well being of individual students. Survey of existing school health program. Sp

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

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

5720-30-40 Graduate Workshop in Health Education (3-6, 3-6, 3-6) Deals with specific health problems designed expressly to be repeated. Special health problems in a concentrated period of time. Su

5810-20-30 Problems in School Health Education (1.3-1, 3-1, 3-1) Individual identification and study of current issues in school health education. Extended reading and critical analysis of literature. E

6000 Doctoral Research and Dissertation (3-15) E

6030 Critical Analysis of Writing and Research in Health Education (3) (Same as Public Health 6030.) F

6050-60 Seminar in Health Education (3, 3) (Same as Public Health 6050-60.) W, Sp

Division of Physical Education

MAJOR

Physical Education

DEGREES

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

Professors:

J. E. Ackerman, M.D. Tennessee; G. F. Brady (Emeritus); Ph.D. Iowa; E. K. Capen (Emeritus); Ph.D. Iowa; B. D. Franka

(Mississippi); P. D. Finegold; A. J. Kozar, Ph.D. Michigan; W. P. Littmann; Ph.D. Iowa; M. M. Philitz, Ph.D. Iowa; B. L. Pihl (Emeritus); Ed.D. Boston; H. B. Watson (Emeritus); Ph.D. Michigan; H. G. Welch, Ph.D. Florida.

Assistant Professors:

E. T. Howley, Ph.D. Wisconsin, N. E. Lay, Ph.D. Wisconsin, G. A. Meyers, Ph.D.

Purdue; C. A. Wittgers, Ph.D. Michigan.

Teaching Assistants:


Teacher's College, Columbia; G. A. Ulrich, M.A. North Carolina.

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 with concentrations in exercise physiology, motor behavior, adapted physical education, and philosophical and sociological foundations.

The Doctor of Philosophy degree in a major with an Education includes options and emphases as listed on page 6.

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

3090 History of Dance and the Related Arts I (2) Dance history and the arts related to it from beginnings in primitive societies through the nineteenth century. F

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

3430 Adaptive Physical Education Laboratory (1) Practical work, including student teaching, supplementing 4110. E

4010 Advanced Modern Technique (2) Development, integration, and synthesis of previous dance vocabulary through advanced practice and principles. Prereq: 3030. May be repeated. Maximum 6 hrs. Available to majors and minors or with consent of instructor. F, W

4020 Practicum in Dance Production (3) Prereq: Consent of instructor. W

4060 Advanced Composition (4) Application of compositional, production, and administrative skills culminating in presentation of two complete choreographic works. Prereq: 3062. 4020. A

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

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

4140 Measurement and Evaluation in Physical Education (3) Relationship of measurement and evaluation in physical education. Administration and critique of the objective measures of physical fitness, sports skills and knowledge, W, Sp, Su

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

4880 Motor Behavior: A Theoretical Perspective (4)
Examines motor behavior from information processing perspective and applies current research to support theoretical base. Prereq: Senior or graduate standing or consent of instructor. F

4890 Motor Behavior Laboratory (2) Beginning experience in methodology and instrumentation for assessing factors related to or affecting motor learning/performance. Prereq or coreq: 4880 or consent of instructor. Prereq: 4140 and/or 5320 or consent of instructor. W

5000 Thesis (1-15) E

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

5110 Administrative Problems in Health and Physical Education (3) F

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

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

5140 Advanced Philosophy of Sport (3) Critical examination of most rigorous and sophisticated essay pieces concerning metaphysical, epistemological, and axiological status of sport. Prereq: Consent of instructor. W

5150 Systematic Philosophical Analyses of Sport (3) Critical examination of most comprehensive, systematic, and revealing accounts of metaphysical, epistemological, and axiological status of sport. Prereq: 5140 or consent of instructor. Sp

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

5230 Supervisory Problems in Physical Education (3) F

5301 Analysis of Basic Motor Skills (3) Mechanical analysis of basic motor skills, emphasizing application of these skills to physical education and athletics. W

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

5330 Psychology of Sport (3) Human behavior in sport context. Prereq: General psychology course and consent of instructor. W

5340 Motor Behavior and Skill Acquisition (3) Application of research on human movement behavior to sport and physical education. Prereq: 4880 or consent of instructor. W

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

5500 Advanced Kinesiology (3) Action of muscles involved in fundamental movements, calisthenics, sports, and gymnastics. Prereq: 3300 or equivalent, Sp

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

5550 Physical Rehabilitation (3) Physical disabilities and rehabilitation techniques. Prereq: 5500 or equivalent. W

5560 Physical Activity and Health (5) Relationship of physical exercise to longevity, weight control, cardiovascular diseases, low back pain and other diseases, mental health, growth, and aging. Applications for maintenance of health. Prereq: Course in physiology of exercise or consent of instructor. 5 lecture hours per week. (Same as Public Health 5580.) Su

5600 Applied Physiology (6) Principles of physiology with special emphasis on application of physiological findings to practical problems related to human function. Prereq: 1 yr general chemistry, or consent of instructor.

5610 Advanced Exercise Physiology (4) Principles of energy transfer, human energy systems, special emphasis on integration of organ systems in adapting to requirements of muscular exercise. Prereq: Zoology 4400 or equivalent. Recommended: 1 yr chemistry, physics, and mathematics. 3 hrs and 1 lab. W

5620 Experimental Techniques in Applied Physiology (3) Laboratory course in experimental methodology and instrumentation. Respiratory and blood gas analysis, human calorimetry, blood chemistry, and pulmonary function tests. May be repeated with consent of instructor. S/NC only.

5650 Social-Psychological Dimensions of Physical Activity (3) Examination of social-psychological factors which influence performance in physical activity with emphasis on research. Prereq: Psychology 3120 or equivalent. F

5810-20-30 Seminar in Physical Education (1, 1, 1) Current issues and problems in physical education with emphasis on outstanding studies and research in field. E

5810-20-30 Problems and Projects in Physical Education (1-3, 1-3, 1-3) Problems of professional interest and value to the individual student, selected by the student and approved by the major professor. S/NC only. E

6000 Doctoral Research and Dissertation (3-15) E

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

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

6330 Advanced Motor Behavior (3) Theoretical issues of contemporary significance in human motor behavior. Prereq: 5540 or consent of instructor. Sp

6410 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: 5310, 5500 and Physics 2210 or equivalent. May be repeated with consent of instructor. S/NC only.

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

6610 Seminar in Applied Physiology (2) Prereq: 5610. May be repeated with consent of instructor. S/NC only. F, Sp

8640 Research Participation in Applied Physiology (1-4) Advanced participation under supervision of faculty member whose research area coincides with interests of student. Prereq: Consent of instructor. May be repeated with consent of instructor. S/NC only. F

8610-20 Practicum (2, 2) Intern experience in areas of major interest. S/NC only. E

Division of Recreation

MAJOR Recreation

DEGREE M.S.

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

Assistant Professors: M. J. Carter, Re.D. Indiana; K. L. Krick, Re.D. Indiana.

The Recreation Division offers the following degree program:

Major of Science degree in Recreation (thesis and non-thesis programs) with concentrations in general recreation, recreation administration, and therapeutic recreation.

4110 Recreation Administration (3) Introduction to recreation administration, including planning, personnel, areas and facilities, program services, finances, and public relations. Prereq: 3140, 3200, 3880, or consent of instructor. F, W

4200 Survey of Recreation for Special Populations (3) Special emphasis on minority groups whose leisure opportunities and needs may require special services. Prereq: 3140, 3200, 3880, or consent of instructor. F, Sp

4310 Camp Administration (3) Program planning and organization, personal management, camp site development and maintenance, camp operation for administrators and supervisors.

4500 Specialized Study in a Selected Area of Recreation (4) Comprehensive study in a selected specialized area within the broad field of recreation. For recreation students only. Prereq: Consent of instructor. May be repeated with consent of division. Maximum 9 hrs. E

5000 Thesis (1-15) E

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

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

5140 Leisure Service Delivery Systems (3) Various systems—public, private, and commercial—involved in provision of leisure services for communities. Prereq: 3140 or consent of instructor. F

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

5420 Therapeutic Recreation (3) Role of recreation in lives and treatment of persons with disabilities, mental, physical and medical. Possibilities for helping ill and disabled realize their fullest potential. Prereq: Consent of instructor. W

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

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

5300 Seminar in Recreation (1) Presentation and general discussion of selected research, studies, projects, and thesis in recreation. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. Sp, W

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

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


5440 Problems and Projects in Recreation (1-9) Independent research on problem of special significance to student. Research consists of limited studies undertaken in lieu of thesis. May be repeated. Maximum 9 hrs. New problem must be undertaken for each repetition. Prereq: 4130. W

5450 Specialized Study in Recreation (1-6) Advanced comprehensive study in selected specialized areas within leisure and recreation field. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E
Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science degree, the Master of Engineering degree, and the Doctor of Philosophy degree. For a listing, consult majors and degrees available on page 8.

**OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEO TAPE-ELECTROWRITER**

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

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

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

**YEAR-IN-JAPAN M.S. PROGRAM**

This is a unique program allowing American engineering students to develop some understanding, both scientific and cultural, of Japan. It allows an M.S. candidate to obtain a degree from UTK while carrying out research work at a Japanese university. The program requires approximately two years, one year being spent in Japan and the remaining period being spent at UTK to fulfill the course requirements and to write the thesis or project report, as appropriate to the particular department. The program is administered in the framework of each department’s regular graduate program except that the research is done in Japan. Although the language of communication in Japan would be English, cultural understanding is one of the important objectives of the program and as such a participant would be asked to begin Japanese language study. At the option of the department, up to 6 hours of graduate credit may be allowed for language study, either at UTK or in Japan.

Financial support for living expenses in Japan and for the roundtrip transportation can usually be arranged through fellowships from the Japanese Ministry of Education.

**Engineering Experiment Station**

W. K. Stair, Associate Director

The Station is organized to conduct investigations in fundamental engineering science and to aid in the development of the state’s resources and industries as far as funds available will permit. The Station may also make special arrangements with any person or company to study any technical question within the capacity of its resources, and to report the results exclusively to the company requesting the study. In such case, the whole expense will be carried by the parties requesting the investigation.

**Engineering Administration**

MAJOR: Engineering Administration

DEGREE: M.S.


A program of study leading to the degree of Master of Science with a major in Engineering Administration is offered. This program is aimed at providing education for graduate engineers in the organization and direction of work in engineering functions, at a level which requires understanding of such areas as marketing, finance, and industrial relations. It should be emphasized that this is an engineering program, aimed at preparing individuals for line management positions in construction, design, development, and manufacturing where both technical and nontechnical factors exert significant influence on the success of a given activity.

The program does not provide the opportunity for in-depth study of any of the traditional areas of business administration. Students with such interests are advised to consider graduate programs available in the College of Business Administration.

To be admitted to The Graduate School as a potential candidate for a Master’s degree with a major in Engineering Administration, the applicant should have graduated from an A.B.E.T. accredited undergraduate institution in engineering with a satisfactory grade point average. In addition, applicants must satisfy one of the following experience requirements: (1) at least two years of engineering experience after graduation if a full-time student or (2) current employment in engineering work if a part-time student.

**THE MASTER’S PROGRAM**

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

1. An Engineering Core, 27 hours of
Departments of Instruction

Chemical, Metallurgical and Polymer Engineering

MAJORS

Chemical Engineering
Metallurgical Engineering
Polymer Engineering

DEGREES

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

Professors:

H. F. Johnson (Head), D. Eng. Yale;
D. J. Bagur, Ph.D., D. Eng. Iowa State;
D. J. Borie, Ph.D., Massachusetts Institute of Technology;
C. R. Brooks, Ph.D., Tennessee;
E. S. Clark, Ph.D., California (Berkeley);
D. P. Caltabiano (Research); L. W. Crawford, Ph.D.;
D. P. Cincinnati; C. L. Culberson, Ph.D., Texas;
F. F. Fleck, Ph.D., Akron;
G. C. Frangos, Ph.D.;
D. J. Johns Hopkins;
J. M. Holmes, Ph.D., Tennessee;
H. W. Hau, Ph.D., Wisconsin;
S. H. Jury (Emeritus), Ph.D., D. Eng.;
C. D. Linnard;
D. P. Renselaer Polytechnic; C. J. McHargue,
Ph.D., Kentucky;
C. F. Moore, Ph.D., Pennsylvania;
D. J. Perona, Ph.D., Pennsylvania;
J. W. Prados, Ph.D., Tennessee;
J. E. Spruell, Ph.D., Tennessee;
Ph.D., California (Berkeley);
C. T. Watson, Ph.D., Tennessee;
R. A. Vandenberg, Ph.D., Institute of Technology;
L. W. Watson, Ph.D., Tennessee;
J. W. White, Ph.D., Delaware;
A. W. Wright, Ph.D.;

Pennsylvania State;

S. Watson, Ph.D., Tennessee;
W. H. Hoffman, Ph.D., Rensselaer Polytechnic;
D. Ph.D. Illinois;
J. D. Burns, Ph.D.

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Thermodynamics of transport and equilibrium in biological systems. Discussion of Voitler's equation and biological clocks. Prereq: Consent of instructor.

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

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

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

5000 Thesis (1-15) E
5050. 

5120 Heat Convection (3) Analysis of heat convection and solution of chemical, metallurgical and polymer engineering problems involving deformation of solid, heat transfer and motion of fluids. (Same as Metallurgical Engineering 5050 and Polymer Engineering 5050.)

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


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

5310 Thermodynamics of Heterogeneous Equilibria (3) Phase rule; equilibrium between phases; composition relationship between phases; ideal and nonideal solutions. Prereq: 3040.

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

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

5610 Stagewise Mass Transfer Operations (3) Equilibrium stage, concepts applied to mass transfer operations, analysis of 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: Mathematics 2840.

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

5900 Special Topics in Chemical Engineering (3) Special topics of current interest to chemical engineers. May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation (3-15) E

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

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

6250 Venture Analysis in the Process Industries (3) Interactions among line functions of typical chemical company in application of modern decision theory and mathematical models to achieve optimum product investment decision in face of external competition. Prereq: 5250.

6310 Thermodynamics of Irreversible Processes (3) Thermodynamic treatment of irreversible chemical processes, transport processes, coupling phenomena, with special emphasis on topics and methods of interest to engineering and biochemical engineers. Prereq: 5130.


6410 Stability Phenomena in Chemical Engineering (3) Discussion of stability problems in chemical process systems, including reactors and separation equipment. Emphasis on formulation of models, associated conservation equations, and methods of solution. Prereq: 5510.


6510 Applied Chemical Reaction Kinetics (3) Chemical reactions in gas and liquid phases, heterogeneous catalysis, catalyst effectiveness and role of transport in kinetics. Emphasis on development of phenomenological description although mechanistic models are discussed. Prereq: 5510.

6520 Catalytic Reactor Design (3) Principles of kinetic heat and mass transfer applied to design and analysis of heterogeneous catalytic reactors. Prereq: 5510.

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

6900 Advanced Topics of Chemical Engineering (3) Advanced topics of current interest to chemical engineers. May be repeated. Maximum 9 hrs.

7110 Engineering Materials I (4) Introductory course covering the atomic, crystal, and micro-
tructure of solids with mechanical, physical, and chemical properties of engineering significance. 3 hrs and 1 lab.

4540 Fracture-Safe Design (3) (Same as Engineering Science and Mechanics 4540). Thermal behavior. Properties of materials and structures. Prereq: 4530 or consent of instructor. May be repeated. E

4610 Physical Properties of Materials (3) (Electrical, mechanical, and magnetic properties of materials; thermal, electrical, and magnetic properties of materials; re-lations of composition, structure, and mechanical properties. 3 hrs or 2 hrs and 1 lab.

4730 Mechanical Metallurgy I (3) Elastic behavior. Description of stress, strain, and elastic constitutive relationships. Effects of composition, structure, and loading on mechanical behavior. Failure by yielding. Prereq: 2110 or 3110 or Chemical and Metallurgical Engineering 3030. Suggested for mechanical engineering, engineering mechanics, and engineering science students.

4870 Casting and Welding (3) Principles of casting and welding. Heat transfer, solidification, and fluid flow, and solidification and microstructural phenomena, effects on microstructure. Prereq: 3120 or 3530 or 4730 or Mechanical Engineering 3650 or consent of instructor. Also suggested for mechanical engineering, engineering mechanics, and engineering science students.

5000 Thesis (1-15) E

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

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

5110 Point Defects and Dislocations (3) Theoretical and experimental analysis of point, line, and planar imperfections in solids. Prereq: 4730 or consent of instructor.

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

5130 Plastic Deformation II (3) Plastic deformation of polycrystalline materials; theoretical and experimental analysis of effects of cold work. Prereq: 4730 or consent of instructor.

5140 Diffusion and Annealing in Solids (3) Analysis of models and experimental observations relating to phase transitions and annealing of solid solutions. Prereq:

5150 Phase Transformations I (3) Analysis of mod-els and experimental observations relating to phase transformations by nucleation and growth; solidifi-cation, precipitation, spinodal decomposition. Pre-req: 5140.

5170-80 Plastic Deformation III (3, 3) Fundamental analysis of processes of creep, fatigue, and fracture in materials. Prereq:

5210-20 Welding Metallurgy (3, 3) Welding processes and their effects on physical and chemical properties of metals and alloys. Prereq: 4720 or consent of instructor. May be repeated. E

5210-30 Advanced X-Ray Diffraction (3, 3) Re-view of crystallography, X-ray crystallography, and crystallography; fundamentals of diffraction theory, analysis of scattered intensity in reciprocal space; relationship of scattered intensity to thermal motion, order-disorder, particle size and lattice faults. Introduction to group theory, topic selection, and crystal structure problems; some laboratory work. Prereq: Mathematics 4610.


5540-50 Electron Microscopy I and II (3, 3) Kinemat-ical, dynamic, and physical electron microscopy are discussed. Special attention is given to metallurgical applications such as plastic deformation, fracture, precipitation, and phase transformations. Prereq:

5610-20 Radiation Effects on Materials (3, 3) Inter-actions of radiation with solids, radiation-induced changes in physical and mechanical properties, theory and experiment. Effect of radiation on solid state reactions. Prereq: 3120 or 3110 with emphasis on materials processing, specification and evaluation. 3 hrs or 2 hrs and 1 lab.

7200-20 Special Topics in Metallurgy (3, 3) Lectures and recitation on more recent developments in metallography and related topics. Prereq: 3120 or 3110 with emphasis on materials processing, specification and evaluation. 3 hrs or 2 hrs and 1 lab.


8310-20 Corrosion (3) Analysis of corrosion processes in terms of polarization measurements and the Pourbaix diagram. Influence of stress, tempera-ture, composition, and state of alliance on behavior of engineering materials. Prereq:

8330 Seminar in Anisotropic Properties of Crystals (3) Selected topics of current interest in the area of anisotropic behavior of crystalline materials. Prereq:


8610 Mechanical and Physical Properties of Crystals (3) Anisotropic behavior of crystalline materials treated by matrix and tensor techniques. Property classification according to transformation behavior. Prereq: Core curriculum in Metallurgical Engineering and Mathematics 4500 or 4710 or consent of instructor.

8810-20 Rate Process in Metallurgy (3, 3, 3) Phases of nucleation and growth, physical behavior of solutes, and transport processes in solids such as diffusion, recrystallization, and grain growth, and phase transformations.

9100-20 Solidification and Cooling (3, 3) Solidification and related phenomena, solidification and cooling of solid solutions, solidification and cooling of melts, and solidification of eutectics. Prereq: 5140 or consent of instructor.

9200-20 Mechanical Properties of Materials (3) Anisotropic behavior of crystalline materials. Property classification according to transformation behavior. Prereq: Core curriculum in Metallurgical Engineering and Mathematics 4500 or 4710 or consent of instructor.

9300 Seminar in Anisotropic Properties of Crystals (3) Selected topics of current interest in the area of anisotropic behavior of crystalline materials. Prereq:

Polymer Engineering

4910 Applied Polymer Science (3) First course in the study of polymers. Properties, structure, crystalline and glass transitions, physical properties of amorphous and crystalline polymers, crystallization, and mechanical behavior are discussed. Not for credit for Polymer Engineering majors.

4920 Polymer Processing (3) Rheological properties of polymer melts and glassy and crystalline polymer solids. Non-Newtonian fluid mechanics including viscosity, viscoelasticity, and mechanical behavior of polymers. Prereq: 5110 or consent of instructor. 2 labs.

5100 Characterization of Orientation in Polymer Systems (3) Characterization using electromagnetic radiation, x-ray diffraction and optical methods. Coreq: 5110 or consent of instructor. 2 labs.

5120 Characterization of Orientation in Polymer Systems (3) Characterization using electromagnetic radiation, x-ray diffraction and optical methods. Coreq: 5110 or consent of instructor. 2 labs.

5110 Laboratory Methods in Polymer Engineering I (1) Basic experimental procedures for polymer characterization, x-ray diffraction and optical methods. Coreq: 5110 or consent of instructor. 2 labs.

5112 Laboratory Methods in Polymer Engineering II (1) Basic experimental procedures for polymer characterization, x-ray diffraction and optical methods. Coreq: 5120 or consent of instructor. 2 labs.

5230 Mechanical Behavior of Solid Polymers (3) Chemical and crystalline structure of important fibers; melt, wet and dry spinning of manmade fibers; drawing and texturizing; preparation of yarn; dyeing, finishing and knitting. Emphasis on qualitative aspects.

4940 Plastics Fabrication Operations (3) Lecture and laboratory course treating unit operations of the plastics industry. Types and mechanisms of operation of machinery used and the structure and properties of fabricated parts. Operations to include extrusion, injection molding, blow molding, rotational molding, and vacuum molding. Not for credit for Polymer Engineering majors.

5000 Thesis (1-13) E

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

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

5110 Structural Characterization of Polymers with Electromagnetic Radiation (3) Theory of scattering and diffraction of electromagnetic waves by matter, specifically waves and current experimental techniques applied to polymers. Wide angle x-ray scattering (SAXS), small angle light scattering (SALS), interpretation in term of polymer chains conformation, crystal structure, morphology and superstructure.


5210 Mechanics of Polymer Fluids and Solids (3) Equations of motion and application to polymer melts and glassy and crystalline polymer solids. Non-Newtonian fluid mechanics including viscoplastic flows and unit experimental techniques applied to polymers. Wide angle x-ray scattering (SAXS), small angle light scattering (SALS), interpretation in terms of polymer chains conformation, crystal structure, morphology and superstructure.


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

5410 Rheology and Polymer Processing (3) Methods for determining the rheological properties of polymer melts, solutions and suspensions; linear viscoelasticity, simple nonlinear constitutive relationships, viscous heat generation; application to processing particularly extrusion, injection molding, and blow molding.

5450 Principles of Injection and Blow Molding Operations (3) Thoretical; theoretical analysis of injection molding, filling, structure of molded parts; principles of injection molding, filling, structure of molded parts; principles of shell theory, application to blow molding and chemical approach. Prereq: Consent of instructor.

5910-20-30 Selected Topics in Polymer Science and Engineering (3, 3, 3) Treatment of latest developments in the area of polymer science and engineering. May include topics of morphology, structure, characterization. Prereq: Consent of instructor.
including a 3 quarter-hour special problems is required. The special problem will culminate in a written report which must be approved by the student's major professor.

ENVIRONMENTAL ENGINEERING

For a major in Environmental Engineering the Bachelor's degree may be in fields other than civil engineering. In some cases permission of the graduate advisor and the chair of the department may be indicated, and in general these must be completed before courses for graduate credit can be taken.

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

Option I: The student must present a minimum of 45 quarter hours of approved graduate courses. The major shall include a minimum of 9 quarter hours of thesis and 18 quarter hours credit of approved environmental engineering course work. A minor may be selected but is not necessarily required.

Option II: The student must present a minimum of 48 quarter hours of approved graduate courses. The major shall include a minimum of 27 quarter hours of approved environmental engineering course work. A minor may be selected but is not necessarily required.

Option I or II must be approved by the department.

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

MASTER OF ENGINEERING PROGRAM

Graduate programs in Civil Engineering and in Environmental Engineering leading to the degree of Master of Engineering are available to qualified graduates of A.B.E.T. accredited undergraduate curricula in civil engineering or environmental engineering. At least one-third of the program of study must be classified as engineering design. The student's advisor will assist in planning the program of study to ensure that it includes the necessary design content. The thesis and non-thesis options noted under the Master of Science programs are available under these programs.

THE DOCTORAL PROGRAM

A graduate program leading to the degree of Doctor of Philosophy is offered in Civil Engineering.

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

1. A minimum of 90 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 36 quarter hours credit in Doctoral Research and Dissertation will be required.

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

3. Supporting courses in related scientific and engineering fields, amounting to a minimum of 24 quarter hours of graduate work, subject to approval by the student's faculty committee. These related fields will normally include such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 12 quarter hours of mathematics will be required beyond the civil engineering undergraduate requirements.

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

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

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

Civil Engineering

4120 Concrete Design (3) Reinforced concrete continuous beams and floor slabs; footings, and retaining walls. Prereq: 4110 and 4410. Sp

4220 Foundations and Substructures (3) Foundations and 4110 in 4520. W

4230 Legal and Ethical Aspects of Engineering (3) Legal principles underlying engineering work; laws of contracts, torts, and professional responsibilities. Prereq: 4220. W; Sp

4240 Structural Design (3) Plastic theory, eccentric connections, industrial building design, timber design. Prereq: 4240 and 4410. 5-3 hr. periods. F, Sp

4290 Photo grammetry (3) Methods of mapping plots from aerial photographs; stereoscopic plotting instruments; applications. Prereq: 2360 or Forestry 300. W

4420 Analysis of Framed Structures (3) Maximum stresses due to moving loads; use of influence lines; lateral forces due to earthquake and wind; analysis of portals, building frames and space frames. Coreq: 4410 W

4430 Construction Methods and Equipment (3) Fundamental operations in construction and selection of equipment; production rates, balancing of equipment, and cost estimates. F, W

4510 Adv Advanced Structural Design (3), 3 Plastic design in steel in 4510; design of short span highway bridges in 4520. Prereq: 3230 for 4510 and 5230 and 4110 in 4520. W

4530 Cost Comparison in Design and Construction (3) Cost of engineering and construction. Comparison of alternate designs with emphasis on applications to civil engineering problems. Prereq or coreq: 3230, 4110.

4540 Computer Utilization (3) Computer use, economic justification, and extent of use by industry. Utilization of personal computer in civil engineering problems. Prereq or coreq: 3230, F, W

4550 Engineering Behavior of Soils (3) Plastic and elastic behavior of soils, determination and use of engineering properties of in-situ soils. Prereq: 4220 or consent of instructor. 2 hrs and 1 lab. F

4560 Stabilization of Soils (3) Mechanic stabilization of soils by compaction, drainage, and blending; chemical stabilization of soils with admixtures; waterproofing and modifying soils with additives. Prereq: 3310. 2 hrs and 1 lab. W

4620 Airport Planning and Design I (3) Emphasis on airport master planning. Included for consideration on the air side are runway configuration, capacity, geometrics and lighting; on the land side are included terminal layout and design, and ground access systems and parking. Prereq: 3600 and 3610. Sp

4640 Traffic Engineering (3) Characteristics of driver, vehicle and roadway and their interaction; traffic studies; basic considerations of traffic circulation and control; elements of urban transportation planning. Prereq: 3600 and 3610. Sp

4660 Airport Planning and Design II (3) Integration and application of principles of airport master planning for purpose of site selection and design of an airport facility through a comprehensive team project, includes environmental evaluation of design. Prereq: 4650. 1 hr and 2 labs. Su

4710 Portland Cement Concrete Mix Design (3) Properties and tests of portland cement concrete, methods of concrete mix design, nondestructive concrete evaluation, properties of concrete admixtures. Prereq: 3710. 2 hrs and 1 lab. F

4720 Asphalt and Bituminous Concrete (3) Properties and tests of asphalt and asphaltic mixes, mix design of bituminous materials, analysis of asphalt in transportation construction projects. Prereq: 3710. 2 hrs and 1 lab. W

4731-32 Seismic and Shear Resistance Structures I, II (4, 4) (Same as Civil Engineering 5731-32) Su

4800 Introduction to Civil Engineering Systems (3) Methods of modeling civil engineering systems and their specific application to problems of transportation, environment, water resources and materials. Prereq: Senior standing or consent of instructor. Sp, Su

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

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter. Student uses university facilities and/or full-time before degree is completed. May be not used toward degree requirements. May be repeated. N/C only. E

5110-30 Statically Indeterminate Structures (3, 3) Deflection of beams and trusses; analysis by force methods and by slope-deflection in 5110; analysis by moment distribution and other displacement methods in 5130. F, Sp

5140 Statically Indeterminate Structures (3) Analysis of complex planar and space frames. Prereq: 5110 and 5120. Sp

5150 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, stability considerations; stiffness and flexibility analysis of plane trusses, general members and structures composed of such members. Prereq: 4540 or consent of instructor. F

5160 Analysis and Design of Plate Structures (3) Bending and buckling of plates; analysis and design of bridge and building floors and structural plate components. Prereq: 5110. F

5170 Introduction to Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures; elements of the design of structural systems; approximate design methods developed. Prereq: 4510. F

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

5220 Pavement Design (3) Pavement loads; pavement design; design practices; construction and maintenance. Prereq: 3310. Sp

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

5350 Advanced Properties of Materials: Bituminous Substances and Mixes (3) Serviceability concepts; pavement failures and remedies; bituminous pavement maintenance techniques, other uses of asphalt products. Prereq: 4720. Sp

5270 Planning and Transportation (3) Preparation of transportation and elements of comprehensive development plans. Analysis of transportation planning team roles and relationships between various transportation modes and between transportation and other community features. (Same as Planning 5270) W

5310 Engineering Practice (3) Valuation and feasibility studies; depreciation and useful life; engineering economics. F
5320-30 Engineering Practice Applied to Administration of Engineering Projects (3, 3) Engineering administration: planning of governmental and industrial projects; cost estimates and methods of financing. W, S

5410 Construction Contract Law and Administration (3) General principles applicable to construction contracts and construction related sales contracts. Emphasis on role of engineer in preparation, award, and administration of construction contracts. Ca, Case study method of instruction. Prereq: 4230 or consent of instructor. W, S

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

5430-40 Construction Management I, II, III (3, 3, 3) Management and organization of heavy and building construction projects. Prereq: 4430 or consent of instructor. W, S

5460-70 Construction Estimating I, II (3, 3) Project costs, estimating techniques; market cost condition analysis, and slope stability analysis. Prereq: 3310 or consent of instructor. W

5550 Soil Mechanics—Plastic Equilibrium (3) Failure theories; earth pressure analysis, bearing capacity analysis, and slope stability analysis. Prereq: 3310 or consent of instructor. W

5560 Soil Mechanics—Elastic Behavior (3) Stress-strain deformation characteristics, consolidation, settlement analysis. Prereq: 3310 or consent of instructor. W

5700 Behavior of Steel Structures (3) Behavior of structural steel members due to static and fatigue loading; relation between research results and current specialization for design. Prereq: 3230. W

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

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

5800 Urban Systems: Engineering and Management I (3) Management of various urban systems usually under city manager and/or city engineer. Organization, financial, personnel administration, purchasing and equipment management and dealing with engineering consultants as each deals with municipalities. Prereq: Graduate standing in Civil or Environmental Engineering or consent of instructor. W

5805 Urban Systems: Engineering and Management II (3) Continuation of 5800. Management and engineering of urban streets, including lighting, cleaning and snow removal, water supply and wastewater drainage, solid waste, air pollution, and regulations. Prereq: 5800. Sp

5810 Traffic Engineering—Characteristics (3) Driver-vehicle-roadway system; level-of-service concept of capacity. Coreq: Statistics 3450. 2 hrs and 1-2 hr lab. F

5820 Traffic Engineering—Operations (3) Fixed-time and volume-density controllers; progressive systems; one-way operations; reversible flows; system operation, including computerized networks; legal aspects of operational controls. Prereq: 5610. 2 hrs and 1-2 hr lab. F

5840 Geometric Design (3) Advanced theory and practice in the geometric design of highways. Prereq: 4600. Sp

5850 Functional Design of City Streets and Urban Freeways (3) Design systems upon which growth and development; classification and function of streets; design features, including cross section, intersections, utility considerations, parking, effect of mass transportation; channelization; mar-

5860 Urban Transportation Planning (3) Prediction of traffic demands and vehicle flows; land use planning; parking needs. Prereq: 5810. F

5870 Public Transits Planning (3) Person movement by bus, rapid rail and taxicab transit. Nature of public transit, its various roles and how they fit community's need; user preferences; modal split models; total social, political, economic, and technical impacts of public transit. Prereq: 4600 or graduate standing, W, A

5890 Traffic Accident Reconstruction (3) Proper accident investigation and analysis basis of designing accident prevention or control programs. Many contributing factors to an accident; proceed with accident; secondary accident causes as they relate to roadway improvements. Prereq: 4640 or 5610 or consent of instructor. Sp, A

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

5910-20-30 Special Topics (1-6, 1-6, 1-6) Topics related to current developments in civil engineering not included in other courses. May be repeated.

6000 Doctoral Research and Dissertation (3-18) 

6110 Behavior of Steel Bridges and Buildings (3) Behavior analysis of steel bridges and buildings and composite members subjected to static and dynamic loading. Prereq: 5170 and 5816. Sp, A

6740 Behavior of Reinforced Concrete Beams and Frames (3) Analysis and behavior of statically indeterminate reinforced concrete structures; applicability of elastic analysis to framed structures; limit analysis. Prereq: 5120 and 5740. Sp, A

6750 Behavior of Reinforced Concrete Slabs (3) Behavior, analysis and design of reinforced concrete slabs on AC Code methods; yield-line theory. Prereq: 5740, 5810 or Engineering Science and Mechanics 6310. Sp, A

6830 Traffic Flow Theory (3) Queuing theory, Markov processes, Monte Carlo methods, simulations of various conditions and/or designs. Prereq: 4540 or Mathematics 3150; 5860.

6860 Statewide Passenger Transportation Planning (3) Comprehensive multimodal transportation plan, intercity traffic models, functional classification, programming and scheduling. Emphasis on regional planning and impact on air and highway investments. Prereq: 5860, W, A

6870 Future Transit Technology and Research (3) New transit systems and new technology; identification of potential transportation policies and planning process and possible research designs. Prereq: 5870. Sp, A


6890 Planning Models for Transportation Systems II (3) Analytical modeling of modal split, trip distribution, and trip assignment. Mathematical, statistical, and computer science techniques for urban transportation planning process. Models integrated for urban transportation planning process. Prereq: 6880. Sp, A

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

Enviromental Engineering

3000 Introduction to Environmental Engineering (3) Introduces the student to the effects of air, water, and land environment in which one lives; role of engineering in environmental control. F, W


4150 Urban Water Management (3) Introduction to urban water modeling; evaluation of optimum urban water policies; formulation of system constraints and analysis of the impact of urban water management on the problem of storm water for beneficial use. Prereq: 3000 and 3330. Sp

4210 Water Resources Engineering Design (3) Elements of water resources engineering for design including reservoirs, dams, control works, and open channel design. Dam safety control, environmental impact of reservoir projects. Prereq: 3330 or consent of instructor. F

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

4330 Hydrologic Design (3) Application of frequency and regression analysis to hydrologic design of reservoir projects; surface runoff and streamflow modeling; urban peak runoff design using kinematic wave theory; evaluation of effects of land use changes on streamflow quantity and quality. Prereq: 3330. W

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

4520 Elements of Water and Wastewater Treatment System Designs (3) Introduction to unit operations and processes employed in 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 3120. Sp, Su

4530 Sanitary Engineering Laboratory (3) Physical, chemical, and bacteriological analysis of water and wastewater. Prereq: 4520. 3 labs

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

4700 Air Pollution-Air Resources Management (3) Introductory course on concepts of air pollution; analysis and control; relationship between meteorology and topographic factors, and adverse effects on receptors; engineering approaches for air pollution control. F

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. F

5000 Theses (1-15) E

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

5150 Water and Urban Welfare (3) Social, environmental, and economic impact on planning and management of urban water systems. Emphasis upon conflict and choice, reconciliation between environmental and development values, measurement of social, economic and equity of life satisfaction. Analyzing multiobjective policy alternatives with selected case studies. Prereq: Consent of instructor.

5160 Planning and Utilities (3) Planning for adequate water supply and sewage waste disposal in the urban environment. Impact of utility patterns on urban growth, development and public utility service policies. Not for civil engineering majors. (Same as Planning 5160.)
5630 Design of Solid and Hazardous Waste Disposal Systems (3) Unit operations and processes for solid and hazardous waste disposal: soil attenuation, incineration and heat recovery, biological processes, lixiviation, and resource recovery. Prereq: 4600, 5593. 1 lab.
5700 Planning and Air Pollution Control (3) Relationship between air pollution, area development, and urban grain. Methods for ambient air monitoring. Use of air monitoring data in air quality management. Prereq: Consent of instructor. F
5715 Ambient Air Monitoring (3) Physical and chemical techniques for ambient air monitoring. Survey network design. Quality control of air monitoring data. Use of air monitoring data in air quality management programs. Prereq: Consent of instructor.
5720 Air Pollution Particle Collection Theory (3) Mechanics of particles suspended in gaseous medium including particle motion, coagulation, and aerodynamic capture of particles. Prereq: Engineering Science and Mechanics 3110. W
5725 Air Quality Modeling and Impact Assessment (3) Techniques to assess the air quality impact of major transportation projects and industrial air pollution sources. Application of atmospheric dispersion models and evaluation of meteorological and air quality data. Prereq: Graduate standing. Computer Science 3150. Sp
5730 Air Pollution Control Device Design (3) Design and evaluation of systems used to control emission of gaseous and particle air pollutants. Comprehensive design of specific devices and systems. Prereq: 5720. Sp
5735 Industrial Source Sampling (3) Sampling methods for collective systems, methods of collection, and emission from industrial processes. Prereq: Graduate standing. 2 hrs and 1 lab. Su
5745 Ambient Air Chemistry (3) Reaction mechanisms for organic and inorganic air pollutants from anthropogenic primary pollutants and naturally occurring precursors. Prereq: Consent of instructor.
5760 Diffusion in the Atmosphere (3) Movement and dilution of natural or man-made material released into the atmosphere. Basic theory. Rise of buoyant plumes, relation between Eulerian and Lagrangian spectra, differences between instantaneous and continuous sources, diffusion in a zone of wind shear and diffusion from urban area sources. Prereq: 5725.
5900 Special Problems in Environmental Engineering (1-9) 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 required. Maximum 9 hrs. S/N only. E
5910-20-30 Special Topics (1-4, 1-8, 1-6) Problems and applications current in the development of field of environmental engineering not included in other courses. May be repeated. E
5990 Environmental Engineering Seminar (1) All phases of environmental engineering including reports on current research at The University of Tennessee, Knoxville. Course credit not applicable to graduate degree program. Prereq: Active standing in environmental engineering. May be repeated. S/N only. F, W, Sp
6110-20 Advanced Topics in Fluid Mechanics and Convective Transport (3, 3) Selected environmental engineering science research topics. May be repeated. E
6230 Kinematic Wave Theory (3) Approximations of DeSaint Venet equations by kinematic wave theory applied to overland flow and streamflow. Criteria for approximation and methods of linkages of infiltration, overland flow and streamflow. Prereq: 5230 or equivalent. Sp
6510 Industrial Air Pollution Processes and Operations (3) Laboratory and pilot plant development of physical, chemical and biological variables for treatment of industrial wastes and residues, utilization of various design techniques. Prereq: 5501, 5502. 5503, 1 lab.
6910-20-30 Special Topics In Environmental Engineering (1, 3, 3) Selected advanced problems of current interest in environmental engineering. Prereq: Consent of instructor. E

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

Electrical Engineering

MAJOR

DEGREES

Electrical Engineering
M.S., M.E., Ph.D.
P.

Professors:

Associate Professors:
D. B. Armstrong, Ph.D. Vanderbilt; T. W. Reddoch, Ph.D. Louisiana State;
A minimum of one-third of the program must be in engineering design, and one-third in one of, or a combination of, advanced math, computer sciences, basic sciences, or engineering sciences.

DOCTORAL PROGRAM

The Ph.D. degree with a major in Electrical Engineering may be pursued in the areas of circuit theory, computers, electro-optics, communication theory, electromagnetic theory, plasma engineering, power systems, solid-state electronics, and control systems.

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

1. A Master of Science or Master of Engineering degree.

2. A minimum of 24 quarter hours of course work beyond the B.S. degree excluding thesis, research, and dissertation credit.

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

4. The student must complete an examination that the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.

5. Satisfactory performance on both a basic and comprehensive exam covering the above course material covered in undergraduate work.

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

MASTER OF ENGINEERING PROGRAM

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

Specific degree requirements which must be met include:

1. Electrical Engineering 5070-80 and 5710.

2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics 4710, 4550, and 4520, or 4510-20-30. Other 4000-5000 level mathematics courses approved by the student's Master's committee must be substituted for any of the above course material covered in undergraduate work.

3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in one area of electrical engineering and 9 quarter hours of 5000-level work in another area approved by the student's Master's committee.

4. The student's master's committee must be satisfied that a reading knowledge of a foreign language is crucial to the student's research efforts.

5. The student must complete an examination that the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.

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

DOCTORAL PROGRAM

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5. Satisfactory performance on both a basic and comprehensive exam covering the above course material covered in undergraduate work.

6. A final oral examination covering the thesis and related course work.
Wave propagation in free space, earth's tropo-

4570 Electro-Acoustics (3) Reproduction of
monophonic and stereophonic sound, micro-
phones, loudspeakers, disc recording, magnetic
recording, film recording; acoustics of studios, au-
ditoriums. Preq: 3060.

4600 Analog Signal Processing Circuits for Elec-
tronics (3) Consideration of aspects of pulse-
mode, clock-mode, and level-mode sequential circuits. Theory and characteristics of one- and two-
dimensional signal processing. Design of large-
scale digital systems using MSI and LSI
integrated circuits. Introduces principles of reliability and error detection in digital systems. Preq: 3180 and
3830. 3 hrs including bieweekly lab.

4620 Sequential Machine and Digital System
Theory (3) Consideration of hardware systems.
Models of communication, and symbols. Inter-
connection. Studies in control of power and fre-
uency as well as voltage and reactive power. Pre-
req: 3059.

4680 Electronic Amplifiers (3) Feedback amplifier
amplifiers and other loading components. Design of systems utilized for microwave power transmission and for
micro wave integrated circuits. Preq: 3060. 4 labs.

4100 Digital Communication Systems (3) Principles of
digital communication systems. Sampling
theorems, pulse amplitude, duration, and posi-
tion modulation methods. Quantization, coding,
and modulation techniques. Description of digital
signals and carrier modulation with digital waveforms. Delta, adaptive delta, delta-sigma, and delta
PCM systems. Preq: 3060.

4590 Elements of Network Synthesis (3) Energy
relationships in networks. Quadratic forms.
Positive-real functions; properties and tests.
Synthesis of L-C networks by Cauer's and Foster's
methods. RL and RC networks. Application to
the synthesis of lossless two-ports in form of ladder
circuits.

4370 Introduction to Feedback System Design (3)
Mathematical formulation of control systems; steady state error and error constants; root-locus method; optimum gain adjustments; compensation

4410 Power System Components and Control (3)
Analysis of power system components and their in-
terconnection. Studies in control of power and fre-
uency as well as voltage and reactive power. Preq:
3080.

4420 Power Systems Analysis (3) System studies
including load flow, faults, and stability. Preq: 3090.

4430 Transmission, Distribution, and Protection (3)
Studies in underground and d.c. transmission; con-
siderations of overvoltages and insulation require-
ments; system protection against faults. Preq: 3090.

4460 Lasers and Masers (3) Introduction of prin-
ciples of laser and maser operation based on classical
concepts and electrical engineering analogies.
Consideration of practical devices and applications.


4480 Plasma III (3) Macrosopic plasma equations, particle orbits, interactions, oscillations and waves. Preq: 3190.

4490 Electro-optics (3) Fourier optics. Diffraction, len-
sing, imaging, coherent imaging. Engineer-
ing applications; holography.

4500 Electro-optics Detection and Instrumentation
(3) Sensitivity, resolution (frequency response) and
noise in optical detection. Consideration of practical
engineering data for both spatial recording media (e.g. photographic emulsions) and temporal detectors (e.g. photodi-
dodes). The last third of the course will be
devoted to selected electro-optic instrumenta-
tion systems (e.g. laser light scattering, optical data

4540 Antennas and Propagation (3) Dipole and
linear antennas, arrays and other simple antennas. Antenna gain, impedance and other parameters.
5510-20-30 Introduction to Switching Theory and Logic Design (3, 3, 3) Boolean algebra and application to computer science, digital logic design, machines. Information structures and sub-systems. For computer science majors and those without prior experience in logic design. Prereq: Elementary linear algebra and calculus of several variables. 4 labs per quarter.


5760-70 Pattern Recognition (3, 3) (Same as Computer Science 5210)

5830-40 Linear Antennas and Antenna Arrays (3, 3) Hertzian dipole, linear antennas, impedance loop transmission. Prereq: 4410-20-30 or equivalent.


5850 Microwave Electronics (3) Space charge potential. Collimated beams, receiving antennas, linear arrays. Prereq: 5820.

6240-50-60 Advanced Systems Theory I, II, III (3, 3, 6000) Doctoral Research and Dissertation (3-15) E equivalent or consent of instructor. (Same as Computer and software interface design. Prereq: 4850 or equivalent or consent of instructor. (Same as Computer Science 5940-50.)

6000 Doctoral Research and Dissertation (3-15) E

6240-50-60 Advanced Systems Theory I, II, III (3, 3, 3) Advanced topics in modern theory. Topics vary. 6240-50-60 Solutions of the control problem, information, recognition and control, hierarchical systems, reliable control. 6250—Algebraic and geometric systems theory, systems defined on groups. 6260—Qualitative analysis of systems. nonlinear systems analysis, stability theory. Need not be taken in sequence. Prereq: 5271-31-91 or consent of instructor.

6270-80-90 Special Topics in Systems Methodology (3, 3, 3) Advanced topics of current interest to system analysis and engineers. Discussion of new developments as found in current literature. Prereq: Consent of instructor.


6500-10 Electrical Conduction in Gases and Plasma in General, Atomic and Molecular Physics (5020-10)

6530 Special Topics in Image and Pattern Analysis (3) Discussion of new developments as found in current literature. Prereq: 5070-80 (Computer Science 5520) or consent of instructor.


6650 Advanced Antenna Theory (3) Cylindrical dipole. Helman’s equation. King’s integral equation, current distribution, terminal impedance, and mutual impedance between several dipoles. Prereq: 5810 and Mathematics 4250 and 4550.


6760 Coding Theory (3) Mathematical structure of algebraic and probabilistic codes. Coding metrics and bounds. Practical schemes and shift registers, convolutional codes, burst-error-correcting codes and decoding methods. Prereq: 5710 or consent of instructor.

6800-10-20 Advanced Topics in Electronic Instrumentation (3, 3, 3) Selected advanced topics in electronic instrumentation based on particular interests of student and physical processes in instrumentation transducers including thermoelectric, magnetoelectric, electromechanical and optical devices. Physical operation of modern discrete, monolithic, and hybrid electronic structures and their application in signal processing, amplifiers, feedback, sensing, response time, and noise considerations in signal processors used in modern electronic instrumentation. Prereq: 5610-20-30. Coreq: Mathematics 5610.

6910-20-30 Advanced Sequential Machine and Automata Theory (3, 3, 3) Finite-state models; algebraic structure of sequential machines including decomposability, minimization and simulation of machines; identification experiments, measurement and control of sequential machines; regular expressions and recursive languages; Reliability and threshold logic. Random processes in sequential machines. Prereq: 5610-20-30. Coreq: Mathematics 5610.


6650 Advanced Antenna Theory (3) Cylindrical dipole. Helman’s equation. King’s integral equation, current distribution, terminal impedance, and mutual impedance between several dipoles. Prereq: 5810-20 and Mathematics 4250 and 4550. Additional course work more than from work in Doctoral Research and Dissertation and a thesis (if any).

6750 Detection Theory (3) Detection theory applied to communication and radar detection systems. Detection of known signals and signals with unknown parameters. Optimal filters for detection and their synthesis. Parameters estimation theory. Adaptive systems. Sequential detection theory of Wald and Finn. Target Fluctuation Models. Suboptimal detection theory. Prereq: 5710 or consent of instructor. The flexibility and interdisciplinary aspect of the program options are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) 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 biomathematics.

THE MASTER’S PROGRAM

Two M.S. plans are offered: Plan I requires a thesis, while Plan II does not. The second plan is offered to meet the needs of engineers employed in industry, or those who plan to teach in community colleges and technical institutes. It will be available, however, to any student who, in the opinion of his/her advisory committee, can benefit from additional course work more than from 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:

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<thead>
<tr>
<th>Course</th>
<th>Hours</th>
<th>Credit</th>
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<tr>
<td>Plan I</td>
<td>18</td>
<td>27*</td>
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<tr>
<td>Plan II</td>
<td>9</td>
<td>9</td>
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(Major option, may include but is not restricted to courses offered by the Engineering Science and Mechanics Department.) Related courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.)

A final examination is required under both plans, covering graduate course work and the thesis (if applicable).

THE DOCTORAL PROGRAM

General policies and requirements of the Graduate School relating to admission, residence, languages, research, examinations, faculty advisory committee, and admission to candidacy apply to this program.

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

1. A minimum of 108 quarter hours credit beyond the Bachelor’s degree, exclusive of credit for the Master’s thesis. These shall include a minimum of 36 quarter hours credit in Doctoral Research and Dissertation and a minimum of 72 quarter hours credit in other courses.

2. A minimum of 36 quarter hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses...

*Engineering courses under Plan I may include advanced laboratory work or special problem work, for example Engineering Science and Mechanics 5910 or analogous courses in other departments.
will normally be 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 be determined by the program selected by the student and the approval of his/her advisory committee.

3. A minimum of 18 quarter hours in mathematics or computer science in courses numbered 4000 and above, exclusive of a first course in ordinary differential equations.

4. A minimum of 9 quarter hours of courses numbered 5000 and above, offered in departments other than mathematics, computer science, and the student’s major department and which are not included in the areas of concentration under item 2.

5. Active participation in graduate seminars and colloquia.

6. Stress analysis consisting of a written qualifying examination and an advanced examination. The qualifying examination covers areas of engineering science and mathematics, for the most part at a level equivalent to that of well-qualified recipients of a Bachelor’s degree in engineering. The advanced examination requires demonstration of special competence in the areas of concentration selected by each student under item 2.

7. Submission of a written proposal for dissertation research to the student’s advisory committee. Oral defense of the proposal is normally required when the student takes the advanced portion of the comprehensive examination.

8. Submission of a dissertation which meets the requirements of the Graduate School, the department, and the student’s advisory committee.

3311 Mechanics of Materials (4) Concepts of stress and strain; stress-strain relations and Mohr’s circle; static analysis of members; area moment of inertia; stress and displacement analysis of axially-loaded members; torsion; bending. Not for departmental graduate credit. Prereq: Basic Engineering 1310. Coreq: Mathematics 2840 or consent of instructor.

3410 Introduction to Biomedical Engineering (4) Designed to introduce the facets and opportunities of biomedical engineering, and to provide basic terminology and understanding of knowledge for courses in the field. Subjects include anatomy, physiology, biotechnology, biomaterials, mathematical models of body systems. Coreq: Mathematics 2840 or consent of instructor.

3420 Introduction to Clinical Engineering (3) Designed to train students in life sciences, health professions, and engineering in use and applications of medical instruments. Body systems are introduced, and instruments used in care of those systems are explained and demonstrated. Prereq: 3410 or consent of instructor.

3520 Materials Behavior and Chemical Process Design (3) Same as Metallurgical Engineering 3520.

3700 Dynamics (4) Kinematics of rigid bodies; mass moments of inertia; coulomb friction; kinetics of rigid bodies using force, mass, acceleration; work-energy; impulse-momentum. Not for departmental graduate credit. Prereq: 2705 or Basic Engineering 1320, Mathematics 2840.

3710 Intermediate Dynamics (3) Three-dimensional dynamics of particles and rigid bodies; dynamics of bodies with varying mass; central force motion; LaGrange’s equations. Prereq: 3700, Mathematics 2840.

420 Engineering Aspects of Infection Control (3) Biomedical engineer’s role in infection control will be related to hospital and clinical activities. Fluid flow phenomenon, pressure measurement methods, and basic bacteriological and mycological tests will be demonstrated. Course identifies new and critical role for biomedical engineering in health care systems and hospital facilities and monitoring systems. Prereq: 3410 or consent of instructor.

4430 Orthopedic Biomechanics (3) Introduction to engineering and flow phenomena. Basic concepts and applications in orthopedics and rehabilitation. Topics include statics, Newton’s laws of motion, stresses in simple sections, statics and dynamics, biologic materials. Prereq: Consent of instructor.

4500 Applied Mechanics for Life Scientists (4) Concrete and broad coverage of basic principles and concepts of stress, strain, mechanics of solids, statics, vibrations, continuum mechanics and properties of materials. Applications in engineering and medicine. Prereq: Mathematics 1860 or consent of instructor.

4520 Biomedical Fluid Mechanics (3) Discuss objectives, review foundations and present developments in biomechanical and fluid mechanics. Properties of human blood and blood vessels, determinants of cardiac performance, analysis and measurement of flow and pressure in arteries, noninvasive study of circulatory system, mechanics of micrcirculation. Applications to areas of hemodynamics, thrombosis, and fluid dynamics of heart assist devices. Prereq: 3410 or consent of instructor.

4529 Biomedical Fluid Mechanics Laboratory (2) Measurement and recording of flow characteristics in biological systems. Project and/or term paper required. Coreq: 4520.

4530 Biomechanics (3) Discuss objectives, review foundations and present developments in areas of mechanical properties of living tissues, biomechanics of injury and prostheses, material compatibility of prosthetic devices and biomechanical problems related to implant. Prereq: 4500 or consent of instructor.

4540 Fracture-Safe Design (3) A critical review of mechanical properties of materials that are indicative of fracture resistance, including transition temperature, R-curves, stress intensity factors, and J-integrals; the use of these properties in design. Prereq: 3310 and Metallurgical Engineering 2110. (Same as Metallurgical Engineering 4540.) 3 hrs or 2 hrs and 1 lab.

4580 Principles of Nondestructive Testing (3) (Same as Physics 4580.)

4610 Experimental Stress Analysis (3) Basic concepts; theory, techniques, and instrumentation of resistance strain gage; theory and techniques of brittle coating; three-dimensional instrumentation; photoelastic analysis methods. Prereq: 3310, Electrical Engineerin 2020 or 3110. 2 hrs and a 3-hr lab.

4620 Dynamic Data Acquisition (4) Instrumentation of measuring systems for dynamic events and responses; signal conditioning; oscillographs, oscil scopes, 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 Photomechanics (3) Introduction to photoelasticity, photoelastic coating method, Moire method, interferometry, and holography. Prereq: 3410, Physics 2320. 2 hrs and a 3-hr lab.

4710 Fundamentals of Vibrations (3) Free and forced vibrations of damped and undamped lumped parameter systems; energy methods. Prereq: 2720, Mathematics 2840.


4810-20 Engineering Analysis (4, 3) Integration of fundamental physical laws and mathematical methods to make emphasis on application to realistic engineering problems. Prereq: 3110, 3311, and Mathematics 3150.

4850 Elementary Structural Matrix Methods (Same as Civil Engineering 4850 and Architecture 4850.)
applied dynamic loads; approximate methods of solution. Prereq: 5410 and Mathematics 4550.

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

5800 Introduction to Continuum Mechanics (3) Fundamentals of mechanics of solids and fluids; Cauchy's stress tensor, strain, deformation, and flow in a continuous medium; constitutive equations, applications to solids and fluids. Prereq: 3130 and 3311 or equivalent. Prerequisite: 4910. Consent of instructor.


5860 Introductory Finite Element Methods (3) General finite element procedure; convergence requirements; programming concepts. Stress analysis, heat transfer, fluid flow, and solution of differential equations. Prereq: 5800 or 5310, or Mechanical Engineering 6410. Consent of instructor.

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

6000 Doctoral Research and Dissertation (3-15) E 6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) Survey of literature on advanced convective momentum, heat, and mass transfer; convective mass flow, high speed flows of Navier-Stokes equations: boundary layer stability analysis; phenomenological theories of turbulence; turbulent boundary layers; flow: flow instability analysis; lectures. Prereq: 5110-20 or equivalent; Mathematics 4610. Consent of instructor.

6140 Advanced Finite Element Methods in Fluid Dynamics (3) Computational fluid dynamics using finite elements; applications; solution formulation for two- and three-dimensional, multispecies compressible flows, second-order turbulence closure; parabolic Navier-Stokes equations. Multidimensional, turbulent, and reacting flows. Prereq: 5130 and 5140.

6230-40-50 Theory of Turbulence (3, 3, 3) Mathematical description of turbulence; isotropic turbulence; statistical description; the co-turbulence model; large and small eddy structure by turbulent flows; turbulent diffusion by continuous movement; applications to turbulent jets, wakes, pipe flow, and boundary layers. Prereq: 5110-20 or equivalent. Prerequisite: Mathematics 4610. Consent of instructor.

6320 Analysis and Design of Thin Shell Structures (3) Geometry of surfaces, derivation of thin shell theory, and applications of theory for structural engineers. Prereq: 6310 or Civil Engineering 5160.


6340 Theory of Plasticity (3) Yield conditions; strain hardening; general constitutive equations; plastic potential; uniqueness theorems; extremum and variational formulations; problems in perfectly plastic solids; finite plastic deformations; piecewise linear plasticity. Prereq: 5410 and Mathematics 4550.

6610 Photocellasticity (3) Stress-optic law in three dimensions and index ellipsoid, rotational effects in three-dimensional photoelasticity, techniques and applications of three-dimensional photoelasticity, scattered light method, dynamic photoelasticity, photothermoelasticity, photoelasticity and photography, and experimental methods in photoelasticity. Prereq: 5460, 5420 and consent of instructor. 2 hrs and 3 labs.

6710 Impact and Stress Waves in Solids (3) Mechanical impact; propagation in elastic solids; impact and wave phenomena; earthquakes, and plate contact problems in impact of elastic bodies; dynamic loading in viscoelastic and plastic materials; dynamic properties and materials. Prereq: 5410. Coreq: Mathematics 5630.

6800 Nonlinear Viscoelasticity (3) Same as Polymer Engineering 6210.

6810 Energy Methods (3) Virtual work, minimum potential energy, and complementary energy; Casiglia's theorem, Hamilton's principle, and Lagrangian equations of motion; variational methods; examples from theory of structures, plates and shells, buckling, vibrations, and advanced dynamics. Prereq: 5710-20 and Mathematics 5610-20.30.

6910 Special Topics in Engineering Mechanics (3) Advanced problems of interest in mechanics, worked either as a group or individually. Prereq: Consent of instructor. May be repeated with consent of department.

NOTE: Not all of the above courses will be offered in any one year.

Industrial Engineering

MAJOR

DEGREES

M.S., M.E.

Professors: J. N. Snider (Head), Ph.D. Ohio State, P.E.; D. C. Dougal, Ph.D. Pennsylvania State University; H. P. Emerson (Emeritus), S.B. Massachusetts Institute of Technology, P.E.; R. M. LaForge, (Emeritus), Ph.D. Georgia Institute of Technology; P.E.; H. L. Loveless, M.S. North Carolina State, P.E.; D. F. DePorter, Ph.D. Virginia Polytechnic Institute, P.E.; E. L. DePoy, Ph.D. Virginia Polytechnic Institute, D. H. Hutchinson, Ph.D. Georgia Institute of Technology; W. A. Lyday, M.S. Tennessee, P.E.

Associate Professors: E. K. Boyce, M.S. Tennessee, W. W. Claycombe, Ph.D. Virginia Polytechnic Institute, P.E.; E. L. DePorter, Ph.D. Virginia Polytechnic Institute, D. H. Hutchinson, Ph.D. Georgia Institute of Technology; A. W. Lyday, M.S. Tennessee, P.E.

Assistant Professors: M. K. Goi, M.S., Tennessee, P.E.; J. C. Hungerford, M.S., Ohio; K. E. Kirby, Ph.D. Tennessee.

THE MASTER'S PROGRAM

A graduate program leading to the degree of Master of Science is open to graduates of recognized undergraduate curricula in industrial engineering or to graduates of other engineering curricula who take up to 15 quarter hours of prerequisite course work. A non-thesis option with 45 hours of course work plus a thesis is available. Graduate work in Industrial Engineering provides for concentrations in operations research, industrial administration, manufacturing and production systems, human factors engineering, and systems engineering. Either one or two minors can be elected in Engineering, Mathematics, Psychology, Business, Computer Science, Statistics or Economics.

MASTER OF ENGINEERING PROGRAM

This professional degree program is intended as a culminating year in a five-year baccalaureate-master program which emphasizes engineering design and professional practice. Admission requirements include those presented above plus the requirement of a Bachelor's degree from an A.B.T.-accredited engineering program. This 45-quarter hour program requires 18 hours of course work in an industrial engineering core, 9 hours of technical methods electives, 9 hours of industrial engineering design electives and 9-hour thesis or design project. Any 4000-level course required in the Bachelor of Science program in Engineering program at The University of Tennessee may not be used for graduate credit in the M.S. or M.E. graduate program in Industrial Engineering.


4060 Material Requirements System Design (3) Theory and application of forecasting, production planning, inventory analysis, planning and control, and systems design and implementation. Design of the material requirements process as an integrated system. Prereq: 3510-20. Not available for graduate credit for industrial engineering students.

4070 Production Systems Design (3) Production planning, scheduling, and control, design and implementation of production systems; design of production facilities as integrated system. Prereq: 4060.

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

4150 Project Control with CPM and PERT (3) A study of project planning and control based primarily on critical path techniques, including resource allocation and cost-time trade-offs. Prereq: 4520 and Engineering Science and Mechanics 3310. Not available for graduate credit for industrial engineering students.

4170 Automatic Process Control (3) Characteristics of automatic processes and controllers; elementary open and closed loop analysis, and applications to industrial control system. Prereq: Mathematics 2660 and Engineering Science and Mechanics 2720.

4200 Production Facilities Design (4) Materials handling, plant layout, service areas, inventory control applications, and operating procedures design. Prereq: 3630, 3510-20, 4060, 4520.

4230 Scheduling Systems (3) Performance measures for job shop and flow shop scheduling, including both static and dynamic conditions, as well as techniques for generating production schedules. Deterministic and probabilistic dispatching conditions. Prereq: 3620.

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

4260 Engineering Economy (3) Methods and problems of valuation of equipment, technical and financial decisions among engineering alternatives, involving capital recovery, economic life of equipment, and rate of return on investment. Not available for graduate credit for industrial engineering students.

530 Case Studies in Engineering Economy (3) Extension of basic engineering economy principles to actual problems faced by competitive firms and regulated industries. Case studies taken from literature form basis of classroom discussion. Out-of-class assignments include the application of cost analysis tools and methods with local companies to evaluate make or buy options, leasing versus cash purchases, equipment replacement studies, energy source economies. Prereq: 4520.

5450 Industrial Development (3) Factors other than mechanical or chemical which enter into successful establishment and expansion of commercial enterprises. Cost and location studies and market analysis to determine the commercial feasibility of new plants or projects.

5990 Simulation (3) Generation of outcome of complex random process by computer. Models of complex systems using available simulation languages. Simulation as design tool for manufacturing enterprise. Cost and location studies and market analysis to determine the commercial feasibility of new projects or plants.

College of Engineering


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


5700 Optimization Methods in Industrial Engineer-ing (3) Operations research. Analytical techniques required in 5710, 5720, and 5730. Classical optimization theory, N-dimension geometry and calculus of variations, selected areas of operations research. Prereq: Computer Science 3150 and matrix algebra.

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

5710 Linear, Quadratic and Separable Program-ming (3) Mathematical programming, linear program-ming, quadratic programming, and separable program-ming. Computer solutions to programming problems. Prereq: Computer Science 3150 and matrix algebra.

5720 Queueing Models and Simulation (3) Theory and application of queueing models and simulation methods employed to evaluate complex queueing systems. Data analysis and hypothesis testing related to pertinent waiting line probability density functions. Prereq: 5700, 5360.

5730 Game Theory and Random Processes (3) Op-erations research including game theory with appli-cations for decision making under uncertainty, queueing, inventory models and decision making. Prereq: 5700.


5830 Health Systems Engineering II (3) Health sys-tems for analysis, control, and improvement of func-tion and total health system. Prereq: 4830.


5900 Design Project (1-10) Industrial engineering topics to fulfill degree requirement in non-thesis program. Enrollment limited to industrial en-gineering students in non-thesis program. May be repeated. Maximum 10 hrs.

5910-20-30 Special Topics in Industrial Engineer-ing (3, 3, 3) Special problems for students qualified for individual or group research projects. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


4600 Determined Time Systems (3) Work design and measurement using predetermined time sys-tem: methods, time measurement, basic motion time-study, or work factor. Theory and application. Prereq: 3600, 3630.

4610 Human Factors in Work Design II (3) Human capabilities and limitations affecting work place layouts, working environments, design of tools and equipment, and planning of operations in human-machine systems. Prereq: 3600, 3630, or consent of instructor.
GRADUATE STUDY PROGRAMS

Graduate programs in Mechanical Engineering or Aerospace Engineering are available which lead to the degrees of Master of Engineering, Master of Science, and Doctor of Philosophy with concentrations in solar energy, environmental technology and utilization, power generation, machine design and dynamics, aerodynamics and gasdynamics, aeroacoustics, stress analysis, propulsion, heat transfer and fluid mechanics, and thermodynamics. In addition to the general policies and requirements of the Graduate School, each student must satisfactorily complete a program of study which has been approved by the student's committee. Specific program requirements are given below.

MASTER OF ENGINEERING PROGRAMS

Entrance into the Master of Engineering program is restricted to qualified graduates of A.B.E.T.-accredited undergraduate curricula in mechanical or aerospace engineering. At least one-third of the program of study must be classified as engineering design. The student's advisor will assist in planning the program of study to ensure that it includes the necessary design content. Three program options (thesis, course, and problems) are described below. Note that some students may not be eligible for the course option.

Masters Program Options

Three program options are available: Lubrication (3) Hydrodynamic theory of lubrication, solid and fluid friction, design and applications. Prereq: 3620.

2. Participation in the departmental seminar program.
3. Passing a comprehensive written final examination on all course work submitted for the degree. The student's committee will be of sufficient size to include all the study areas reflected in the course program.
4. The Problems Option. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 36 quarter hours of course work which includes at least 18 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally 9 quarter hours of course work (4000-level or above) in mathematics.
   2. A minimum of 36 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.

5. Passing a comprehensive written final examination of all course work submitted for the degree and an oral examination of all work (including problems) submitted for the degree.

THE DOCTORAL PROGRAM

Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds.

The student must satisfactorily complete an approved program of study which normally includes:

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or problems.
2. A minimum of 36 quarter hours credit in doctoral dissertation.
3. A minimum of 18 quarter hours in mathematics in courses numbered 4000 or above.
4. A minimum of 36 quarter hours in mechanical and/or aerospace engineering courses numbered 5000 and above, with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis, problems or dissertation credit.
5. Participation in the departmental seminar program.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Junior (3000-level) and senior (4000-level) mechanical and aerospace engineering courses may be taken for graduate credit by non-mechanical or non-aerospace engineering majors if approved by the student's major department. Mechanical or aerospace engineering majors may normally use more than one 4000-level engineering course to meet their advanced degree requirements. Non-mechanical or non-aerospace engineering graduate students should consult with instructors regarding prerequisites for undergraduate courses.

Mechanical Engineering

3600 Energy—An Overview (4) Introduction to available energy resources, environmental and utilization; power generation techniques including conservation schemes; emphasis on the resources-environment-human interaction associated with energy; primarily for non-engineering students.

3110 Applied Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties; applications to engineering problems.

3111 Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties.

3330 Engineering Thermodynamics (3) Properties of gases and mixtures; chemical reactions; equilibrium; applications to mechanical engineering problems.

3410 Fluid Flow (3) Development of continuity, momentum and energy principles for fluid systems; applications of mechanical and aerospace engineering methods.

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

3520-30-40 Thermal Sciences (3, 3, 3) Fundamental principles of thermodynamics and transport phenomena as applied to engineering design. To be taken in sequence.

3610 Mechanics of Machinery—Kinematics (3) Machine motions, graphical and analytical methods; instantaneous centers, velocities; accelerations.

3620 Mechanics of Machinery—Dynamics (3) Applications of Newton's laws, work, energy, and impact to machinery. Force analysis of mechanisms, balancing, gyroscopic effects, flywheels. Prereq: 3610.


3650 Introduction to Machine Design (3) Ductile-brittle behavior of materials under static and cyclic loading. Stress concentration, design factors and theories of failure. Changes in material behavior in processing and fabrication. 2 hrs and 1 2-hr lab.

3910 Engineering Analysis (3) Advanced analysis techniques for problems of aerospace and mechanical engineering. Emphasis on approximate methods.

4140 Energy Conversion Systems (3) Laws governing energy transformations and their application to power plants.

4150 Energy Conversion Systems (3) Operating and design characteristics of new technology energy conversion systems, selected direct conversion techniques.

4160 Energy Conversion Systems (3) Economic and technical design parameters as applied to power plants for public utilities or industrial applications; selected design and layout problems.

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

4180 Energy Production and Utilization (3) Thermodynamics constraints on energy production; comparison of power generation methods; evaluation of new energy sources and concepts; energy conservation schemes.

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

4420 Heat Transfer (3) Heat transfer by free and forced convection, heat transfer in phase change, heat transfer in high speed flow, heat exchanger applications.

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

4471-91 Experimental Mechanical Engineering (3,
3) Experimental methods and measurements of force, length, time, temperature, pressure, transport rates, and physical properties. Planning, conducting, and reporting experimental tests and experiments, run according to test standards and other specifications.

4510 System Dynamics (4) Analytical models of physical systems, linearization, Laplace transforms, dynamic characteristics and stability of systems, numerical simulations, and analog computer solutions. Not for departmental graduate credit.

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

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

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


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

4625 Manufacturing Process Engineering I (3) Process specification: dimensional analysis of size and form; true position tolerance theory; tolerance analysis; and workpiece control for production to tolerances.

4631 Energy Methods in Mechanical Design (2) Application of strain energy principles in complex beams and structures.

4632 Application of Lagrangian Mechanics in Vibrational Problems: Coordinated coordinates and multiple degree of freedom vibrating systems.

4633 Matrix Analysis (3) Application of matrices to solution of complex structures and lumped parameter vibrating systems.

4660 Materials and Manufacturing Process (3) Selection of materials in design process, emphasizing relationship between stress and strain analysis, material properties, environment, temperature, manufacturing technology and cost.

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

4680 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design machine elements, springs and shafting, selection of sleeve and rolling element bearings.

4690 Machine Design (3) Innovative design of complete machine; documentation including specifications: sketches, 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 heat exchangers; 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 available systems. A survey of selected heat transfer topics pertinent to solar energy collection and use: design analysis of solar energy collectors and concentrators; heat transfer; solar radiation; building heat transmission; building heat; physiological effects.

4810 Internal Combustion Engines (3) Thermophysical phenomena in internal combustion and propulsion engines. Combustion, detonation, exhaust, engine design, and performance of internal combustion engines using ideal and real fluids.

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

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered in the MS program. A student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. Prerequisites: S/N only. E

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

5120 Convection Heat Transfer (3) Equations of viscous fluid flow, energy equation, convection analysis of internal and external flows including effects of variable heat flux, surface temperature, and fluid properties. Prereq: S/NC or equivalent.


5140 Phase Change Heat Transfer (3) Fundamental mechanisms, modeling and prediction of nucleate, transition and film boiling; critical heat flux, forced convection boiling and post dry-out heat transfer; two phase flow and pressure drop; condensation heat transfer. Prereq: 5120 or consent of instructor.


5220 Microscopic Thermodynamics (3) Thermodynamic properties, kinetic theory and statistical mechanics. Prereq: 5210.

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

5310 Intermediate Fluid Mechanics (3) Vector descriptions of fluid motions; derivation of basic equations; two-dimensional potential flows; viscous flows with emphasis on boundary-layer theory. Prereq: 3630, 3910.


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

5510-20 Mechanical Engineering Design (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.


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

5690 Vibrations of Mechanical Systems (3) Free and forced vibration of single and multiple degree of freedom systems; linear and nonlinear. Prereq: 3630.


5840-50-60 Turbomachinery Systems (3, 3, 3) Design, development, and systems integration of turboengines components. Prereq: First year graduate standing; consent of instructor.

5870 Dynamic Modeling and Simulation (3) Modeling physical systems including mechanical, thermal, hydraulic, pneumatic and electronic/mechanical systems. Techniques and connection between simulation and system parameters. Analog and digital computer simulation techniques. Prereq: 3630, 4420, and Aerospace Engineering 3911.

5900 Selected Engineering Problems (3-9) Selected problems in mechanical engineering to fulfill requirement of Problems Program. Enrollment limited to students in Problems Program. Prereq: Consent of advisor. May be repeated. S/N only.

5950 Seminars (1) All phases of mechanical engineering, including reports on current research at The University of Tennessee, Knoxville. May be repeated. S/N only.

5990 Special Topics in Mechanical Engineering (1-3) May be repeated.

6000 Doctoral Research and Dissertation (3-15) E

6110-20 Advanced Topics in Fluid Mechanics and Heat Transfer (3-3) Advanced theory and application of fluid mechanics and heat transfer, natural convection, two-phase flows, high speed reacting and non-reacting flows, advanced boundary layer techniques. Prerequisite: Instructor.

6130-40 Advanced Radiation Heat Transfer (3, 3) Radiation heat transfer in absorbing, emitting and scattering media; interaction of thermal radiation with fluid media and heat transfer. Radiation heat transfer in hypersonic flow; radiative characteristics of luminous flames and nonuniform gas flows; scattering by cold and hot atmosphere. Prereq: 5110-20-30; Mathematics 4550.

6420 Selected Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium of heat transfer; meta-stable states. Prereq: Consent of instructor.

6430 Selected Topics in Thermodynamics (3)

6610 Engineering Vibrations (3) Mechanical transients. Linear and nonlinear single degree of freedom systems. Prereq: Consent of instructor.

Aerospace Engineering

3610 Dynamics (3) Newton's Law: work-energy impulse-momentum, Lagrange equations, central force, gyroscopic effects. Applications to aerospace systems.

3620 Mechanical Vibrations (3) Free and forced vibrations of single and multiple degree vibration systems, balancing of rotating machinery.

3630-40 Structural Analysis of Aerospace Vehicles (3, 3) Fundamentals of structural analysis as applied to configurations of aerospace interest. Introduction to aerelasticity phenomena. Must be taken in sequence.

4110 Aerodynamic Fundamentals (3) Atmosphere, dynamics and thermodynamics of perfect gases, fluid flow types, airflow theory, wing theory, drag, for non-aerospace engineering majors only.

4120 Aircraft Propulsion and Performance (3) Propellers, propulsion systems for aircraft, static performance and special performance problems, maneuvers, control surfaces, stability and control. For non-aerospace engineering majors only.

4220 Compressible Flow (3) One-dimensional internal flow; shock and expansion waves; friction and nonadiabatic flow.

4220 Low Speed Aerodynamics (3) Potential flow
theory; kinematics and dynamics of perfect fluids; analysis and design of aerospace vehicles.

4230 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow; compressibility effects; numerical solution methods.

4240 Aeronautics (3) Propulsion, trajectories, guidance, control, and atmospheric reentry of space vehicle systems.

4250 Propulsion (3) Principles of propulsion devices: rocket, ramjet, and ramjet engines.

4260 System Design (3) Synthesis of aerospace system. Design report on the system.

4471-91 Experimental Aerospace Engineering (3, 3) Experimental research, design and measurement of force, length, temperature, pressure, transport rates and physical properties. Planning, conducting, analyzing, and reporting experimental tests run according to test standards and other specifications.

4510 Airplane Performance (3) Introduction to airflow, force, moment, drag, propellers; static performance and maneuverability; theory and design of control surfaces: stability.

4910 Selected Topics in Aerospace Science (3) Current problems; student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree assignment. Prereq: Approval of advisor. May be repeated. S/NC only.

5000 Thesis (1-15) E Credit to be arranged; 3 hrs maximum each quarter.

5002 Non-Thesis Graduation Completion (3-15) Required of students not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree assignment. Prereq: Approval of advisor. May be repeated. S/NC only.

5110 Fundamentals of Fluid Dynamics (3) Kinematics and dynamics of perfect fluids; potential flows about simple geometries. Prereq: Mathematics 4250.

5120 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests (supersonic and subsonic), water table experiments, supersonic flow measurements, boundary layer measurements. Prereq: 4210-20-30 or Mechanical Engineering 5310.

5150-60-70 Air Vehicle Aerodynamics and Performance (3, 3, 3) Application of aerodynamics to air vehicle to provide estimates of performance, stability, and control. Prereq: 4210-20-30 or Meteorology 4710. May be repeated. S/NC only.

5210 Dynamics of Viscous Fluids (3) Equations of viscous fluid flow: laminar and turbulent flow; transition: separation; boundary layer theories; exact and approximate solutions. Prereq: Mechanical Engineering 5310 or equivalent.

5230 Introduction to Hypersonic Flow (3) Skewer body theory, blunt body science and engineering required for an understanding of the several areas of aerospace science.

5400-5500 Advanced Aerodynamics (3, 3) Subsonic, transonic, supersonic, and hypersonic flight. Prereq: Consent of instructor.


6000 Doctoral Research and Dissertation (3-15) E Credit to be arranged; 3 hrs maximum each quarter.

6100 Physical Gasdynamics (3) High-speed, high temperature flow of gases from molecular point of view; molecular concepts and simple kinetic theory; mechanical/properties of gases and gas mixtures from steady-state kinetic theory chemical thermodynamics, and statistical mechanics. Prereq: 5100-20-30 or equivalent.

6200 Physical Gasdynamics (3) Continuation of 6100; flows of mixtures in local thermodynamic and chemical equilibrium; physical and chemical basis of the equation of state with applications to vibrational and chemical nonequilibrium. Prereq: 6100.

6510-20-30 Advanced Aerodynamics (3, 3, 3) Subsonic, transonic, supersonic, and hypersonic flows treated in a generalized and unified manner with combined viscous/inviscid effects. Relationships among various regimes of fluid flows. Fundamental assumptions, limitations of approximations and consequences. Foundations of gas dynamics with emphasis on applications to airplane, rocket, ground propulsion, and jet propulsion. Discussion of special topics according to students' interest. Prereq: 5110, 5220, and 5420 or equivalent.

6810 Advanced Boundary Layer Theory (3) Derivation and critical review of governing equations. Asymptotic solutions; similarity methods; boundary layer transformations. Approximate integral methods to include compressibility and heat transfer. Attached and separated flows; shock-wave boundary layer interaction. Prereq: 5220, Mechanical Engineering 5120, and Physics 5630.

6910 Advanced Topics in Gasdynamics (3) Selection of topics based on current needs and interests of students: nonequilibrium transport phenomena, radiative gasdynamics, nonequilibrium gasdynamics flows, chemical nonequilibrium, nonequilibrium, and perturbation techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

Nuclear Engineering

MAJOR DEGREES

Nuclear Engineering

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

Professors: P. F. Pasqua (Head), Ph.D. Northwestern, P.E.; J. B. Fausel, Ph.D. Georgia Institute of Technology; T. W. Kerlin, Ph.D. Tennessee; J. E. Mott, Ph.D. Minnesota; R. Perez, Ph.D. Madrid (Spain); J. C. Robinson, Ph.D. Georgia; H. C. Rolland, Ph.D. France; P. N. Stevens, Ph.D. Northwestern, P.E.

Associate Professor: H. D. Dood, Ph.D. Tennessee, P.E.

Assistant Professors: E. M. Katz, Ph.D. Tennessee; L. Miller, Ph.D. Texas A & M P.E.; B. Upadhyaya, Ph.D. University of California.

The Department of Nuclear Engineering offers degrees leading to the Master of Science, Master of Engineering, and Doctor of Philosophy with concentrations in nuclear science, nuclear engineering, radiation biology, and risk, radiation transport, thermal hydraulics, and core analysis.
MASTER OF SCIENCE PROGRAM

A graduate program leading to a degree of Master of Science is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary prerequisite courses before he/she enters the program. The students 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, statistics or computer science.
4. Final examination covering the thesis and graduate course work.

An alternate program is available for the Master of Science degree which involves engineering practice rather than a thesis. The student must complete a program of study which includes the following:

1. Thirty-six quarter hours of course work similar to the requirements for the regular Master of Science Program (see above).
2. Twenty-four quarter hours of Nuclear Engineering 5980. A student usually registers for 6 hours of Nuclear Engineering 5980 each quarter in addition to 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 A.B.E.T. basic level criteria. In addition to Graduate School requirements the following degree requirements must be met:

1. Thirty-six quarter hours of course work, 18 of which must be in graduate nuclear engineering.
2. A minimum of 9 hours of design project, thesis, or 24 hours of Nuclear Engineering Practice (5980). Documentary proof of significant engineering experience may be submitted in lieu of the design project, thesis, or Nuclear Engineering Practice, but in this case 45 hours of course work are required.
3. Nine hours of course work submitted must be from out of department.
4. A minimum of one-third of the program must be in engineering design, and one-third in one of, or a combination of, advanced math, computer sciences, basic sciences, or engineering sciences. In addition, pass a final oral examination on all work presented for the degree.

THE DOCTORAL PROGRAM

Students in the field of nuclear engineering desiring to study for the degree of Doctor of Philosophy must have a Bachelor of Science or a Master of Science degree from a recognized university, with a major in engineering or physics, and present at least a B average. All candidates will be required to demonstrate special competence in a comprehensive examination in the areas of engineering science, mathematics, and physics. At the same time, all candidates will be required to demonstrate special competence in nuclear design.

Specific course requirements for the Ph.D. degree in Nuclear Engineering include:

1. A minimum of 72 quarter hours credit beyond the Bachelor’s degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.
2. A minimum of 36 quarter hours of credit in doctoral level courses.
3. A minimum of 45 quarter hours in nuclear engineering courses numbered 5000 and above (or the equivalent), with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.
4. A minimum of 18 quarter hours in mathematics, computer science, or statistics in courses beyond nuclear engineering undergraduate requirements. Must be numbered 4000 or above.
5. A minimum of 9 quarter hours in courses numbered 5000 or above from a department other than nuclear engineering. The choice depends on the student’s overall program and should expand his/her knowledge in a given field.

A reading knowledge of one foreign language will be determined by the student’s doctoral committee.

4110-20-30 Introduction to Nuclear Reactor Theory (3, 3, 3) Nuclear structure; radioactive decay laws; neutron interaction; fission process, chain-reacting systems; diffusion equation including multigroup diffusion theory, neutron moderation; reaction coefficients; perturbation theory. Prereq: Physics 3720 or consent of instructor.

4140 Thermodynamic Systems (3) Fusion reactions; properties of plasmas; plasma containment; plasma diagnostics; thermonuclear devices. Prereq: Physics 3720, Mathematics 4550.

4210-20-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation, counting statistics, half-life and decay schemes, gamma spectrometry, cross-section measurements, analog computation, diffusion properties of neutrons, critical loading experiments, control rod calibration, statistical weight shielding, xenon poisoning, prompt critical reactor behavior, fission density and adjoint flux. Prereq or coreq: 4110 or equivalent.


4710 Energy Transport (4) Development of differential and integral energy conservation equations; conduction, convection, and radiation heat transfer applications to nuclear reactor fuel elements and heat exchangers. Prereq: 3720, F.

4720 Reactor Thermal Design (4) Hydrodynamics and heat transfer in boiling systems; boiling crises; fuel element thermal design, steam generator design. Prereq: 4710, F.

4730 Nuclear Reactor Design (3) First order reactor design, integration with non-nuclear heat transfer and power conversion system, economic evaluation, optimization of reactor design, description of typical systems. Coreq: 4130. Sp.

4810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation, shielding design. Prereq: Physics 3720, 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, W.
clear engineering. Prereq: Consent of instructor. May be repeated with consent of department.

5980 Nuclear Engineering Practice (3-12) Experiences in solving and reporting on engineering problems. Prereq: Approval of Nuclear Engineering Department. May be repeated. Only Alternate Plan students may take this course. S/NC only.

6000 Doctoral Research and Dissertation (3-15) E

6110-20-30 Selected Topics in Reactor Theory (3, 3, 3) Transport theory, control rod theory, and perturbation theory. Selected topics from literature. Prereq: Consent of instructor. F, W, Sp

6140 Radiation Shielding (3) Advanced topics in radiation shielding. Monte Carlo techniques and space radiation problems. Natural space radiator, energy-source radiators, dose conversion, probability. Selected neutron, gamma, and space-radiation shielding problems. Prereq: Consent of instructor.

6150 Reactor Dynamics (3) Special topics in reactor dynamics and control. Prereq: Mathematics 5630. Su

6410 Selected Topics in Nuclear Systems Reliability Engineering (3) Advanced state-of-the-art topics in nuclear systems reliability engineering and risk assessment. Prereq: 5330 or consent of instructor.

6510 Nuclear Reactor Noise Analysis (3) Modern system theoretical methods for evaluating reactor performance descriptors from operating data. Prereq: 4610 and Electrical Engineering 5740 or equivalent.

6710 Two-Phase Flow and Heat Transfer (3) Pool boiling and flow boiling; hydrodynamics of two-phase flow, boiling crises, two-phase instabilities. Prereq: 5130 or equivalent. Su
Graduate work in Home Economics prepares the student for teaching, research and public service in colleges and universities and for managerial positions in government and industry. Graduate study leads to the degrees of Master of Science in: Child and Family Studies; Consumer Studies and Housing; Public Policy; Interior Design and Housing; Food Science; Food Systems Administration; Vocational-Technical Education (concentration in home economics education); Nutrition; and Textiles and Clothing; and the degree of Doctor of Philosophy in Home Economics with three options: interdisciplinary, food science, and nutrition.

GENERAL REQUIREMENTS FOR GRADUATE STUDENTS

General requirements for graduate study are prescribed by the Graduate School and by the student's department. Each student's application is reviewed by faculty, and students lacking adequate preparation may be required to take additional courses at the undergraduate level as prerequisites to graduate study. A student deficient in English may be required to take courses as necessary to remove the deficiency.

APPLICATION FOR ADMISSION AND FINANCIAL AID

Requirements for admission to the Graduate School are on page 12 of this catalog. A College of Home Economics application and three letters of recommendation are required. These may be obtained at the Dean's Office, Jessie Harris Building, or write or call: Jay Stauss, Assistant Dean for Graduate Studies College of Home Economics The University of Tennessee Knoxville, Tennessee 37916 Phone: (615) 974-5221

Graduate Record Examination scores for the aptitude test including the quantitative, verbal, and analytical sections are required for application to the Ph.D. interdisciplinary program, to the Master's program in Child and Family Studies, and Consumer Studies and Housing: Public Policy.

ACADEMIC COMMON MARKET

The doctoral program in Home Economics is listed in the Academic Common Market of the Southern Regional Education Board. Residents of Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, South Carolina, or West Virginia are eligible to enroll at UTK on an in-state tuition basis. The Master's program in Food Systems Administration is also listed for residents of Arkansas, Kentucky, or West Virginia; as is the Master of Science program in Nutrition for residents of Alabama and Virginia.

PROGRAMS LEADING TO THE DEGREE OF MASTER OF SCIENCE

Thesis Option:

- Majors and minors are offered in the following areas:
  - Child and Family Studies
  - Consumer Studies and Housing
  - Public Policy
  - Interior Design and Housing

  *Requirements include Interior Design and Housing 5615 or Child and Family Studies 5170; Child and Family Studies 5700 or Planning 5100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5860. Three-hour course in research methods or statistics. Twenty-four hours in consumer studies or housing to include 9 hours of Child and Family Studies 5000 or Interior Design and Housing 5000.

  Consumer studies courses to be selected from Child and Family Studies 5140, 5170, 5180, 5700, 5800, 5900; Interior Design and Housing 5120; Food Science 4040; Textiles and Clothing 5180; Agricultural Economics 4710; Economics 5050-60; Political Science 5641, 5670-80, 5710; Library and Information Science 5550. Housing courses to be selected from Agricultural Mechanization 5110, 5610; Interior Design and Housing 4330, 5615, 5510-20-30; Planning 5360-80, 5455; Geography 5520.

  Twelve hours in an area of home economics other than the area (consumer studies or housing) chosen above. Minimum 27 hours in and 8 hours outside College of Home Economics. Minimum of 27 hours 5000 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.

Non-Thesis Option:

- The non-thesis option is available for all majors listed under the thesis option and in the only option available for public health nutrition.

  In addition to the regulations of the Graduate School, the non-thesis program of study for all majors except Consumer Studies and Housing: Public Policy * will consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000-level. A minimum of 27 hours of 5000 and 6000 level courses is required in the program. Some majors may require 9 hours in one collateral area.

  Request for the non-thesis option must be made in writing by the student to the department head not later than the end of the first term in residence.

*Requirements include those listed under the thesis option for the major in Consumer Studies and Housing: Public Policy except that 21 hours are needed in consumer studies or housing to include Home Economics 5060 (6 hours), or Child and Family Studies 5060 or Interior Design and Housing 5000.
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 other behavior; community programs to meet economic change; technological needs. Emphasis may be on: the impact of: physiological response to nutrient intake, food selection. The effects of social, economic and technological influences on improvement of nutritional status through childhood, adolescence, and adulthood; behavior in diverse environmental and cultural settings; interaction processes within families; community services and planning for meeting 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: 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 for meeting development needs of individuals and families.

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 and 3 hours from Food Science 5610-20-30-40, 6110, Food Systems Administration 6110; and Zoology 5350 or equivalent.

2. Twenty-four hours in 5000- and 6000-level courses in food science or food systems administration.

3. Nine hours in a collateral area. Upon approval of student's faculty committee, 4000, 5000, and 6000 courses in a 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 or equivalent.

2. Nine hours in a collateral area. Upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area beyond the 9 hours may be substituted for 5000 and 6000 courses in nutrition.

3. Minimum of 4 hours of credit in doctoral seminar.

GRADUATE PROGRAMS 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.

Departments of Instruction

Child and Family Studies

MAJORS

Child and Family Studies

Consumer Studies and

Housing: Public Policy

Home Economics

degrees

M.S.

M.S.

Ph.D.

Professors:


Assistant Professors: P. Horwick, M.S.M. Florida International; G. Peterson, Ph.D. Iowa State; L. Southworth, Ed.S. Tennessee.

4110 Student Teaching in PreSchool Settings (6) Increasing responsibility for planning and guiding groups of young children under supervision of head teacher includes: observation, evaluation, group plans, and class meetings. Prereq: 1500, 3210, 3300, 3350: 3360 recommended. E

4210 Family Finance (3) Analysis of alternative ways of meeting financial problems encountered during life cycle of family. E

4230 Conserving Time and Energy in the Home (3) Application of management principles to homemaking activities; evaluation of equipment, work centers and work procedures in terms of time and energy demands. Adaptations for the handicapped.

4250 Adult Development and Aging (3) Adult life in our society. Adjustment to internal and environmental changes through middle and aged years. Prereq: 2110 or Home Economics 1510 or equivalent background in adult development or consent of instruc-

4350 Advanced Child Development (3) Survey of selected theories relevant to child development with emphasis on research literature and research method-

ology. Prereq: 4 hrs psychology and 6 hrs child development or equivalent. W

4420 Learning Experiences with Parents (3) Dynamics of parent-child interaction. Emphasis on a variety of techniques for developing communi-

cactions and working between parents and teachers through experiences in a variety of settings. Prereq: 3210 or Home Economics 1510. W

4430 Family Relationships (3) Interpersonal rela-

tionships among family members and societal roles. Prereq: 3510 or 3515. Sp

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

4620 Administration of Programs for Young Chil-

dren (3) Planning for family finance, feeding, scheduling, and financing for day care of infants and young children, nursery school programs, and special services for special need children. Prereq: 3510 or 4510.

4630 Field Work in Child, Family and Consumer Studies (3-5) Opportunity for students to work in nursery schools or community agencies; focus on children, families, and/or consumer concerns. Prereq: arranged. Prereq: Consent of instructor. May be repeated. Maximum 15 hrs. S/N only. E

4710 Contemporary Developments (1-3) Student or staff-initiated course for study of special topic(s) pertinent to the field; topics selected to be deter-

mined by students and approved by departmental approval. Elective credit only. Prereq: Consent of instructor. May be repeated with departmental ap-

proval. Maximum 9 hrs.

4610 Afro-American Families (3) Historical back-

ground, contemporary family structure and rela-

tionships; emerging needs and programs. Prereq: 4 hrs in social sciences.

4830 Consumers and the Market (3) Analysis of elements in marketplace which create problems for consumers. Special attention is given to consumer decision making, need for information and con-

straints and opportunities associated with govern-

ment protection of consumers. Prereq: Economics 2110. W, Sp

5000 Thesis (1-15) E

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

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

5110 Field Work in Family Life (3) School and community programs concerned with education for fami-

ily living. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/N only. E
5140 Consumption and Standards of Living (3) Economic and welfare aspects of consumption. Analysis of factors associated with changes in the standard of living. Review of major consumption studies. Prereq: 4030 or S/NC or consent of instructor.

5150 Assessment of Family Behavior (3) Methods of measurement related to study of family. Current methodological issues. Prereq: 5140 or 5530 or consent of instructor.


5170 Consumer Economics (3) Consumer functions in economy; structure of consumer markets; government action relating to consumers; factors affecting prices of consumer goods.

5180 Family Financial Consultation (3) Analysis of family expenditure patterns, common financial difficulties, avenues by which families are assisted. Field experience with consumer consulting services. Prereq: 4210, 4830 or S/NC.

5190 Standards in Consumer Protection (3) Product performance standards in consumer protection. Theoretical and operational questions relating to various consumer products and services. Prereq: 4210 and consent of instructor. Prereq: 4830, S/NC or consent of instructor.

5210 Theories of Child Development (3) Prereq: 5350 or consent of instructor.

5220 Family Life Programs (3) School and community programs in family life, survey and evaluation; standardization of family life material. Prereq: 4210 and consent of instructor.


5410 Advanced Family Relationships (3) Problems in modern family life, individual adjustments, group relationships. Prereq: 3515, 4430, or consent of instructor.

5420 Parents and Children (3) Common problems of young children faced by parents and teachers; emphasis on methods available to modify problem behavior.

5430 Families in Crisis (3) Interpersonal transactions in disordered family behavior. Prereq: 5410 or equivalent. 2 hrs and 1 lab.

5510 Survey of Research in Child and Family Studies (3) Research literature; locating, abstracting, reporting research studies. Prereq: 3515 or 4430 or consent of instructor.

5530 Research Methods in Child and Family Studies (4) Research procedures in child and family behavior; basic methodology of behavioral sciences. Recommended as prerequisite to beginning thesis work in this area. Prereq: 9 hrs child and family studies. 3 lectures and 1 discussion.

5540 Learning in Preschool Programs (3) Description, analysis and evaluation of various preschool models and programs. Prereq: 6 hrs in child and family studies or preschool education. Sp

5550 Supervision in Preschool Programs (3) Guidance of students working in nursery school and day care centers. Guiding students through seminar discussion, individual conferences, and various evaluation techniques. Prereq: 5540. 3 hrs and 1 2-hr lab.

5610 Theories of Management in the Family Environment (3) Fundamental management concepts, 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: 3220.

5640 Teaching Child and Family Studies (3) Seminar and practicum in techniques for teaching child development and family relationships. Prereq: Consent of instructor.


5850 Children's Effects on Parents and Marriage (3) Theory and research about how children change parents and influence marital relationships. Prereq: 4340 or consent of instructor.

5900 Seminar in Child and Family Studies (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6250 Advanced Topics (3) Individual study and group discussion of current problems. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6310 Individual and Family Development—Physiological Determinants (3) Family members' physiological potential, development, and status. Family's contribution to members' physiological potential for growth and development and to realization of human potential. Prereq: 6 hrs advanced child and family studies, 4 hrs nutrition, 4 hrs physiology, or equivalent. Sp

6520 Individual and Family Development: Cognition (3) Processes through which human individuals learn to recognize their world. Cognitive processes involved in development across life span, focus on research findings and methodology. Prereq: 5210, 5410, or equivalent.

6410 Theory Construction in Family Studies (3) Process and application of theory construction in contemporary research areas and family studies. Emphasis on family systems theory. Prereq: 5140 or consent of instructor.

6450 Conceptual Frameworks for the Family (3) Theorization of family theory, development of family theoretical and research levels. Historical to contemporary, application of methods; analysis of sensory data. Prereq: 5410 or consent of instructor.

6540 Seminar in Programs for Infants and Preschool Children (3) Research related to programs for infants and young children. Various programs model education for infants and young children, methods of working with parents, and student training programs. Prereq: 5210, 5540 or equivalent.

6610-20 Applied Behavior Analysis in Natural Settings (3, 3) Individual supervision in application of applied behavior analysis in natural settings. Prereq: 5410 or consent of instructor.

6710 Elements of Consumer Choice (3) Analysis of consumer decision making, theory of consumer choice. Impact of affluence on consumers, and consideration of dynamic aspects of consumer behavior, including roles of aspirations, expectations, uncertainty and information. Prereq: 5170 or consent of instructor.

6720 Consumer Protection (3) Consumer protection, regulatory agencies, standards, information disclosure and other consumer protection legislation. Assumptions involved in these efforts and relation to existing and successive strategies of different types. Prereq: 5170, 5190 or consent of instructor.

5900 Seminar in Child and Family Studies (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
and biophysical interactions in food. Prereq: 4010; Nutrition 3320 or equivalent, or consent of instructor. W, Sp.

5630 Carbohydrates and Fats in Relation to Food Science (3) Physical and chemical characteristics of sugars, starches, and fats with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5640 Proteins in Relation to Food Science (3) Physical and chemical characteristics of the proteins of milk, eggs, flour, and meat with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5700 Current Programs and Trends in Food Science (1-3) Recent advances in food science, impact on curricular considerations, and implications for teachers, extension workers, and dietitians. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Science (1-3) Advanced study from field of food science. Prereq: Consent of department head and professor in charge of investigation. May be repeated.

5850 Field Experience (3-9) Experience in food-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. S/NC only.

6000 Doctoral Research and Dissertation (3-15) E

6110 Advanced Topics in Food Science (3) Comprehension of the individual study and group discussion of topics related to current problems in food science. Prereq: Consent of Instructor. May be repeated.

6210 Food Diaparisons (3) Physical characteristics of solutions, colloidal dispersions, and suspensions in relation to treatments applied. Prereq: 5520.

6310-20 Structure of Food Plants and Animal Tissues (3, 3) Histological structure of food plants and animal tissues related to physical characteristics and chemical properties of components. Prereq: 5360-40.

6510-20 Food and Sociocultural Change (3, 3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5550 or 5560; or consent of instructor. F, W

6900 Seminar (1-3) May be repeated. S/NC only. E

Nutrition

3310 Organic Chemistry (4) Emphasis on subjects leading to 3320-30. Textiles and Clothing 4220. Prereq: General Chemistry. 3 hrs and 1 lab. Not for graduate credit. Coreq: 3320.

3320 Food Analysis (4) Elementary quantitative analysis; typical food analyses. Prereq: 3310 or equivalent. 3 hrs and 1 lab. Not for graduate credit to degree majors. Prereq: 3320.

3330 Physiological Chemistry (3) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Not for graduate credit to degree majors. Prereq: 3330.

3339 Physiological Chemistry Laboratory (1) Prereq: 3320; Coreq: 3330. I. Not for graduate credit to degree majors. Prereq: 3330.

4010 Reproductive and Developmental Nutrition (3) Nutritional requirements for infant, toddler, child, adolescent, and adult. Application of basic principles and research findings to good nutrition for children, adolescents and adults. Prereq: 3020, 3050, or 3410. 2 hrs and 1 lab. F

4020 Nutrition for Children, Adolescents and Adults. Application of basic principles and research findings to good nutrition for children, adolescents, and adults. Prereq: 3020, 3050, or 3410. 2 hrs and 1 lab.

4030 Community Nutrition (3) Nutrition problems and services in the community; supervised field experiences are integral part of the course. Prereq: 3030 or 3410. 3 hrs and 1 lab.

4110 Introduction to Nutrition Research (3) Discussion of principles and laboratory experiences. Prereq: 3410 or equivalent. 2 hrs and 1 lab.

4230 Nutrition in Disease (4) Nutrition problems in diseases influenced by diet. Prereq: 3410. W, Su

4231 Clinical Experiences in Dietetics (1) Planned clinical experiences applying principles of nutrition in disease. Coreq: 4230. Su

4240 Nutrition in Disease (II) (3) Interdisciplinary lectures and discussions on the metabolic processes of normal and diseased organs and tissues and the dietary or behavior modifications required. Prereq: 4230. Designed for 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 effects of medication on metabolism and toxicity of drugs. Prereq: 3410 or consent of instructor. W

5000 Thesis (1-15) E

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

5110 Advanced Physiological Chemistry (4) Bioenergetics and related metabolism of nutrients. Prereq: 5410-20.

5120 Advanced Physiological Chemistry (3) Nutritional factors in relation to body fluids, gas transport, and endocrine function. Prereq: 3330. W

5140 Foods and Nutrition: Physicochemical Principles (3) Physical and chemical properties of proteins, carbohydrates and lipids; chemistry of colloid state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: Nutrition 3330-30 and Mathematics 1540 or equivalent. Sp, A


5230 Experimental Methods in Nutrition (3) Use of small animals in experimental nutrition. Prereq: 3320-30. 3 hrs and 1 lab. F


5310 Community Nutrition (3) Nutrition problems and practices in community; supervised field work. Prereq: 3410 and consent of instructor. 3 labs. F

5320 Community Nutrition (3) Observations and participation in nutrition programs of local and state agencies. Prereq: 5310 and consent of instructor. 3 labs. W

5330 Community Nutrition (3) Nutrition programs of state and federal agencies; preparation of material for nutrition education; supervised field work. Prereq: Consent of instructor. 3 labs. Su

5340 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of in-depth study to be selected in consultation with instructor. Prereq: 3030 and consent of instructor. S/NC only. Sp

5350 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students in training at Child Development Center, UT Center for the Health Sciences, Memphis. Prereq: Consent of department head. F, W

5410-20 Human Nutrition (3, 3) Functions of carbohydrates, proteins, fats, minerals, and vitamins. Nutritional requirements of humans throughout life and practical problems in meeting requirements. Prereq: 3410 and 5110. W, Su

5430 Physiological Bases for Diets in Disease (3) Developments in dietary treatment of disease in which nutrition plays a major role. Prereq: 5210 or equivalent.


5450 Survey Methods in Human Nutrition (3) Food consumption, food practices and nutritional status of population groups. Prereq: 5210 or 5410-20. 2 hrs and 1 lab.

5460 World Food Supply and Human Nutrition (3) Food supplies and food practices as related to human nutrition throughout the world. Regional, national, and international agencies concerned with food and nutrition problems. Prereq: 5210 or 5410-20. Sp

5470 Nutrition and Aging (3) Nutritional problems of aging individual, nutritional requirements, dietary intake, and effects of nutrition on rate of biological aging. Prereq: 5210 or consent of instructor. W

5610 Nutrition in Mental Retardation and Developmental Disabilities (1-12) Interdisciplinary diagnosis and treatment of developmentally-handicapped child. Role of nutritionist; clinical experiences; lectures at Child Development Center, Center for the Health Sciences, Memphis. Prereq: Consent of department head. E


5800 Problems in Nutrition (1-3) Advanced study selected from field of nutrition. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5900 Seminar (1-3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. S/NC only.

6000 Doctoral Research and Dissertation (3-15) E

6110 Advanced Topics in Food Science (3) Comprehension of the individual study and group discussion of topics related to current problems in food science. Prereq: Consent of Instructor. May be repeated.

6200 Food Diaparisons (3) Physical characteristics of solutions, colloidal dispersions, and suspensions in relation to treatments applied. Prereq: 5520.

6300-20 Structure of Food Plants and Animal Tissues (3, 3) Histological structure of food plants and animal tissues related to physical characteristics and chemical properties of components. Prereq: 5360-40.

6510-20 Food and Sociocultural Change (3, 3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5550 or 5560; or consent of instructor. F, W

6900 Seminar (1-3) May be repeated. S/NC only. E

Food Systems Administration

4130 Food Systems Administration (3) Functions of management applied to food service systems. Prereq: 3110. F

4140 Food Systems Personnel Development (3) Development of training programs for food systems personnel. Prereq: 3110, 4150. W

4150 Design and Layout of Food Service Systems (3) Design of physical facilities and selection and purchasing of equipment for food service systems. Prereq: 3110 or consent of instructor. Sp

4200 Food and Lodging Managerial Cost Control (3) Cost analysis for control. Use of financial statements for decision making for food and lodging systems. Prereq: 4130, Accounting 2130. W, Sp

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 and illumination systems. Types of building materials and construction. Prereq: 3110, 4140 or consent of instructor. 3 hrs and 1 lab. W

4270 Tourism, Food and Lodging Information Systems (3) Qualitative and quantitative analysis of information systems for decision making in food and lodging operations or other operations related to the tourist industry. Prereq: 4130, 4250, Computer Science 1410. Sp

5000 Thesis (1-15) E

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

5110-20 Experimental Quantity Food Study (3, 3) Analysis of food production, holding environment, and service problems related to quality of food preparation, texture, and appearance. Prereq: 4130, 3110, or consent of instructor. Su, A

5220 Experimental Design of Food System Facilities (3) Environment in which food is prepared, held, and served in volume. Prereq: 4150. Su

5230 Food Systems Evaluation (3) Management research techniques in food systems. Standards for control. Prereq: 4130, or consent of instructor. F


5310 Administration of Food Service Delivery Systems (3) Role and responsibilities of administrator in maintaining desired qualitative and quantitative standards in food service delivery system. Prereq: 3110 or consent of instructor. W, A

5500 Clinical Training in Health Care Agencies (3) Instructional and supervisory techniques in clinical settings by nurses and dietitians for training of entry-level health care providers. Prereq: Nursing 4760 or consent of instructor.

5700 Current Programs and Trends in Food Systems Administration (1-3) Recent advances in food systems administration and 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 food service system. Prereq: Consent of instructor.

5900 Seminar (1-3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. S/NC only.

6110 Advanced Topics in Food Systems Administration (3) Comprehensive individual study and group discussion of current problems in food systems administration. Prereq: Consent of instructor.

6210 Manpower Planning and Training for the Food Service Industry (3) Identification of manpower needs by skill levels; programs for personnel in food service industry. Prereq: 4140, 5210 or consent of instructor. Su

6310-20 Quantitative Methods to Control Resource Systems in Food Service Systems (3) Interrelationships of resources and evaluation of efficiency and effectiveness of food service systems. Prereq: 5230 or consent of instructor. Taken in sequence. Credit for 6310 contingent upon completion of 6320. Su, A

6900 Seminar (1-3) May be repeated. S/NC only. E

Home Economics

MAJOR

Home Economics

Ph.D.

5060 Practicum (1-12) Field experience in selected organizations that focus on interdisciplinary solutions to multilevel problems of society. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

5100 International Studies (1-15) Student- or staff-initiated course for study in foreign country of topics pertinent to field. Topic to be determined by student and instructor with department and college approval. May be repeated. Maximum 15 hrs.

5210 History and Philosophy of Home Economics (3) Historical development of home economics; survey of concepts and philosophy of component disciplines and analysis of current programs; emphasis on projection of future developments.

5220 Development of Community Services Programs (3)

5230 Evaluation of Community Services Programs (3) Purposes of evaluation, clarification of objectives and procedures for determining progress.

5600 Home Economics in the Community (3) Role of home economists in community and how interactions among professionals of all community resources and communities are working for and/or solving problems of individuals, families, and communities related to quality of life. Prereq: Agricultural Economics 4320 or Economics 5340 or Planning 4100 or Child and Family Studies 5700 or consent of instructor.


5800 Problems in Community Services (1-3) Prereq: 5600. May be repeated. S/NC only.

5900 Seminar in Human Resource Development (1-3) May be repeated. S/NC only.

6000 Doctoral Research and Dissertation (3-15) E

6110-20 Theoretical Issues in Human Resource Development (3,3) Interdisciplinary approach to development and use of human resources in solution of family and consumer problems. Prereq: 12 hrs of 5000-level courses representing 2 areas of home economics. F, W


6310 Advanced Topics (3) Comprehensive individual study and group discussion of individual and family behavior, physiological development and well-being, environmental factors, and economic and social well-being. Prereq: 6110. May be repeated.

6500 Methodological Issues in Home Economics (3) Advanced methodology in home economics, including analysis of research literature and issues. Prereq: 1 graduate-level course in research methodology or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

Home Economics Education

Graduate study in home economics education provides for an M.S. in Vocational-Technical Education (concentration in home economics education) and opportunity for participation in the Ed.D. program in Vocational-Technical Education in the College of Education. (See page 64 for staff and course offerings.)

Textiles, Merchandising, and Design

MAJORS
Textiles and Clothing

M.S.

Interior Design and Housing

M.S.

Consumers Studies and Housing: Public Policy

M.S.

Home Economics

Ph.D.

Professors:

R. G. Blakemore Ph.D. (Florida State);
B.G. Goswami, Ph.D. (Manchester (England));
J. Y. Ominato (Head), Ph.D. (Iowa State).
nean area and/or America. May be repeated. Maximum 18 hrs.

5210 Furniture Appreciation (2) Aesthetic qualities of past and present styles. Significant structural and formal characteristics.

5310 Interior Design (3) Advanced problems in planning and design of interior architectural environments—derivation of design implications from anatomy, physiology, anthropology, and behavioral sciences. Prereq: 5 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5410 Advanced Problems (3) Individual development of techniques of appreciation. Prereq: 9 hrs related art or equivalent.

5510 Environmental Factors in Interior Design (3) Human factors and associated research techniques related to design of architectural environments—derivation of design implications from anatomy, physiology, anthropology, and behavioral sciences. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5520 Environmental Factors in Interior Design (3) Systematic design methodology as applied to design of microenvironments using human factors in form. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5530 Environmental Factors in Interior Design (3) Human factors and systematic design methodology applied to analysis, synthesis, and evaluation of research-oriented interior design projects. Prerequisites: 15-20-30 hr major advisor and department head. May be repeated. Maximum 9 hrs.

5610 Furniture Design (3) Analysis of human factors data in design of body support, task support, and storage, furniture and systems; production of construction drawings and scale models. Prereq: Consent of instructor. Sp

5613 Housing Management (3) Role and functions of housing management specialist in problems of private and assisted housing management. Prereq: 4320 or consent of instructor.

5614 Housing Regulations and Controls (3) Function of regulations and other control practices and mechanisms as determinants of nature, availability of housing in local communities by various user groups. Prereq: 4320 or consent of instructor.

5615 Housing Programs and Policies (3) Analysis of private and public programs and policies to promote realization of suitable homes and living environments for families. Economic and social problems related to national housing objectives. Prereq: 4320 or consent of instructor.

5620 Experimental Methods in Household Equipment Research (3) Laboratory study of the research problems and techniques in determining performance of household equipment. Prereq: 3 courses in science. Prereq: 4320 or consent of instructor. 1 hr and 2 labs.

5630 Environmental Requirements for Family Work Centers (3) Trend in planning work center areas such as kitchens and laundries; adequacy, convenience, surface treatment, facilities and costs; problems of installation and remodeling.

5815 Environmental Design Research (1-3) Evaluation and application of research methodologies to interior design problems. Hours and credit arranged. Prereq: 5510-20-30 or equivalent and consent of department head and instructor in charge of investigation. May be repeated. Maximum 9 hrs.

5820 Interior Design (1-3) Advanced study in interior design. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. Maximum 6 hrs.

5830 Problems in Housing (1-3) Advanced study in housing. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5910-20-50 Seminar (1-4, 1-4, 1-4) Hours and credit arranged. Prereq: Consent of instructor.

6110 Contemporary Housing Issues and Problems (3) Individual study and group discussion of various issues and problems related to housing. Prereq: Consent of instructor.

6120 Advanced Topics in Housing Research (3) Various concepts, theories and methodologies of social sciences in housing research. Prereq: Consent of instructor.

6210 Environmental Design Analysis (3) Advanced methodology in psychology of environmental design, multidisciplinary research data and methods. Prerequisite: 6 hrs behavioral science. May be repeated. Maximum 9 hrs.

6220 Perspectives in Interior Design (3) Historical influences related to contemporary concepts in interior design. Prereq: 5040, 6 hrs of graduate level art history, or consent of instructor.

Textiles and Clothing

4210 Elementary Textile Microscopy (3) Microscopic techniques as applied to the study of textile fibers and fabrics. Prereq: 4010, 1 hr and 2 labs. W, A

4240 Design Analysis II (3) Interpretation of dress design terminating in finished garments developed through the media of draping.

5000 Thesis (1-15) E

5002 Non-Thesis Graduation Completion (3-15) May not be used toward degree requirements. May be repeated. Maximum 12 hrs.

5110 Textiles Testing and Methods of Research in Textiles (3) Physical and chemical testing. Research methods 3 labs. Sp

5120 Advanced Problems in Textiles and Clothing (3) Refresher course; new developments in textiles. Selecting fabrics, agencies aiding consumer, and individual problems in textile field. 2 hrs and 1 lab. F

5130 Advanced Tailoring (3) Comparison of hand tailoring and trade methods used in making suits, coats, or costumes. 3 labs.

5150 Principles of Design Analysis (3) Application of 2D flat pattern theory to garment design incorporating relationships of fabric geometry, texture, hand, and surface ornamentation to design. Prereq: Consent of instructor. 1 hr and 2 labs. W

5160 Review of Literature (3) Intensive survey and evaluation of recent literature; implications for further research. F

5170 Social, Psychological and Economic Aspects of Clothing (3) Clothing as it relates to human behavior. Prereq: 6 hrs or equivalent from each of follow ing areas: sociology, psychology, economics. W

5180 Advanced Textile Economics (3) Economic problems or problem areas of current importance in textile and apparel industries—production, consumption, and governmental policy. Prereq: 3420, 6 hrs economics or consent of instructor. W

5210 Evaluation of Instructional Materials in the Field of Textiles and Clothing (3) Evaluating instructional materials in communicating information in various areas of textiles and clothing. 1 hr and 2 labs.

5220 Historic Textiles (3) Development of textile industry in world; fibers used, design, and color. F

5240 Practicum (1-6) Off-campus experience with business, industry, governmental agencies and civic groups; preplanned; supervised. Prereq: Consent of major advisor and department head. May be repeated. Maximum 9 hrs. S/NC only.

5250-56-70 Problems in Textile Chemistry (4, 4, 4) Theoretical and experimental study of chemistry of textile fibers including polymerization, reactions, dyeing, and finishing. 5250 and 5270 must be taken first, 5260 and 5270 need not be taken in sequence. 5250—Emphasis on structure; property relationships and reactions of fibers. 5260—Emphasis on fabric finishes. 5270—Emphasis on dyes and dyeing. Prereq: 3420 or equivalent; 1 qr organic chemistry. 2 hrs and 2 labs.

5310 Fashion Analysis (3) Fashion as social and economic force; evolutionary theories of fashion operation. Prereq: 6 hrs each of sociology and economics.

5320 Problems in Historic Costume (3) Variable flow of styles in relation to cultural determinants. Prereq: 3480 or consent of instructor. May be repeated. 6 hrs.
Aviation Systems

**MAJOR**
Aviation Systems

**DEGREE**
M.S.

Lead Professor:
M. A. Wright, Ph.D. Wales.

Professors:
W. Froel, Ph.D. Washington; W. F. Jacobs, Ph.D. Goettingen (Germany); A. A. Mason, Ph.D. Tennessee; J. M. Wu, Ph.D. California Institute of Technology; R. L. Young, Ph.D. Northwestern.

Associate Professors:
F. G. Collins, Ph.D. California (Berkeley); R. D. Kimbertin, M.S. Tennessee; J. R. Maus, Ph.D. North Carolina State.

Assistant Professors:
W. B. Baker, Jr., Ph.D. Tennessee; V. K. Smith, III, Ph.D. Georgia Institute of Technology.

The University of Tennessee Space Institute offers a program leading to the Master of Science with a major in Aviation Systems. The Aviation Systems program is designed for those who possess a Bachelor's degree in engineering or science and who wish to study under a "systems philosophy" toward careers in research and development or administration in various phases pertinent to aviation. The program features 18 quarter hours major field credit in various aspects of aviation systems, 6 or more quarter hours credit in each of the areas of research, development and administration, and electives which permit further specialization to either area. To qualify for admission to this program, the applicant must possess a Bachelor's degree in engineering or science from a recognized institution, show evidence of ability to pursue and benefit from the program, and fulfill The University of Tennessee Graduate School admission procedures and grade point standards. Subject matter prerequisite to the program includes basic knowledge of computer utilization 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 4120 or equivalent, a background in accounting as represented by Accounting 5010 or equivalent basic accounting courses, a basic knowledge of economics as represented by introductory economics or equivalent.

Both thesis and non-thesis programs are available. The thesis program involves satisfactory completion of the following minimum requirements:
1. 18 hours in the major field of aviation systems.
2. For the research and development area, 6 quarter hours in Industrial Engineering 5700 and 5710; for the administration area, 6 quarter hours in Economics 5030 and Accounting 5810, for a total of 12 quarter hours.
3. 6 hours of electives selected from the major field, engineering and/or the areas in item 2.
4. 9 hours in Aviation Systems 5000, Thesis, hence demonstrating the ability to conduct and report on an independent investigation.

The non-thesis program will be permitted in special circumstances and involves satisfactory completion of the following minimum requirements:
1. 18 hours in the major field of aviation systems.
2. For the research and development area, 9 quarter hours in Industrial Engineering 5700, 5710, and 5720; for the administration area, 9 quarter hours in Economics 5030, Accounting 5810 and Finance 5010-20, for a total of 18 quarter hours.
3. 6 hours of electives in one of the areas in item 2.
4. 6 hours of electives in the major field, engineering and/or the areas of item 2.
5. Satisfactory completion of 3 quarter hours in Aviation Systems 5100, Project in Aviation Systems.
6. Satisfactory completion of a comprehensive final written examination on all course work submitted for the degree and defense of the project course paper.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.

Courses suitable for credit in the major field include: Aerospace Engineering 5810 and 5820, Industrial Engineering 5840; Aviation Systems 5070, 5080, 5090, 5210, 5220, and 5970.

Electives typical of those suitable for credit in the area of aviation systems, research and development include: Aerospace Engineering 5150-60-70; Computer Science 3510-20, 4550 and 5555-65-75; Industrial Engineering 4060, 4150, 4230, 5720, 5730, 6700, 6730; Mathematics 4225-35-45, 4510-20-30; Metallurgical Engineering 5810-20-30; and Statistics 3450.

Electives typical of those suitable for credit in the area of aviation systems, administration include: Accounting 5020; Business Law 5010; Economics 5020; Management 5130; Marketing 5010-20; Transportation 5050, 5130, 5210-20, and 5910.

M.S. Thesis (1-15) E

5070 Airports and the Community (3) Structure of airports and their communities. Technology and economics of cargo, baggage, ticket and passenger handling. Airport management, economics and logistics. Interfaces with the community, collection and distribution, demand requirement analyses, types of developments and their projections. Prereq: Aerospace Engineering 5610.

5080 Collection and Distribution (3) Capabilities, technology, plans, programs and developments for collecting and distributing passengers and freight to and from various types of airports. Ground, water, air and mixed transportation modes, present and future; requirements analysis, and model analysis of the system. Prereq: Aerospace Engineering 5810.

5090 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure and administrative and enforcement procedures. Prereq: Aerospace Engineering 5810.

5100 Project in Aviation Systems (3) In-depth study and formal report on aviation systems topic, normally performed during last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.

5210-20 Experimental Flight Mechanics (3, 3) Flight mechanics, experimental techniques. Specialty-
the Comparative and Experimental Medicine degree program (M.S. and Ph.D.) is a jointly administered graduate program intended to prepare students for teaching and/or research in health sciences. This program emphasizes the comparative approach to the study of pathology, immunopathology, aberrant metabolism, oncology, and genetic disorders. The program, which is open to approved graduate students seeking training in this area and is especially useful for individuals with professional degrees. For the student with an undergraduate biological science background, the Comparative and Experimental Medicine program provides an unusual opportunity to study disease processes common in humans and animals from a multidisciplinary perspective. The scope of this intercollegiate program, which pools faculty resources from both veterinary and human medicine, is broadened by faculty members representing animal science and numerous aspects of the life sciences. The interdisciplinary training environment includes such diverse support as facilities and personnel at the Veterinary Teaching Hospital, the Oak Ridge National Laboratory, Knoxville Zoological Park, Hemophilia Clinic, Birth Defect Clinic, Aberrant Metabolism Laboratory, and Hematology and Oncology services.

For specific course listings please see College of Veterinary Medicine, page 53 and College of Medicine—Knoxville Unit, page 144 in this catalog.

ADMISSION REQUIREMENTS

General Requirements
Admission requirements of The Graduate School 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; (3) departmental application and 3 rating forms; (4) the Graduate Record Examination (optional).

Application forms for admission should be obtained from the Graduate School. Inquiries concerning the admission requirements should be addressed to the Director. Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37916.

ADVISORS

Advisors are selected from ecologists in several departments of the University who have competence in the area in which the student expects to work. Entering students should consult early with the Director of the program on the choice of a faculty advisor who will become the chairperson of the student’s faculty committee.

THE MASTER’S PROGRAM

The minimum 45 quarter hours of graduate credit shall include 18 hours of ecology courses (exclusive of thesis), of which 6 shall be in course Ecology 5210-20-30 and at least 8 additional hours in ecology courses numbered above 5100; 9 hours of thesis in Ecology 5500, and 18 additional hours in ecology or supporting courses. To insure an interdepartmental program, the required minimum 45 hours shall include no more than 18 hours of non-thesis courses from any one department of instruction.

The general requirements for this Master’s degree are listed on page 19. A minor in ecology is available.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of The Graduate School. In addition, the doctoral program must include Ecology 5210-20-30 and a minimum of 9 quarter hours of courses numbered above 6000. A student cannot enroll for dissertation until the research proposal has been discussed and approved by the doctoral committee.

Shared Faculty

J. F. McCormick, Director, Ph.D. Emory

The Graduate Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary ecology for students from undergraduate programs in basic and applied biology, social sciences, mathematics and engineering. Research opportunities in both fundamental and applied ecology are intended to prepare students for academic careers as well as professional positions in industry or government. The Environmental Sciences Division of the Oak Ridge National Laboratory and the Tennessee Valley Authority provide advisors and research facilities. The Great Smoky Mountains, Cumberland Plateau, valley and ridge topography, TVA lakes and wild rivers provide locally a spectrum of natural habitats and consequent biological diversity which is truly unique. In addition, faculty research programs provide opportunities for student research elsewhere on this continent and abroad.

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; (3) departmental application and 3 rating forms; (4) the Graduate Record Examination (optional).

Application forms for admission should be obtained from the Graduate School. Inquiries concerning the admission requirements should be addressed to the Director. Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37916.

ADVISORS

Advisors are selected from ecologists in several departments of the University who have competence in the area in which the student expects to work. Entering students should consult early with the Director of the program on the choice of a faculty advisor who will become the chairperson of the student’s faculty committee.

THE MASTER’S PROGRAM

The minimum 45 quarter hours of graduate credit shall include 18 hours of ecology courses (exclusive of thesis), of which 6 shall be in course Ecology 5210-20-30 and at least 8 additional hours in ecology courses numbered above 5100; 9 hours of thesis in Ecology 5500, and 18 additional hours in ecology or supporting courses. To insure an interdepartmental program, the required minimum 45 hours shall include no more than 18 hours of non-thesis courses from any one department of instruction.

The general requirements for this Master’s degree are listed on page 19. A minor in ecology is available.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of The Graduate School. In addition, the doctoral program must include Ecology 5210-20-30 and a minimum of 9 quarter hours of courses numbered above 6000. A student cannot enroll for dissertation until the research proposal has been discussed and approved by the doctoral committee.
Industrial and Organizational Psychology

MAJOR DEGREES

Major Industrial and Organizational Psychology

M.S., Ph.D.

Committee:
J. M. Larsen, Jr. (Chairperson); W. H. Calhoun;
F. A. Chambliss; H. D. Dewhirst; M. E. Gordon;
R. T. Ladd; J. W. Lounsbury; M. C. Rush;
E. D. Sundstrom; D. J. Wheeler;
G. H. Whitlock.

(For complete Faculty Listing, see Departments of Management and Psychology)

The Master's and doctoral programs are offered jointly by the Department of Psychology and the Department of Management. They are designed to prepare students for personnel, managerial, and organizational research, for university teaching, and for leadership in relationships with industry. The emphasis is upon applied research utilizing a thorough theoretical background, including classical and modern organization theory, organizational behavior, psychology, and management. The programs are administered by a joint committee of the two departments, appointed by the Vice Chancellor for Graduate Studies and Research on recommendations from the two department heads.

It is intended that students entering the program will represent widely different undergraduate and graduate backgrounds including psychology, business administration, engineering, science, and liberal arts. The first-year program provides the opportunity to take courses which will assist the student to attain a reasonable level of sophistication in areas of deficiency.

ADMISSION PROCEDURE

Applicants for admission should request forms and make application to the Graduate Office and the Chairperson of the department to which they have been admitted. Prereq: 4 hrs of ecology at the upper division level.

5310 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused disturbances have on plants, animals, and ecosystems. Laboratory, field trips, and research methods. For students in Graduate School of Planning and Environmental Engineering.

5320 Implementation of Environmental Policy (3) Ecological, legal, and sociological principles that influence the implementation of environmental policy. Laboratory, field trips, and research methods. For students in Graduate School of Planning and Environmental Engineering.

5610 Environmental Toxicology (3) Same as Biochemistry 5610.

5640 Techniques in Environmental Toxicology (2) Laboratory exercises in ecological methodology. Comparisons between land, freshwater, and marine environments, including human's role in the world's ecosystems. Must be taken in sequence. Prereq: 4 hrs of ecology at the upper division level.

5650 Research Methods in Environmental Toxicology (2) Laboratory exercises in ecological methodology. Comparisons between land, freshwater, and marine environments, including human's role in the world's ecosystems. Must be taken in sequence. Prereq: 4 hrs of ecology at the upper division level.

5660 Doctoral Research and Dissertation (3-15) E

5670 Seminar (1-15) E

5680 Seminar in Community Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5690 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5700 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5710 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5720 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5730 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5740 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5750 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5760 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5770 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5780 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5790 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5800 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5810 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5820 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5830 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5840 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5850 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5860 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5870 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5880 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5890 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5900 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5910 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5920 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5930 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5940 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5950 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5960 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5970 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5980 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

5990 Seminar in Radiation Ecology (2) Ecology. Prereq: Consent of instructor. May be repeated.

6000 Doctoral Research and Dissertation (3-15) E

6100 Seminar (1-15) E

6110 Seminar in Animal Behavior (2) Seminar in animal behavior and related topics. Prereq: Consent of instructor. May be repeated.

6120 Seminar in Aquatic Ecology (2) Seminar in aquatic ecology. Prereq: Consent of instructor. May be repeated.

6130 Seminar in Physiological Ecology (2) Seminar in physiological ecology. Prereq: Consent of instructor. May be repeated.

6140 Seminar in Community Ecology (2) Seminar in community ecology. Prereq: Consent of instructor. May be repeated.

6150 Seminar in Radiation Ecology (2) Seminar in radiation ecology. Prereq: Consent of instructor. May be repeated.

6160 Seminar in Systems Ecology (2) Seminar in systems ecology. Prereq: Consent of instructor. May be repeated.

6431 Current Topics in Environmental Toxicology (1) Same as Biochemistry 6431.

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field of doctoral research and related topics, and must be passed at least four weeks prior to the awarding of the degree.

G. Maintenance of at least 3.0 grade point average.

Management Science

MAJOR Management Science

DEGREE M.S.

Committee: R. S. Garfinkel (Chairperson), Management Science; R. W. Boling, Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; E. Glustoff, Economics; W. J. Morse, Accounting; R. E. Rosenthal, Management Science; R. E. Shrieves, Finance; C. C. Thigpen, Statistics; M. G. Thomason, Computer Science.

THE MASTER'S PROGRAM

The M.S. program in Management Science is designed as preparation for a career in the application of quantitative techniques for the solution of management problems in large organizations. The program's flexibility also makes it appropriate as preparation for doctoral study in Management Science. Management Science course work will expose students to both the theoretical development of quantitative techniques and their application to managerial decision making. In addition to the development of sufficient mathematical maturity for creative use of quantitative skills, the program requires concentrated study in a supporting area. Supporting areas are available in other departments of the College of Business Administration (excluding statistics) as well as in computer science, public administration, ecology and other areas, subject to approval by the Management Science Committee.

Applications are encouraged from all majors, but mathematics background equivalent to the completion of at least two years of college calculus and proficiency in a computer language (e.g., Computer Science 3150) is required. The program is designed to be completed in one calendar year by full-time students entering in the fall quarter. However, students may start the program in any quarter and may pursue an M.S. degree in Management Science on a part-time basis.

Course Requirements

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Management Science 5310-20-30-35-40</td>
<td>14</td>
</tr>
<tr>
<td>Applied concentration area (approved by advisor)</td>
<td>12</td>
</tr>
<tr>
<td>Statistics 5110</td>
<td>3</td>
</tr>
<tr>
<td>Statistics elective (5000 level or above)</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (4000 level or above)</td>
<td>6</td>
</tr>
<tr>
<td>Electives selected from mathematics, statistics, computer science, and/or management science</td>
<td>6</td>
</tr>
<tr>
<td>Electives in any area approved by advisor</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
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</tbody>
</table>

A thesis option is available which substitutes 9 hours of thesis credit for the following 14 hours of course work: Management Science 5335-40, and one 3-hour course in the applied concentration area and 6 hours of electives in any area. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student’s first quarter and must approve all courses on a quarter-by-quarter basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. For example, an undergraduate mathematics major with a strong background may be allowed to take 6 additional hours of electives in place of the mathematics requirements. On the other hand, a student lacking experience in rigorous senior-level mathematics courses will be asked to take such courses to fulfill the 6-hour mathematics requirement. The total course load will remain 50 hours for all non-thesis students and 45 hours for all thesis students; however, the number of hours of electives can be reasonably expected to vary between 6 and 18 as a function of prior background.

For course listings and description of the Ph.D. program in Management Science, refer to the Department of Management Science, College of Business Administration.
The College of Liberal Arts offers programs leading to eight advanced degrees.* See page 9 for degrees and majors.

General Information
FOREIGN STUDY COURSES
Foreign study courses offered in some departments of the College provide an opportunity to undertake independent study outside the United States. Prior to departure the student must have a plan of study approved by the department head and a supervising faculty member of the department concerned. Credit will be given only upon fulfilling all requirements set by the department and may vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

OFF-CAMPUS STUDY
Recognizing that learning is not restricted to formal classroom situations, the College provides for students to earn credit toward graduation for approved off-campus study. Such study may be undertaken only with prior approval of the faculty member and the department concerned. It may include certain kinds of work experiences, community involvement, working in political campaigns, etc. Credit per quarter will vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

INDEPENDENT STUDY
Certain educational goals may best be met through independent study done by an individual under the direction of a faculty member. Students who wish to do such independent work should obtain the approval of the faculty members and the departments concerned prior to embarking upon their study. Credit per quarter will vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

THE MASTER'S PROGRAM
1. A minimum of three quarters of residence at The University of Tennessee, Knoxville.
2. A minimum of 45 quarter hours for graduate credit, including preparation of thesis. Thirty-six of these 45 hours must be in anthropology, 9 hours may be taken in closely related disciplines (at least one-half of the courses must be at the 5000 level).
4. A thesis. In addition to the two (2) copies required by the Graduate School, one bound copy of the thesis is to be presented to the department and one bound copy to the student's thesis advisor.

THE DOCTORAL PROGRAM
Although there is no minimum credit hour requirement for the Ph.D. degree, students in this program should plan to devote to its attainment no less than 3 years beyond the B.A. level and to complete the following requirements:
1. Admission to Ph.D. program through passing Graduate Evaluation Examination at completion of first year of study, or through departmental acceptance of a previously earned M.A. degree in Anthropology.
2. Formation of an advisory committee and establishment in consultation with that committee of a program of study. Delineation of field(s) of competence by the student and subcommittee and subsequent presentation to graduate advisor.
3. Demonstration of competence in a foreign language as determined by the student's committee.
4. Successful completion of oral and written comprehensive examinations and admission to candidacy.
5. Successful completion of the dissertation and final oral examination.

3070 Genetics and Society (3) (Same as Botany 3070)
3419 Principles of Cultural Anthropology (3) Basic concept and objectives in study of culture. Range of cultural phenomena and approaches to its study. Recommended prereq: 2530. F or W
3440 Religion of Primitive Peoples (3) Religions of nonliterate peoples. Place of religion in their social and cultural systems. Recommended prereq: 2530. (Same as Religious Studies 3440.) F or Sp
3450 Community Studies in Complex Culture (3) Review of cross-cultural comparative urban and village communities and methodologies used in community studies. Recommended prereq: 2530. A
3510 Peoples and Cultures of Mainland Asia (3) Ethnographic survey of the indigenous cultures of mainland Asia. Cultural diversity and human ecol-