I. Concentration in Partially Seeing
a. Completion of requirements of Elementary (K-9) or Secondary Education Curriculum;
b. Special Education and Rehabilitation 3333, 4160, 4850, 4923;
c. At least 45 quarter hours selected from the following: Special Education and Rehabilitation 3520, 4110, 4120, 4150, 4250, 4840;
d. Office Administration 2110 (for those lacking high school credits in typewriting).

TOTAL MINIMUM REQUIRED: Total hours required for endorsement in the above Special Education programs appear on curriculum sheets available from the faculty advisors.

VI. Vocational-Technical Education

A. Business Education
See curricula for Secondary Education (7-12) p. 96 for General Education and Professional Education requirements.

63 quarter hours in business and economics to meet five business endorsement areas approved by the department advisor. A statement of requirements and alternative programs may be obtained from the chairman of Business Education.

B. Distributive Education

GENERAL EDUCATION 85 hours
Communications (12 hours)
- English 1510-20 and speech elective.
Health and Physical Education (9 hours)
- School Health 3510 and health and P.E. electives.
Mathematics (8 hours)
- Mathematics 1540 and 1550.
Humanities (16 hours)
- Literature elective (4) plus 12 hours humanities electives.
Natural Science (12 hours)
- Biological or physical science sequence.
Psychology (7-8 hours)
- Psychology 2500; Psychology 2520 or Educ. Psych. 3110.
Social Studies (20 hours)
- History 1510-20 or 2510-20; Economics 2110-20-30; plus elective.
PROFESSIONAL EDUCATION 42 hours
SPECIALIZED COURSES 45 hours
- Business Admin. 1110; Office Adm. 4310 or 4320; Accounting 2110; Marketing 3110-20, 4140, 4310, 4150; Finance 3120; Industrial Management 3070; Textile elective; Business Law 4110; Distributive Edu. 4140; Advertising 3000.
ELECTIVES 30 hours

TOTAL MINIMUM REQUIRED 183 hours

*C Requires admission to Teacher Education Program.

C. Industrial Education

Option 1. Concentration in Trades and Industries

GENERAL EDUCATION 66 hours
Communications (11 hours)
- English (8 hours); speech elective (3 hrs).
Health and Physical Education (9 hours)
- Health and P.E. electives. (Both areas must be represented.)
Humanities (15 hours)
- Literature elective (4 hrs). Two additional areas taken from the following: philosophy, anthropology, art education, literature, foreign language, music or religious studies.
Mathematics (3 hours)
Natural Science (12 hours)
Psychology (4 hours)
Psychology 2500.

Social Studies (12 hours)
- Two areas from the following must be represented: history, anthropology, economics, geography, political science, sociology.

PROFESSIONAL EDUCATION 39 hours
- Education C&I 3010, 3020, 3030; Ed. Psych. 3110; Ind. Educ. 3010 or 3020; Ind. Educ. 3110, 3130, 4110, 4120, 4120, 4310, 4410 and/or 4420.

TEACHING AREAS 45 hours
- Ind. Educ. 1620, 1642, 1661, 2621, 3010, 3020, 3030, 3621, 4520 or Econ. 3410.

ELECTIVES 36 hours

TOTAL MINIMUM REQUIRED 186 hours

Option 2. Concentration in Industrial Arts

GENERAL EDUCATION 66 hours
Communications (11 hours)
- English (8 hrs); speech (3 hrs).
Health and Physical Education (9 hours)
- Health and P.E. electives. (Both areas must be represented.)
Humanities (15 hours)
- Literature elective (4 hrs); art or art edu. (6 hrs); Additional hours taken from the following: history (upper division), philosophy, anthropology, foreign language (beyond introductory level), music or religious studies.
Mathematics (3 hours)
- Natural Science (12 hours).
Psychology (4 hours)
- Social Studies (12 hours).
- Two areas from the following must be represented: history, anthropology, economics, geography, political science, sociology.

PROFESSIONAL EDUCATION 36 hours

TEACHING AREAS 39 hours
- Ind. Educ. 1620, 1642, 1661, 2621, 2641, 2652, 2660, 3640, 3691, 3662, 4662, 4670, 4671.

OPTIONS 21 hours
- Option 1-Outside Minor
- Option II-Industrial Arts Sequence
  1) Power and Energy Sequence: Ind. Educ. 1610, 1630, 2611, 2631, 3615, 3632, 4682.
  2) Visual Communications Sequence: Ind. Educ. 3621, 4621, 4690, Journalism 3010, 3910, Broadcasting 4030, 3 hours visual communications electives.

ELECTIVES 24 hours

TOTAL MINIMUM REQUIRED 186 hours

D. Agricultural Education

See page 51 for this program.

E. Home Economics Education

See page 153 for this program.

Departments of Instruction

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

Art and Music Education

Professors:


Associate Professors:


Assistant Professors:


Art Education (141)

1511 Field Experiences in Teaching Art (1) Field experiences in which students perform tasks related to teaching and to teacher roles. Satisfactory-No Credit. May be repeated for credit.

2100 Introduction to Art Education in the Schools (6) Art Grades 1 through 12; growth and development, objectives, motivation, evaluation. Experiences with school media. 1 hr and 2 labs.

2110 Drawing, Painting, and Design Activities in Elementary School (3) Prereq: 2100. 1 hr and 2 labs.

2120 Drawing, Painting, and Design Activities in Junior and Senior High School (3) Prereq: 2100. 1 hr and 2 labs.

3110 Crafts in the Elementary School (3) Prereq: 2100. 1 hr and 2 labs.

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

3511 Field Experiences in Teaching Art (1) Field experiences in which students perform tasks related to teaching and to teacher roles. Satisfactory-No Credit. May be repeated for credit.

3920 Clay in School Program (3) Exploring methods of hand-built forms, glazing and firing procedures. Prereq: 2100. 1 hr and 2 labs.

3930 Textiles in School Program (3) Exploration of processes of weaving, stitching, batik, and silk screen. 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 art grades one through twelve. Preq: 2100 or consent of instructor. 1 hr and 2 labs.

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

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

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

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

4410 The Administration and Organization of Recreational Arts and Crafts Programs (3) Purpose of art activity in recreation; scope of activities, organizational procedures, resources, and coordination required in community arts and crafts programs.

GRADUATE 5000 Thesis

5002 Non-Thesis Graduation Completion (3)

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

5310 Art of Education (3)

5320 Program Development in Art Education (3)

5850-60-70 Problems in Art Education (3, 3, 3)

Music Education (707)

The curricula in music education provide for five areas of concentrations: vocal music (voice principal); instrumental music (vocal or organ principal); elementary music education (vocal principal); elementary music education (voice principal), vocal music (piano or organ principal); and
instrumental music.

1010-20 Choral Laboratory (1, 1) Choral conduct- ing: methods and materials, required of all music education majors. Prereq: approval of instructor.

1511 Field Experience in Teaching Music (1) Field experiences in which students perform tasks related to teaching and to teacher roles. Satisfactory-No Credit. May be repeated for credit.

2100 Basic Experiences in Classroom Music (3) Vocal, instrumental, rhythm, listening, music reading, and creative activities. For music education majors. Prereq: approval of instructor, one year of music theory. 2 hrs and 1 lab.

2110 Experiences in Classroom Music (3) Vocal, instrumental, rhythm, listening, music reading, and creative activities. For music education majors. Prereq: approval of instructor, one year of music theory. 2 hrs and 1 lab.

2411-12-13 Methods, Materials, and Techniques of String Class Instruction (2, 2, 2) Structure, use, techniques of playing, care, and repair of principal instruments in school instrumental organizations. Emphasis on techniques necessary for basic understanding and effective teaching of the instruments. Practical use of current instructional materials. 2 hrs per week.

2421-22-23 Methods, Materials, and Techniques of Woodwind Class Instruction (2, 2, 2) Structure, use, techniques of playing, care and repair of principal instruments in school instrumental organizations. Emphasis on techniques necessary for basic understanding and effective teaching of the instruments. Practical use of current instructional materials. 2 hrs per week.

2431-32 Methods, Materials, and Techniques of Brass Class Instruction (2, 2) Structure, use, techniques of playing, care and repair of principal instruments in school instrumental organizations. Emphasis on techniques necessary for basic understanding and effective teaching of the instruments. Practical use of current instructional materials. 2 hrs per week.

3110 Teaching Music in the Primary Grades (3) Singing, rhythm, instrumental, listening, creative, and music reading activities; evaluation; materials appropriate for Grades K-3. For elementary education majors only. Prereq: 2100 or 2110, Educational Psychology 2430, upper-division standing.

3120 Teaching Music in the Intermediate and Upper Grades (3) Singing, rhythm, instrumental, listening, creative, and music reading activities; evaluation; materials appropriate for Grades K-3. For elementary education majors only. Prereq: 2100 or 2110, Educational Psychology 2430, upper-division standing.

3130 Teaching Music in the Elementary School (3) Singing, rhythm, instrumental, listening, creative, and music reading activities; evaluation; materials appropriate for grades 4-6. Primarily for elementary education majors. Prereq: Music 2100 or 2110, Educational Psychology 2430 and upper-division standing.

3141 Guiding Musical Learning Experiences in the Primary Years (3) Course designed primarily for music education student majoring in elementary music education in which emphasis is given to musical skills and learnings appropriate for children, ages five through eight. Prereq: 2110 and Educational Psychology 2430.

3142 Guiding Musical Learning Experiences in the Intermediate Years (3) Course designed primarily for music education student majoring in elementary music education in which emphasis is given to musical skills and learnings appropriate for children, ages nine through eleven. Prereq: 3141.

3150 Teaching Music in Junior and Senior High Schools (3) Procedures, techniques, curriculum, scheduling, administration, evaluation, materials and equipment, community relations. Prereq: Two years of music theory.

3410-20 Teaching Instrumental Music (3, 3) Problems and techniques, materials, instrument and equipment selection. Prereq: six hours credit from 2411-21-31 series.

3511 Field Experiences in Teaching Music (1) Field experiences in which students perform tasks related to teaching and to teacher roles. Satisfactory-No Credit. May be repeated for credit.

4350-60-70 Problems in Music Teaching (3, 3, 3) The Administration and Organization of Recrea- tional Music Programs (3) Purpose of music in recreation; scope of activities, organizational pro- ceedures, resources, and coordination required in community music programs.

4420-30 Choral and Instrumental Conducting (3, 3) Reading, conducting, and interpretation of vocal and instrumental scores suitable for school, church, and community groups. 4420 deals with vocal music. 4430 with instrumental music. Prereq: 1010-20 and three hours credit from 2411-21-31 series and two years of music theory. Must be taken in sequence. 2 hrs and 1 lab.

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


4460 Marching Band Techniques (3) Functions, organization, and direction of a school marching band. Prereq: Senior standing and approval of instructor.

4510 Choral Methods and Materials (3) Organization and administration, teaching techniques, choral literature, and interpretation. Prereq: 1010-20, 4420, one year of voice instruction, two years of music theory. 2 lecture hrs and 2 one-hr labs; labs meet with 1010-1020.

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5150 Studies in Secondary School Music (3)

5210 Psychological Foundations in Music (3)

5220 Administration and Supervision of School Music (3)

5230 Comparative Teaching Procedures in Music Education (3)

5240 Evaluation Procedures in Music Education (3)

5250 Role of Music in Education (3)

5260 Music for Early Childhood (3)

5270 Studies of Music for Children in Primary Grades (3)

5320 Advanced Choral Literature and Conducting (3)

5350-60-70 Special Problems in Music Education (3, 3, 3)

5410 Advanced Band Literature and Conducting (3)

5510-20-30 The Talent Education Program of Shinichi Suzuki (2, 2, 2)

5710 Research in Music Education (3)

5810-20-30-40 Seminar (3, 3, 3, 3)

Continuing and Higher Education (267)

Professors:


Assistant Professors:


GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5060 Adult Education: A General Survey (3)

5110 Seminar in College Teaching (3)

5330 Theory and Research in Human Learning (3)

5360-70 Problems in Continuing and Higher Education (3, 3)

5440 American Higher Education (3)

5450 Instruction in Higher Education (3)

5460 Adult Development (3)

5510 Governance of Colleges and Universities (3)

5550 Fiscal Problems in Higher Education (3)

5660 Program Planning in Continuing and Higher Education (3)

5860 The Community-Junior College (3)

5955-65-75 Practicum in Continuing and Higher Education (3, 3, 3)

5960-70 Seminar In Continuing and Higher Educa- tion (3, 3)

6450 Community Education for Adults (3)

(Curriculum and Instruction (301)

Professors:


Associate Professors:


*Alumni Distinguished Service Professor.
3310 History of Education (3)

3320 History of Education in the United States (3)

3350 Teaching Arithmetic in the Elementary School (3) Goals, methods, materials, and evaluation. Undergraduate credit only. Prereq: Educational Psychology 2430 or equivalent. Mathematics 2110-20-30, admission to Teacher Education.

3510 Books and Related Materials for Children (3) (Same as Library and Information Science 3610.)

3511-12-13 Field Experiences in Teaching: Elementary (1, 1, 1) Field experiences in which students perform tasks related to teaching and to teacher roles. May be taken separately or concurrently by consent of instructor. Must be taken concurrently. Prereq: Educational Psychology 2430 or equivalent. 3512-13—admission to Teacher Education. Satisfaction-No Credit.

3520 Books and Related Materials for Young People (3) (Same as Library and Information Science 3520.)

3521-22-23 Field Experiences in Teaching: Secondary (1, 1, 1) Field experiences in which students perform tasks related to teaching and to teacher roles. May be taken separately or concurrently by consent of instructor. Satisfaction-No Credit.

3531-32-33 Field Experiences in Teaching: Social Foundations (1, 1, 1) For description, see 3521-22-23. Satisfaction-No Credit.

3561 Teaching of Speech and Drama, Grades 7-12 (3) For description, see 3563.

3562 Teaching of Modern Foreign Languages: Oral Communication (3) Prereq: Composition 1300 or 1301 and 1304. This course and Educ. C & I 3563 are required for certification in foreign languages. Must be taken concurrently with 3563.

3563 Teaching of Modern Foreign Languages: Reading, Literature, Grammar, and Composition, Grades 7-12 (3) For description see Educ. C & I 3562. This course and Educ. C & I 3562 are required for certification in foreign languages. Must be taken concurrently with 3562.

3565 The Teaching of Social Studies, Grades 7-12 (3) (Purpose, techniques, materials, and evaluation; directed observation in public schools; preparation of teaching plans and materials. Undergraduate credit only. Prereq: Educational Psychology 3810 or equivalent.

3564 The Teaching of Science, Grades 7-12 (3) For description, see 3563.

3565 The Teaching of Latin, Grades 7-12 (3) (Same as Classics 4210.)

3567 Teaching Language, Composition and Speaking, Grades 7-12 (3) For description, see 3563. Both this course and Ed. C & I 3568 are required for certification in English.

3568 Teaching Reading, Literature, and Listening, Grades 7-12 (3) For description, see 3563. Both this course and Ed. C & I 3567 are required for certification in English.

3720 Teaching Science in the Elementary School (3) Methods and materials, undergraduate credit only. Prereq: Educ. Psych 2430 or equivalent, admission to Teacher Education.

3751 Teaching of Mathematics: Numerical and Algebraic Concepts, Grades 7-12 (3) For description, see Educ. C & I 3563. Both this course and 3752 are required for certification in mathematics.

3752 Teaching of Mathematics: Geometry and Analysis, Grades 7-12 (3) For description, see Educ. C & I 3563. Both this course and 3751 are required for certification in mathematics.

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

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

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

4210 Curriculum in Elementary School Social Studies (3) Survey of 245 curricular approaches and trends in elementary school social studies. Prereq: teaching experience or student teaching.

4215 Teaching Elementary School Science (3) Methods and materials used in teaching of science in elementary school. Developmental and diagnostic/corrective programs. Not open to students without current course or background in teaching of elementary school science.

4216 Teaching Elementary School Mathematics (3) Methods and materials used in teaching of mathematics in elementary school. Developmental and diagnostic/corrective programs. Not open to students without recent course or background in teaching of elementary school mathematics.

4217 Teaching Elementary School Language Arts (3) Methods and materials used in teaching of elementary school language arts. Development of functional relationships with other curriculum areas, diagnostic procedures, and corrective work. Not open to students without recent course or background in teaching of elementary school language arts.

4250 Initiating the Activities Program (3) Prereq: Educational Psychology 2430, six quarter hours of methods of teaching in the elementary school, and junior or senior standing.

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

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

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

4300 Developmental Reading in the Secondary School (3)

4301 Teaching Developmental Reading (3) Methods and materials used in teaching of reading in the elementary school. Course 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-Preschool (3) In-depth view of language development during years birth to three: preadolescence; application of process of language development to instructional programs for early and middle childhood.

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

4540-60 problems in Teaching English (3, 3, 3)

4531-61-71 Problems in Teaching Mathematics (3, 3, 3)

4532-62-72 Problems in Teaching Social Studies (3, 3, 3)

4533-63-73 Problems in Teaching Science (3, 3, 3)

4534-64-74 Problems in Teaching Language Arts (3, 3, 3)

4535-65-75 Problems in General Curriculum (3, 3, 3)

4536-66-76 Problems in Instructional Materials (3, 3, 3)

4537-67-77 Problems in Teaching Foreign Languages (3, 3, 3)

4539-69-79 Problems in Teaching Conservation (3, 3, 3)
4380-90-4400 Problems in the Improvement of Instruction (2, 2, 2) Registration in special conferences, workshops, or in-service programs.

4381 Problems in Early Childhood Education (3) May be repeated for a total of 9 hrs. Six hrs can be taken concurrently.

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

4430 Practicum in Teaching in the Elementary School (3) Practicum experience in elementary school classroom teaching designed for students seeking elementary certification who have obtained degrees in areas other than elementary education, and who have obtained degrees and certification in areas other than this. Application must be filed with student teaching office at least one quarter prior to registration for practicum. Prereq: 3260-70-80, 3350, 3720 or equivalents and admission to teacher education.

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

4451 Teaching in Kindergarten: Program Development (3) Curriculum planning and organization; classroom management. Prereq: Education C&I 4450 or permission of instructor.

4452 Elementary School Teaching: Minicourse (1-2) Minicourse focusing on various aspects of teaching in elementary school. Topics vary. Prereq: Student teaching. May be repeated. S/N/C.

4530 Home and School Relations (3) Study of need and techniques which can develop closer relationship between the home and school at both elementary and secondary levels. Prereq: Senior standing.

4630 Current Educational Problems (3)

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

4710 Student Teaching, Grades 7-12 (8) Application for student teaching must be filed not later than final quarter of junior year. Students should hold themselves available to do this work in off-campus center. Must be taken with 4720. Prereq: 3010-20-30, Educational Psychology 3810, appropriate specialized methods course(s), minimum grade point average of 2.0. Undergraduate credit only. Satisfactory-No credit.

4720 Student Teaching, Grades 7-12 (6) Cooperative teaching with other students and teachers; analyses of teaching practices; evaluation of teaching capabilities as a result of student teaching. Must be taken with 4710. Undergraduate credit only. Satisfactory-No credit.

4750 Audivisual Methods and Techniques (3) Selection, operation, and use of equipment and materials. (Same as Library and Information Science 4750 and Vocational-Technical Education 4750.)

4810 Student Teaching in the Elementary School (9) Application for student teaching must be filed not later than final quarter of junior year. Students should hold themselves available to do this work in off-campus centers. Must be taken with 4820. Prereq: 3010-20-30, 3260-70-80, 3350, 3720; Educational Psychology 2430, Library Service 3810, minimum grade point average of 2.0. Undergraduate credit only. Satisfactory-No credit.

4820 Student Teaching in the Elementary School (6) Must be taken with 4810. Undergraduate credit only. Satisfactory-No Credit.

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

4850 Student Teaching in Early Elementary School (K-3) Application filed no later than second quarter of junior year with placement one quarter prior to quarter of graduation. Prereq: Educ. C&I 3260, 3270 or 3720, 3280, 3350, 4450; CFS 3120, 3210. S/N/C.

4851 Student Teaching in Early Elementary School (K-3) Application filed no later than second quarter of junior year with placement at least one quarter prior to quarter of graduation. Prereq: Educ. C&I 3260, 3270 or 3720, 3280, 3350, 4450; CFS 3120, 3210.

4860 Programmed Learning (3) Theories of learning as related to technology of programmed instruction. Techniques and applications of programming. 2 lectures and 1 lab. Prereq: Psychology 3210, Educational Psychology 3720, or permission of instructor. (Same as Psychology 4860.)

GRADUATE
Graduate instruction in the Department of Curriculum and Instruction provides opportunities to improve the effectiveness of educational service in a number of areas.

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5040 Seminar in Elementary School Language Arts (3)

5100 History of European Education (3)

5110 History of Education (3)

5120 Principles of Education (3)

5140 Comparative Philosophies of Education (3)

5141 Pragmatism in Education (3)

5142 Existentialism in Education (3)

5143 Supervised Readings in Philosophy of Education (3)

5150-60-70 Seminar (1, 1, 1) 1890-90-5200 Educational Specialist Research and Thesis (3, 3, 3)

5210 Seminar in International Education: Asia and Africa (3)

5211 Instructional Strategies in Elementary School Social Studies (3)

5220 Supervised Readings in International Education (3)

5230 Diagnosis and Remediation of Arithmetic Difficulties (3)

5240 Creative Thinking and Expression in Elementary School (3)

5220 Seminar in Comparative Education: The Americas (3)

5250 Secondary School Instruction (3)

5270 The Elementary School Curriculum (3)

5280 Teaching Language Arts in the Elementary School (3)

5281 Teaching Social Studies in the Elementary School (3)

5282 Teaching Science in the Elementary School (3)

5283 Programs and Materials in Teaching Elementary Science (3)

5284 Seminar in Teaching Elementary Science (3)

5290 The Teaching of Mathematics in the Elementary School (3)

5291 Programs and Materials in Elementary School Language Arts (3)

5292 Seminar in Research and Theory in Teaching Mathematics in the Elementary School (3)

5302 Psychology of Reading (3)

5304 Programs and Materials for Reading Instruction (3)

5305 Trends and Issues in Teaching Reading (3)

5306 Teaching Reading to the Linguistically Different Learner (3)

5350 Curriculum Development and Evaluation (3)

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

5385 Mathematics Laboratories in Elementary School (K-9) (3)

5380 Diagnosis of Remedial Reading Problems (3)

5381 Remediation of Remedial Reading Problems (3)

5382 Developmental Reading Practice (3)

5383 Remedial Reading Practice (3)

5390 Organization and Administration of Reading Programs (3)

5410 The High School Curriculum (3)

5530 Curriculum Laboratory for High Schools (3)

5580 Curriculum Planning and Development (3)

5610 Educational Statistics (3)

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

5630 Practicum in the Individualization of Instruction (3)

5640 Newer Trends in Elementary Education (3)

5650-60 Curriculum Laboratory for Elementary Schools (1, 3)

5670 Curriculum Laboratory for Early Childhood Education (3)

5691 Production and Use of Audio-Visual Materials (3)

5710 Techniques of Research in Education (3)

5720 Classroom Observation and Analysis (3)

5800 Seminar in Cooperative Curriculum Research (3)

5820 Seminar in the Teaching of Mathematics (3)

5825 Teaching Mathematics in the Middle and Junior High School (3)

5835 Seminar Mathematics in the Senior High School and Community/Junior College (3)

5841 Trends and Issues in Early Childhood (3)

5842 Problems in Education: Early Childhood (3)

5843 Seminar in Early Childhood Education (3)

5844 Mathematics in Early Childhood Education (3)

5845 Social Studies and Science in Early Childhood Education (3)

5846 Language Arts in Early Childhood Education (3)

5850-60-70 Problems in Education: English (3, 3, 3)

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

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

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

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

5855-65-75 Problems in Education: General Curriculum (3, 3, 3)
5866-76 Problems in Education: Instructional Materials (3)
5857-67 Problems in Education: Foreign Languages (3, 3, 3)
5859-69-79 Problems in Education: Conservation (3, 3, 3)
5900 Seminar in the Teaching of English in the Secondary School (3)
5901 Linguistics and the Teacher of English (3)
5902 Teaching Composition in the High School (3)
5903 Teaching Fiction in the Secondary School (3)
5904 Teaching the Mass Media in the English Classroom (3)
5905 Teaching English in the Community/Junior College (3)
5906 Teaching Poetry in Grades 7-12 (3)
5907 Teaching Drama in Grades 7-12 (3)
5908 Developing Speaking and Listening Skills in Grades 7-12 (3)
5909 Instructional Theory and Design (3)
5910-20-30 Problems in Lieu of Thesis (3, 3, 3)
5911 Directing the Forensic Program (4)
5912 Play Production in Secondary Schools (4)
5950 Reflective Thinking: The Method of Education (3)
5960 Teaching Natural Science (3)
5961 Seminar in Science and Environmental Education (3)
5970 Teaching the Social Studies (3)
5980 Projects, Programs, and Materials in Social Studies (3)
6000 Doctoral Research and Dissertation
6010 Studies in English Education (3)
6020 Seminar in Teaching the Social Studies (3)
6030 Research and Theory in Teaching Reading (3)
6031 Seminar in Reading and Language Arts (3)
6040 Seminar in Curriculum and Instruction (1, 1, 1)
6060 Philosophy of Methodology in the Elementary School (3)
6070 Advanced Seminar in International Education (3)
6080 Advanced Seminar in Philosophy of Education (3)
6081 Phenomenology and Education (3)
6082 Philosophical Analysis and Education (3)
6150 Education as Social Policy (3)
6210 Seminar in Elementary School Social Studies Research (3)
6230 Programs for Curriculum Improvement (3)
6250 Seminar in History of Education (3)
6282 Advanced Studies in Elementary School Science (3)
6350 The Professional Education of Teachers (3)
6400 The Dynamics of Educational Change (3)
6500 Advanced Studies in Early Childhood Education (3)

5610 Advanced Studies in Elementary School Language Arts (3)
6710 Advanced Educational Statistics (3)
6720 Interpretation of Data (3)
6730 Theory and Evaluation in Curriculum Planning (3)
6731 Studies in Curriculum Theory and the Structure of Knowledge (3)
6740 Curriculum Workshops in Instructional Improvement (3)
6750-60-70 Problems in Curriculum and Instruction (3, 3, 3)
6830 Studies in Mathematics Education (3)
6850 Principles of Educational Leadership (3)

**Educational Administration and Supervision (292)**

**Professors:**

**Associate Professors:**

**Assistant Professor:**
P.M. Husen, Ed.D. Stanford.

"U.T. at Nashville.

**GRADUATE**

**5000 Thesis**

**5002 Non-Thesis Graduation Completion (3)**

**5100 Internship in Educational Administration (3)**

**5130 Introduction to Educational Administration (3)**
**5180-90-5200 Educational Specialist Research and Thesis (3, 3, 3)**
**5220 Philosophy and Theory in Educational Administration (3)**
**5230 Seminar in the Behavioral Sciences for Educational Administration (3)**
**5290 The Politics of Education (3)**
**5310 School Administration in a Multi-Ethnic Society (3)**
**5420 District Level Administration (3)**
**5430 Building Level Administration (3)**
**5440 Introduction to Law, Finance, and Business Management at the Building Level (3)**
**5450 Organization of the School Program (3)**
**5470 Introduction to School Facility Planning (3)**
**5480 Introduction to Supervision and Personnel Administration (3)**
**5490 Administration of Community Education (3)**
**5530 Introduction to Educational Planning (3)**
**5560 Analysis and Interpretation of Research for Educational Administrators (3)**
**5580 Seminar in Communication Skills for Educational Administrators (3)**
**5711-21-31 Problems in Educational Administration and Supervision: School Operation (3, 3, 3)**
**5712-22-32 Problems in Educational Administration and Supervision: Higher Education (3, 3, 3)**
**5713-23-33 Problems in Educational Administration and Supervision: State School Administration (3, 3, 3)**
**5714-24-34 Problems in Educational Administration and Supervision: Preparation Programs (3, 3, 3)**
**5715-25-35 Problems in Educational Administration and Supervision: Community Education (3, 3, 3)**
**5720 Seminar in Urban School Administration (3)**
**5730 School Business Management (3)**
**5740 School Law (3)**
**5751-61-71 Problems in Educational Administration and Supervision: Theory (3, 3, 3)**
**5752-62-72 Problems in Educational Administration and Supervision: Finance (3, 3, 3)**
**5753-63-73 Problems in Educational Administration and Supervision: Transportation (3, 3, 3)**
**5754-64-74 Problems in Educational Administration and Supervision: Business Management (3, 3, 3)**
**5755-65-75 Problems in Educational Administration and Supervision: Personnel (3, 3, 3)**
**5756-66-76 Problems in Educational Administration and Supervision: School Plant (3, 3, 3)**
**5757-67-77 Problems in Educational Administration and Supervision: Organization and Structure (3, 3, 3)**
**5758-68-78 Problems in Educational Administration and Supervision: School Law (3, 3, 3)**
**5759-69-79 Problems in Educational Administration and Supervision: Supervision (3, 3, 3)**
**5770 Maintenance of School Plants (3)**
**5780 Supervision (3)**
**5790 School Board-Superintendent Relationships (3)**
**5810 Survey Research Methods (3)**
Educational Psychology and Guidance (311)

Professors:

Associate Professors:

Assistant Professors:

Memphis Center.

1000 Career Development: Exploration and Decision Making (3)
Exploration of occupations based upon analysis of self and occupational requirements; development of commitment to teaching and understanding of teaching-learning problems in the classroom. Prereq: consent of instructor. Satisfactory-No Credit.

2000 Field Experience (1)
Field experiences in working with children and youth and their teachers. Students will perform various teaching tasks and be given opportunity to act in teaching roles. May be repeated for a total of six credit hours.

2430 Child Study (3)
Child learning and development study of individual children, ages 5-12. Prereq: Psychology 2500 or equivalent. Coreq: either Educational Psychology I or the Psychology of Educational Psychology 2500 or a 2 hour/week field experience.

2510 Child and Adolescent Study (4)
Encompass study of principles of behavior, intervention techniques, principles of child and adolescent development, special categories of children, child relation to family and community, and methods of studying children. Prereq: Educational Psychology 1000 and Psychology 2110 or permission of instructor.

2520 Study of Self and Self-Concept (4)
Study of self-understanding of how the self develops that prospective teacher can better understand pupils and student's understanding of himself. Prereq: Educational Psychology I or Educational Psychology 2110, and Educational Psychology 2510 or permission of instructor.

3000 Field Experience (1)
Field experiences in working with children and youth and their teachers. Students will perform various teaching tasks and be given opportunity to act in teaching roles. May be repeated for a total of six credit hours.

3110 Classroom Behavior Management (4)
Student will develop understanding of behavior management procedures and skill in utilizing behavior management procedures in shaping pupil classroom behaviors. Prereq: Psychology 2110.

3550 Child Psychology (4) (Same as Psychology 3550.)

3560 Individual Skills for Campus Leaders (3)
Knowledge and skills for effectively managing leadership and administrative roles in campus organizations.

3730 Educational Psychology (3) Increasing effectiveness of learning. Prereq: Psychology 2110-20 or equivalent.

3810 Educational Psychology: Adolescence (3)
Physical, emotional, intellectual, social career and ethical dimensions of adolescent development; major emphasis given to effective communication with adolescents within the educational setting. Prereq: Psychology 2500 or equivalent. Coreq: either Educational Psychology I or Guidance 3000 or a 2 hour/week field experience.

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

4130 Mental Health (3)

4350-60-70 Problems in Educational Psychology and Guidance (3, 2, 3)

4440 General Evaluation Procedures for Public Schools (3) Prereq: 2450 or equivalent.

4551-52-53-54-55-56 Student Leadership Workshops (1, 1, 1, 1, 1, 1) Series of small group and individualized experiences to develop knowledge and skills required of students in leadership roles. Sections are designed for resident assistants, student government leaders, student activities, and other student organizations. Prereq: Permission of instructor. Satisfactory-No Credit.

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

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

4780 Assertion Training - Theory and Application (3) Exploration of theoretical and experiential bases of interpersonal behavior which enables a person to be self-assertive.

4780 Advanced Child Study (3) Prereq: 2450 or 3810 or permission of instructor.

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

4880 Differential Psychology (3) Nature and sources of individual differences in behavioral characteristics, and differences between racial, ethnic, socioeconomic, sex, and other groups.

4910 Diagnostic and Corrective Teaching (3)

GRADUATE

5900 Thesis

5902 Non-Thesis Graduation Completion (3)

5040 Guidance and Pupil Personnel Services in Education (3)

5050 Children and Adolescents (3)

5060 Group Approaches with Students (3)

5070 Seminar in Elementary School Guidance (3)

5099 Field Work in School Psychology (1-6)

5100 Developmental Psychology (3)

5110 Psychology of Women (3)

5111-12-13 Seminar in Current Issues in School Psychology (1, 1, 1)

5140-50-60 Psychoeducational Assessment (3, 3, 3)

5149-59-69 Practicum in School Psychology I (2, 2, 2)

5180-90-5200 Educational Specialist Research and Thesis (3, 3, 3)

5210 Interpreting Published Articles: Statistics (3)

5220 Interpreting Published Articles: Research Design (3)

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

5320 Advanced Classroom Behavior Modification (3)

5330 Theory and Research in Human Learning (3)

5331 Current Developments in Human Learning (3)

5340 Group Dynamics (3)

5350 Educational Applications of Cognitive Theorists (3)
School of Health, Physical Education, and Recreation

Madge M. Phillips, Director
At the undergraduate level, professional preparation programs are offered for teachers of health, physical education, dance, and/or recreation and for administrators of public health or recreation programs. For information on graduate programs leading to the Master of Science, the Master of Public Health, Educational Specialist, the Doctor of Education, or the Doctor of Philosophy degrees, see the Graduate School Catalog.

The School of Health, Physical Education, and Recreation also provides activities programs for all students in physical education and service courses in health and safety.

Health and Safety Education


Associate Professors: J.A. Ahmad, Ph.D. Oregon; M.D. Punjab (India); J.D. Gorski, Dr. P.H. UCLA; C.B. Hamilton, Dr. P.H. Oklahoma.

Assistant Professors: A.I. Pickett, M.S. Columbia; A.F. Thompson, Ph.D. Michigan.


Public Health (839)

1110 Principles in Personal Health (3) To develop ability to approach health scientifically and to develop justified confidence in judgments affecting personal health.

2040 Seminar in Human Sexuality (2) Problems and responsibilities of being male and female. Satisfaction-No Credit.

2050 Seminar in Drug Use and Abuse (2) Intensive look at problems related to use and abuse of drugs. Satisfaction-No Credit.

3000 Foundations of Health Science (3) In-depth study of content areas relating to personal health and contemporary health problems, i.e., mood modifying products, consumer health, international health, personal health practices, reciprocal relationships involving man, disease and environment. (Same as School Health 3200.)

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

3310 Communicable and Non-communicable Diseases (3) Modern concepts of diseases; etiology of common communicable and chronic disease problems including prevention and control. Prereq: One year of biological science and one course in bacteriology.

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

3330 Introduction to Public Health (3) Philosophy, organization, and functions of federal, state, and local, official and voluntary public health agencies. Includes periodic field trips.

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

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

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

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

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

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

4411 Instructor's Advanced First Aid and Emergency Care (3) Designed to teach First Aid. Satisfactory completion qualifies one for American National Red Cross Certification as a First Aid and Emergency Care Instructor. (A requirement for this certification is that an applicant must be at least 21 years of age.) Prereq: 3210 or valid Advanced First Aid and Emergency Care Certificate.

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

4700-10-20 Field Practice in Public Health (3, 3, 3) Field practice in public health under supervision of public health profession. Satisfaction-No Credit.

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 for credit.

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

GRADUATE

5002 Non-Thesis Graduation Completion (3)

5010-20-30 Workshop in Public Health (3-6, 3-6, 3-6)

5070-80-90 Field Practice and Seminar in Public Health Education (5, 5, 5)

5110 Environmental Health (5)

5120-30 Occupational Health and Safety (5, 5)

5140 Ergonomics and Work in Occupational Health and Safety (3)

5210 Ecosystem of Public Health Education (5)

5220 Health and Sickness in the Focus of Public Health Education (2)

5410 Epidemiology (3)

5420 Administration of Public Health (3)

5430 Vital and Medical Statistics (4)

5440 Methods and Materials in Public Health Education (4)

5540 Factors in Problem Solving for Community Health (5)
5550 The Public Health Educator in Community Organization and Development (3)
5560 Functions and Roles of the Public Health Educator (3)
5580 Physical Activity and Health (5)
5705 Advanced Professional Health Education: Health Planning I (3-5)
5710 Advanced Professional Health Education: Health Planning II (3-5)
5715 Advanced Professional Health Education: Health Planning III (3-5)
5730 Dental Health Education (3-5)
5735 Emergency Medical Services (3-5)
5745 Family Health Unit (3-5)
5750 Health and Medical Care Legislation and Law (3-5)
5755 Health Facilities Administration (3-5)
5760 Health Services Administration (3-5)
5785 Occupational Health Unit (3-5)
5790 Self-Care Unit (3-5)
5795 The Training of Paramedical Personnel (3-5)
5840-50-60 Problems in Public Health Education (1-3, 1-3)
6000 Doctoral Research and Dissertation
6030 Critical Analysis of Writing and Research in Health Education (3)
6050-60 Seminar in Health Education (3, 6)
6210 Health Aspects of Gerontology (3)
6220 Seminar on the Nation's Health (3)
6230 International Health (3)

Safety (890)
3520 Principles of General Safety (3) Deals with principles, practices and procedures in general safety. Covers safety problems in school traffic, recreation, industry, home, and other public areas.
4410 Driver and Traffic Safety Education (5) Preparation of teachers of driver education in schools and colleges. Students are required to teach at least one non-driver. Valid driver's license required, 3 hrs and 2 labs.
4420 Advanced Driver and Traffic Safety Education (5) Development of competency in teaching of driver education through use of simulation, multimedia and multiple-car driving range. Emphasis placed on teaching skills and supervision. Prereq: 4410.
4430 Sports Safety (5) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and their interrelationships in sports injury and their control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hrs lecture and 2 hrs lab.
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 for credit.
GRADUATE
5000 Thesis
5002 Non-Thesis Graduation Completion (3)
5320 Behavioral Problems in Safety Education and Accident Prevention (3)
5330 Problems and Research in Accident Prevention (3)
5340 Organization, Administration and Supervision of Safety Programs (3)
5350 Civil and Defense Education (3)
5720-30-40 Graduate Workshop in Safety (3-6, 3-6, 3-6)
5810-20-30 Problems in Safety I (1-3, 1-3, 1-3)
5870-80-90 Current Issues in Safety Education (1, 1, 1)
6010-20-30 Internship and Research in Safety Education (3, 3, 3)

School Health (898)
3210 First Aid and Emergency Care (4) (Same as Public Health 3210.)
3410 School Health Instruction (3) Selection of health content in school curriculum.
3420 School Health Services (3) Development, maintenance, and protection of health of students including examination, screening, special services, communicable disease control, emergency care, and school health records.
3510 The School in Community Health (3) Role of teacher in community health education; school's responsibility in promoting healthful living and the place of existing media and agencies in program. Not open to health and physical education majors.
3610 Methods in Elementary Health Instruction (3) Preparation and presentation of health topics. Teaching method is emphasized and student participation stressed. Required for elementary teachers. Prereq: 3510 or Public Health 1110 or Nutrition 1230.
3820 The Teaching of Sex Education (3) Trends, content, methods, and materials.
3850 Methods in Secondary Health Instruction (3) Preparation and presentation of health topics. Teaching method is emphasized and student participation is stressed. Prereq: 3410.
4710 Workshop in School Health Education (3-6) For advanced students, teachers, school administrators, nurses and other para-medical school personnel. Lectures, demonstrations, films, field trips, and supervised research in special health problems. May be repeated for credit.
4810-20-30 Problems in School Health Education (1, 1, 1) Individual identification and study of current problems in school health education. Extensive reading of literature required.
GRADUATE
5000 Thesis
5002 Non-Thesis Graduation Completion (3)
5010 Problems and Practices in School Health (3)
5510 Curriculum Construction in School Health Instruction (3)
5520 Evaluation in School Health Instruction (3)
5530 School Health Program Surveys (3)
5620 School Health Administration and Supervision (3)
5630-40 Workshop in School Health Education (3, 3)
5720-30-40 Graduate Workshop in Health Education (3-6, 3-6, 3-6)
5810-20-30 Problems in School Health Education (1-3, 1-3, 1-3)
6000 Doctoral Research and Dissertation
6030 Critical Analysis of Writing and Research in Health Education (3)

6050-60 Seminar in Health Education (3, 3)

Physical Education (764)

Professors:

Associate Professors:
E.T. Howley, Ph.D.; Wisconsin; N.E. Lay, Ph.D.; Florida; B.J. Mead, Ph.D.; Purdue.

Assistant Professors:
P.A. Boroviak, M.S. Tennessee; C.J. Johnson, M.S. Tennessee; J.L. Lewis, Ed.D. Tennessee; M.G. McCutchen, M.S. Tennessee; B.L. Morgan, M.S. Brigham Young; C.G. Shell, M.A. Florida State; I.S. Silger, M.S. Tennessee; B.G. Ulrich, M.A. North Carolina.

Instructors:

1000 Career Orientation and Performance Prerequisites in Physical Education (2) Introduction to physical education with special emphasis on analyzing motor skills of each student. Satisfactory-No Credit. No substitution.

1020 Physical Education: Swimming (1)
1021 Physical Education: Bowling (1)
1022 Physical Education: Basketball (1)
1032 Physical Education: Tennis (1)
1032 Physical Education: Soccer-Speedball (1)
1032 Physical Education: Volleyball (1)
1032 Physical Education: Golf (1)
2400-50-60 Dance Production (2, 2) Preparation and presentation of public dance performances. Prereq: approval of instructor.
2700 Orientation in Dance—Appreciation (3) History, aesthetic principles, and current trends in dance.
3000 Administration of Athletics (2) Conduct of program of athletic sports in high schools and colleges.
3010 Beginning Dance Techniques (2) Analytical and practical study of modern dance movements.
3040 Beginning Jazz Techniques (2) Instruction and practice in styles and techniques of jazz dance.
3050 Rhythmic Analysis (2) Emphasis on analysis of organic movement. Prereq: junior standing; consent of instructor.
3060 Beginning Dance Composition (2) Experience in creative forms of dance. Prereq: 3010.
3070 Beginning Ballet Techniques (2) Introductory course designed to acquaint students with discipline of classical ballet, cultural, and educational values, and relationship to other dance forms.
3080 Officiating Women's Volleyball (3) Officiating based on rules of National Association for Girls and Women in Sport. Ed.D. Oral states and tests will be given. Both men and women are encouraged to take the course.

*See also the courses listed under "Service Program in Physical Education" later in this section.*
3100 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.

3110 Social Dance (2) Instruction, practice, and teaching in basic social dance steps.

3110 Athletic Coaching of Football (2) Fundamentals and coaching techniques. Prereq: approval of instructor.

3210 Coaching of Basketball (2) Individual and team fundamentals for the high school coach; attention given to conditioning, schedule making, and other business arrangements. Prereq: approval of instructor.

3310 Athletic Coaching of Track and Field Events (2) Techniques and training procedures. Prereq: approval of instructor.

3511 History of Dance and the Related Arts II (2) Survey of dance and the arts related to it tracing their development in the nineteenth century.

3610 Officiating Women's Basketball (3) Officiating based on rules of National Association for Girls and Women in Sport. National tests and ratings will be given. Both men and women are encouraged to take the course.

3710 Weight Control and Physical Activity (3) Theoretical knowledge and of practical experience in principles and methods of weight control and the relationship to physical activity.

3810 Track and Field (2) Methods and practical experience in various events of track and field. Special emphasis on teaching techniques, demonstration, progression, and analysis.

3900 Athletic Coaching of Baseball (2) Individual and team fundamentals for the high school and college coach. Prereq: permission of instructor.

3210 History and Principles of Physical Education (3) Principles from basic sciences of anatomy, bacteriology, biology, chemistry, physiology, psychology, and sociology applied to health, physical education, and athletic coaching.

3220 Physical Fitness Activities (3) Teaching of calisthenics, conditioning activities, and weight training with emphasis on physical fitness concepts including muscular development of the body.

3240 Team Sports (2) Instruction, practice, and student teaching in selected team sports.

3250 Athletic Training Techniques (2) Theory and practice in the prevention and care of basic athletic injuries. Prereq: Approval of instructor.

3260 Practicum for Physical Education Majors (1–10) Observation and supervised teaching, and leadership experiences in physical education programs. Experiences intended to cover the first one-half to two-thirds of professional preparation. May be repeated. Maximum of 10 hrs credit. Satisfactory- No Credit.

3320 Applied Anatomy and Kinesiology (3) Bones, joints, ligaments, and muscles involved in movement, reaction of joints and muscular mechanism to bodily development and efficiency.

3330 Stunts and Tumbling (2) Instruction and practice; student teaching and lesson planning stressed with emphasis on safety techniques.

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

3450 Physical Education in the Elementary School (3) Movement experiences appropriate for elementary school children; planning and teaching the last developmental program.

3510 Conceptual Bases for Study of Human Movement Behavior (2) Bio-physical, percepto-cognitive, and psychosocial forces causing humans to move as they do. Prereq: 1011 or 1012.

3530 The Teaching of Swimming and Lifesaving (2) Certification in ARC Water Safety Instructor Training or Senior Lifesaving with additional practice in teaching of swimming.


3560 Human Growth and Motor Development (3) Structural and functional changes in man from birth to old age, and relationship of changes to physical performance and skill development.


3610-20 Individual and Dual Sports (1, 1) Instruction, student teaching, and practice in organizing adult sport and recreational activities suitable for schools, churches, or community recreation centers.

3650 Teaching Strategies and Program Implementation in Elementary Physical Education (3) Understanding and employing teaching strategies appropriate to elementary physical education, and study of program content and implementation. Prereq: 3570.

3660 Basic Movement Sequences for Children (3) Movement patterns and skills which are fundamental to movement activity, with emphasis upon designing and presenting sequential learning tasks, and creative activity experiences. Prereq or Coreq: 3650.

3670 Practicum in Developmental Movement for Early Childhood (3) Experiences in designing and presenting developmental movement tasks to preschool children. Prereq or Coreq: 3660.

3680 Structured Movement Activities in Elementary Physical Education (4) Self-testing, games and sports, and dance activities included in elementary school physical education program, with emphasis upon designing and presenting sequential learning experiences. Prereq: 3670.

3710 Camping (2) Theory and practice in leadership with practical experience in camp craft skills.

3880 Social Recreation (3) Theory and practice in social recreation for camps, community centers, clubs, and schools. Course includes folk and square dance, quiet and active games, skits, stunts, other recreational activities, and program planning. (Same as Recreation 3880.)

4010 Advanced Dance Technique (2) Development, integration, and synthesis of previous dance vocabulary; emphasis on analysis and practice of dance principles; solo and group work. Prereq: 3200.

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

4060 Advanced Dance Composition (2) Creation and development of ideas, themes, and dance forms; solo and group work. Prereq: 3060.

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

4110 Adapted 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.

4120 Administration of Physical Education (3) Selected topics in organization and administration problems related to physical education programs in schools. Emphasis placed on human relations approach to solving problems in administration.

4140 Tests and Measurements in Physical Education (3) Study of elementary statistics related to measurement. Critical examination of tests used to evaluate strength, sports skills, and physical fitness. Prereq or coreq: 3200.

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

4230 Program Planning in Physical Education (3) Curriculum building, course construction, and lesson planning for public schools and colleges.

4310 Folk and Square Dance (2) Materials and methods for public schools, colleges, and recreation centers.

4320 Tap Dance (2) Instruction, practice, and student teaching.

4330-40-50 (1, 1, 1) Specialization study in selected area of physical education.

4410 Wrestling (2) Theoretical and practical work for prospective teacher; emphasis on safety procedures.

4430 Women's Gymnastics (2) Development of skills on balance beam, uneven parallel bars, and side horse vaulting; special emphasis on progression, safety, and teaching techniques. Open to men and women. Prereq: 3330.

4440 Men's Gymnastics (2) Development of skills on pommel horse, parallel bars, and long horse vaulting. Special emphasis placed on safety, progression, and teaching techniques. Open to men and women.

4450 Men's Gymnastics II (2) Development of skills on still rings, horizontal bar, trampoline, and exhibition gymnastics; special emphasis placed on safety, progression and teaching techniques. Open to men and women. Prereq: 4440.

4460 The Coaching and Judging of Women's Gymnastics (3) Appreciation of techniques used in the coaching and judging of women's gymnastics according to the rules of the United States Gymnastics Federation. National tests and ratings will be given. Both men and women are encouraged to take this course. Prereq: 2734 or 4440.

4550 Methods of Teaching Dance (2) Individual work with analysis and criticism. Prereq: senior standing and approval of instructor.

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5110 Administrative Problems in Physical Education (3)

5120 Problems of the Curriculum in Physical Education (3)

5130 Methods in Physical Education (3)

5210 Principles and Philosophy of Physical Education (3)

5220 Readings in Physical Education (3)

5230 Supervisory Problems in Physical Education (3)

5310 Analysis of Basic Motor Skills (3)

5320 Seminar in Research Techniques in Physical Education (3)

5410-20-30 Specialization Study in a Selected Physical Education Area (1-3, 1-3, 1-3)

5500 Advanced Kinesiology (3)

5510 Selected Topics in Anatomy (3)

5550 Physical Rehabilitation (3)

5580 Physical Activity and Health (5)

5600 Applied Physiology (6)

5610 Advanced Exercise Physiology (4)
5620 Experimental Techniques in Applied Physiology (3)
5650 Scientific Bases for Physical Education (3)
5810-20-30 Seminar in Physical Education (1, 1, 1)
5910-20-30 Problems and Projects in Physical Education (1-3, 1-3, 1-3)
6000 Doctoral Research and Dissertation
6010 Seminar in Physical Education (1)
6220 Independent Research (3)
6410 Practicum in Kinesiology (3)
6510-20 Issues and Problems in Physical Education (3, 3)
6610 Seminar in Exercise Physiology (2)
6640 Research Participation in Applied Physiology (1-6)
6810-20 Practicum (2, 2)

Service Program in Physical Education

The service program in physical education provides all students a program of physical education planned in accordance with their present and future needs and interests.

2701 ARC Advanced Life Saving (2)
2702 ARC Water Safety Instructor Training (2)
2703 ARC Water Safety Instructor for Handicapped (2)
2705 Archery (2)
2707 Badminton Elementary (2)
2708 Badminton Intermediate (2)
2711 Ballet Elementary (2)
2712 Ballet Intermediate (2)
2713 Ballet Advanced (2)
2714 Basketball (2)
2715 Bowling Elementary (2)
2716 Bowling Intermediate (2)
2717 Bowling Advanced (2)
2719 Equitation Elementary (2)
2725 Field Hockey (2)
2727 Flag Football (2)
2728 Folk and Square Dance (2)
2730 Foundations of Physical Fitness (Lecture, Lab, Activity) (2)
2731 Golf Elementary (2)
2732 Golf Intermediate (2)
2734 Women's Elementary Gymnastics (Coed) (2)
2735 Women's Intermediate Gymnastics (Coed) (2)
2736 Women's Advanced Gymnastics (Coed) (2)
2737 Handball Elementary (2)
2738 Handball Intermediate (2)
2739 Handball Advanced (2)
2741 Ice Skating Elementary (2)
2742 Ice Skating Intermediate (2)
2743 Ice Skating Advanced (2)
2745 Lacrosse Elementary (2)
2747 Modern Dance Elementary (2)
2748 Modern Dance Intermediate (2)
2749 Modern Dance Advanced (2)
2750 Modern Jazz (2)
2752 Paddleball Elementary (2)
2753 Paddleball Intermediate (2)
2755 Racquetball Elementary (2)
2756 Physical Fitness (Conditioning Program) (2)
2757 Men's Elementary Gymnastics (Coed) (2)
2758 Personal Safety and Defense for Women (2)
2759 Men's Intermediate Gymnastics (Coed) (2)
2760 Soccer (2)
2761 Men's Advanced Gymnastics (Coed) (2)
2762 Social Dance (2)
2764 Softball (2)
2765 Sport in Society (2)
2766 Racquetball Intermediate (2)
2767 Squash Elementary (2)
2770 Racquetball Advanced (2)
2771 Swimming Elementary (2)
2772 Swimming Elementary II (2)
2773 Swimming Intermediate (2)
2774 Swimming Advanced (2)
2775 Synchronized Swimming Elementary (2)
2776 Synchronized Swimming Intermediate (2)
2777 Tap Dance Elementary (2)
2779 Tap Dance Intermediate (2)
2781 Tennis Elementary (2)
2782 Tennis Intermediate (2)
2783 Tennis Advanced (2)
2784 Track and Field (2)
2785 Tumbling Elementary (2)
2786 Tumbling Intermediate (2)
2787 Tumbling Advanced (2)
2789 Volleyball Elementary (2)
2790 Volleyball Intermediate (2)
2791 Volleyball Advanced (2)
2792 Weight Control and Figure Improvement (2)
2794 Weight Training Elementary (2)
2795 Weight Training Intermediate (2)
2797 Wrestling Elementary (2)
2798 Wrestling Intermediate (2)

Recreation (853)

Associate Professor: M.L. Peters (Chairman), Ph.D. Illinois.
Assistant Professors: P. Borovick, M.S. Tennessee; C.J. Johnson, M.S. Tennessee; K.L. Krick, Dr. Rec. Indiana.

1000 Field Practice (1-6) Supervised practice in an approved agency offering leisure services. May be taken for variable credit up to 6 hours. Each one-hour credit requires 25 contact hours in the field agency. For recreation students only. Prereq; Recreation 1000.

3000 Field Practice (1-6) Supervised practice in an approved agency offering leisure services. May be taken for variable credit up to 6 hours. Each one-hour credit requires 25 contact hours in the field agency. For recreation students only. Prereq; Recreation 1000 & 2000.

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

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

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

3301 Outdoor Recreation Skills and Techniques I (3) Fundamentals necessary for safe participation in outdoor recreation activities such as: skeet shooting, hunting, casting and angling, power boating, rappelling and backpacking. Emphasis enjoyment of natural environment without disturbance or destruction of plant and animal habitats. Prereq; consent of instructor.

3302 Outdoor Recreation Skills and Techniques II (3) Instruction in safe conduct of outdoor recreational activities such as: sailing, skin diving, caving, orienteering, and nature interpretation without disturbance of environment. Provision of outdoor recreation experiences for the handicapped. Prereq; consent of instructor.

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


4130 Recreation Administration (3) Introduction to recreation administration, including planning, personnel, areas and facilities, program services, finances, and public relations. Prereq: 1100, 3100, 3140.

4200 Survey of Recreation for Special Populations (3) Responsibility of recreation profession to minority groups whose leisure opportunities and needs may require special servicing.

4500 Specialized Study in a Selected Area of Recreation (1-9) Comprehensive study in a selected specialized area within the broad field of recreation. For recreation students only. May be taken for variable credit up to 9 hours. May be repeated for a maximum of 9 hours credit with permission of the division. Prereq; Consent of instructor.

GRADUATE

5000 Thesis (9)
5002 Non-Thesis Graduation Completion (3)
5140 Leisure Service Delivery Systems (3)
5150 Current Issues in Recreation (3)
5240 Therapeutic Recreation (3)
5300 Seminar in Recreation (1)
5440 Problems and Projects in Recreation (1-9)
5450 Specialized Study in Recreation (1-9)
Special Education and Rehabilitation (933)


Associate Professors: I.L. Coleman, Ph.D; Kent; E.E. Gibbings, Ph.D; Southern Illinois; M.C. Hannum, Ed.D; Northern California; G.C. Masiel, Ed.D; Texas; J.H. Miller, Ed.D; Auburn; L.C. Murphy, Ed.D; SUNY; J.M. Nosalisky, Ed.D; Auburn; W.E. Woodrick, Ed.S; Mississippi State.

Assistant Professors: J.W. Colwell, Ph.D; Kansas; C.R. Colvin, Ed.M; North Carolina; R.E. Kretschmer, M.S; West Virginia; H. Sawyer, Ed.D; Auburn; W.J. Schindler, M.E; Kent State.

Instructors: R.F. Bynum, M.S; Florida State; R.L. Dominique, M.S; Tennessee; R.N. Freeman, M.A; MTSU; M.H. Raulston, M.A; Kentucky; J.E. Siealf, B.A; Gustavus Adolphus College; W.D. Smith, M.S; Florida State.

Lecturers: S.W. Mulkey, M.S; Tennessee; O.E. Reece, B.S; Memphis State.

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

Course sequences may be planned in the areas of (1) crippling and special health conditions; (2) acoustically handicapped; (3) mentally retarded; (4) gifted; (5) partially seeing; (6) speech correction; (7) socially or emotionally maladjusted; (8) rehabilitation counselor education.

The specialized professional courses in special education may be taken at the undergraduate or graduate levels. For planning a program, the student should consult an advisor in the chosen area.

DISABILITY EXAMINER EDUCATION 5700 Disability Evaluation: Issues, Processes, and Programs (4)

5710-20 Medical Aspects of Disability Evaluation (4)

5720 Vocational Assessment in Disability Evaluation (3)

5740 Problems/Practicum in Work Evaluation (3)

5750 Principles and Problems of Disability Evaluation (3)

5760 Seminar: Functional Capability Assessment (3)

5770-71 Current Problems in Disability Claims Evaluation (1-3, 1-3)

CRIPPLING AND SPECIAL HEALTH CONDITIONS 4190 Special Education for the Brain-Injured Child (3) Nature of brain-injured child; skills for identifying educational, physical, and emotional characteristics; special educational techniques.

4190 Education Problems of Hospitalized and Homebound Children (3) School and home responsibilities for physical care and social relationships, educational adjustment, vocational needs, and cooperation with related service resources.

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

4921 Student Teaching in Crippling and Special Health Conditions (3-15) Observation and supervised practicum in home, hospital, and classroom. Satisfactory-No Credit.

EDUCATION OF THE ACOUSTICALLY HANDICAPPED 2110-20-30 Field Experience (1, 1, 1) Students observe, tutor, and perform teacher related tasks in Special Education Programs. S/NC.

3210-20-30 Field Experience II (1, 1, 1) Students observe, tutor, and perform teacher related tasks in Special Education Programs. S/NC.

4000 Rehabilitation Practicum (3) Evaluation of client data in predicting rehabilitation prognosis. Prereq: 4230.

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

4200 Practicum in Speech Development of Hearing Impaired (3) Application of theories and techniques of speech development and improvement with hearing impaired. Prereq: 4190 and permission of instructor. Same as Audiology and Speech Pathology 4200.

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

4220 Language Development for the Hearing Impaired II (3) Techniques; various systems by which formal language is presented. Same as Audiology and Speech Pathology 4220.

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

4240 Nature of Hearing Impairment (3) Basic principles of 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 rehabilitative disciplines. Observation and practicum.

4250 Introduction to the Education and Psychology of the Deaf (3) Offered for those planning to enter field of teaching the deaf and hard-of-hearing. Review of history of education of the deaf. Research studies relating to psychology, social adjustment, and learning of the deaf. Survey of professional literature in the field of deaf and hard-of-hearing. Same as Audiology and Speech Pathology 4250.

4280 Curriculum Development in Elementary and Secondary Schools for the Deaf (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.

4290 The Teaching of Reading to Hearing Impaired Children (3) Reading activities, developmental approaches, theories, and specialized materials for curricula in teaching reading.

4351-61-71 Practicum in Special Education (3, 3, 3) Students observe and deliver units of instruction in Special Education Programs. S/NC.

4719 Audiology Laboratory (1) (Same as Audiology and Speech Pathology 4719.

4870 Student Teaching of Acoustically Handicapped Children (3) Supervised practicum with preschool, day school, and residential pupils. Satisfactory-No Credit.

4871 Practicum with Acoustically Handicapped Children (6) Satisfactory-No Credit.

5220 Linguistics in the Education of the Auditory Impaired (3)

5240 Seminar in Language Remediation for the Hearing Impaired (3)

5280 Seminar on Educational Implications of Language Deficiency (3)

5310-20-30 Manual Communication (2, 2, 2)

5410 Instructional Media for the Handicapped: Design, Production, and Evaluation of Prototypical Curriculum Materials for the Deaf (9)

5490 Educational and Vocational Guidance of the Deaf and the Hard-of-Hearing (3)

5820 Curriculum Development Applied to Programs for the Hearing Impaired (3)

EDUCATION OF THE EMOTIONALLY DISTURBED 4610 Nature and Characteristics of Learning and Behavior Disorders (3) Forms of academic and socially disturbing behavior, degrees of severity, possible causes, and relationships to each other. Relationships with respect to personality characteristics and developmental factors interpreted through behavior management, cognitive-behavioral therapy and other practical situations in which learning and behavior disorders may occur.

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

4630 Practicum in Residential Settings Serving Children with Disturbing Behavior (3) Practicum in residential settings. Prereq: 4610 or permission of instructor.

4640 Practicum in Public School Systems Serving Children with Learning and Behavior Problems (6) Practicum in public school systems. Prereq: 4610 or permission of instructor.

4924 Student Teaching of the Emotionally Disturbed (9) Individual tutoring and classroom observation and teaching. Prereq or parallel: Education, Curriculum and Instruction 4702 or 4820. Satisfactory-No Credit.

EDUCATION OF THE MENTALLY RETARDED 4110 The Nature and Concept of Mental Retardation (3) Identification, description, and study.

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

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

4810 Student Teaching Mental Retardation (3) Pre- req: Major in education of mental retardation. Satisfactory-No Credit.
4811 Student Teaching Mental Retardation (9) Prereq: Major in education of mental retardation. Satisfactory-No Credit.
4922 Student Teaching of the Educable Mentally Retarded (3) Observation and supervised practicum. Satisfactory-No Credit.
5111 Psychology of Mental Retardation (3)
5112 Psychology of the Severely Mentally Retarded (3)
5113 Advanced Curriculum for the Mentally Retarded (3)
EDUCATION OF THE VISUALLY HANDICAPPED
4160 Education of Partially Sighted Children (3) Curricular adjustments and materials; home visits for parents' cooperation in medical care and special needs.
4850 Eye Problems Encountered by the Teacher (3) Eye anatomy and hygiene, common diseases and defects; testing and treatment; educational adjustments for specific eye conditions; related service resources.
4923 Student Teaching of the Partially SEEING (3) Observation and supervised practicum in special and regular classes. Satisfactory-No Credit.

SCHOOL SPEECH AND HEARING THERAPY
3310 Articulation Disorders (4) (Same as Audiology and Speech Pathology 3310.)
3710 Audiology I (4) (Same as Audiology and Speech Pathology 3710.)
4030 The Public School Speech and Hearing Program (3) Organization, administration, and procedures.
4040 Appraisal of Speech and Language Disorders (4) (Same as Audiology and Speech Pathology 4040.)
4310 Stuttering (4) (Same as Audiology and Speech Pathology 4310.)
4320 Clinical Practice in Speech Pathology (1-6) (Same as Audiology and Speech Pathology 4320.)
4330 Clinical Practice in Speech Pathology (1-6) (Same as Audiology and Speech Pathology 4330.)
4340 Clinical Practice in Speech Pathology (1-6) (Same as Audiology and Speech Pathology 4340.)
4341 Clinical Practice in Speech Correction in the Public Schools (3) Prereq: Audiology and Speech Pathology 4320-30-40, Special Ed. 4030 and consent of instructor. Satisfactory-No Credit.
4342 Seminar in Speech Correction in Public Schools (3) Prereq: Audiology and Speech Pathology 4320-30-40, Special Ed. 4030 and consent of instructor.
4400 Voice Disorders (4) (Same as Audiology and Speech Pathology 4400.)
4450 Clinical Practice in Audiology (1-6) (Same as Audiology and Speech Pathology 4450.)
4460 Clinical Practice in Audiology (1-6) (Same as Audiology and Speech Pathology 4460.)
4470 Clinical Practice in Audiology (1-6) (Same as Audiology and Speech Pathology 4470.)
4700 Audiology for Educators of the Deaf (4) (Same as Audiology and Speech Pathology 4700.)
4720 Audiology II (4) (Same as Audiology and Speech Pathology 4720.)
4930 Aural Rehabilitation: Speechreading and Auditory Training (4) (Same as Audiology and Speech Pathology 4930.)
4939 Laboratory in Aural Rehabilitation (1) (Same as Audiology and Speech Pathology 4939.)
4940 Advanced Aural Rehabilitation (4) (Same as Audiology and Speech Pathology 4940.)
5040 Advanced Clinical Practice in Audiology (1-6)
5380 Cerebral Palsy (3)
5390 Cleft Palate (3)
5540 Seminar in Language Pathology (3)

REHABILITATION COUNSELING
5100 Orientation to Rehabilitation (3)
5110 Medical Aspects of Rehabilitation Counseling (3)
5120 Psycho-Social Aspects of Disability (3)
5130-40 Seminar in Rehabilitation (3, 3)
5150-60 Internship in Rehabilitation (9, 9)
5170 Systematic Human Relations Training I (3)
5180 Systematic Human Relations Training II (3)

GENERAL COURSES
3333 Education of the Exceptional Child (3) Principles, characteristics, and special needs; local and state programs for diagnosis and care; educational provisions in regular or special classes; home teaching; social and vocational guidance.
3520 Language-Speech Handicapped Child in the Classroom (3) Recognizing and understanding speech problems; observing normal and defective speech development in children; incorporating speech improvement activities into the curriculum. For students not majoring in speech and hearing.
4350-60-70 Problems in the Education of Exceptional Children (3, 3, 3) Prereq: Consent of instructor.
4740 Diagnostic and Remedial Approaches in Special Education and Rehabilitation (3) Critical examination of specialized tests and methods employed in measurement of educational needs of children and adults who are mentally retarded, learning disabled, multiple handicapped or physically handicapped.
5000 Thesis
5002 Non-Thesis Graduation Completion (3)
5260 Education of Gifted Children (3)
5400 Assessment and Remediation of Learning Disabilities (3)
5401 Prescriptive Teaching for Children with Learning Disabilities (3)
5402 The Exceptional Child in the Regular Classroom (3)
5403 Resource Teachers for the Handicapped (3)
5450-60-70 Experience in Teaching and Supervision of Exceptional Children (1-6, 1-6, 1-6)
5510-20-30 Administrative Practice or Problems in Institutional Care of Children (3, 3, 3)
5550-60-70 Problems in the Education of Exceptional Children (3, 3, 3)
5620 Counseling Parents of Exceptional Children (3)
5630 Psychology of the Exceptional Child (3)
5830 Seminar: Issues and Theories in the Education of the Exceptional Child (3)
5910-20-30 Problems in Lieu of Thesis (3, 3, 3)
5970 Juvenile Delinquency and the School (3)

Vocational-Technical Education (988)

Professors: R.J. Woodin (Emeritus), Ph.D. Ohio State; G.R. Rice, Ph.D. Ohio State.
Associate Professors: M.D. Miller (Head), Ed.D. Oregon State; W.A. Cameron, Ph.D. Ohio State; R.R. Hanson, Ph.D. Purdue; E.R. Smith, Ph.D. Ohio.


3000 Introduction to Vocational Education (1) Introductory and exploratory experiences concerned with teaching careers in all areas of vocational education. Includes visitation within a vocational setting.

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

GRADUATE
5002 Non-Thesis Graduation Completion (3)
5010 History and Organization of Vocational-Technical Education (3)
5020 Competency Based Vocational Education (3)
5040 Guidance and Pupil Personnel Services in Education (3)
5180-90-5200 Educational Specialist Research and Thesis (3, 3, 3)
5250 Issues and Trends in Vocational-Technical Education (3)
5260 Continuing Education in Vocational-Technical Education (3)
5270 Placement, Follow-up, and Evaluation Procedures in Occupational Education (3)
5300 Occupational Program Development for Disadvantaged Persons (3)
5310 Supervision of Vocational-Technical Education (3)
5850-60-70 Problems in Vocational-Technical Education (1-6, 1-6, 1-6)
6000 Doctoral Research and Dissertation
6040 Seminar in Vocational-Technical Education (1, 1, 1)
6210 Curriculum Planning in Vocational-Technical Education (3)
6220 Program Planning and Development in Vocational-Technical Education (3)
6230 Evaluation of Vocational-Technical Education Programs (3)
6310 Administration of Vocational-Technical Education (3)
6411-12-13 Internship in Vocational-Technical Education (3, 3, 3)

Agricultural Education (056)

Associate Professors: D.G. Craig, Ed.D. Cornell; J.D. Todd (Chairman), Ed.D. Illinois.

3450 Agricultural Experience and Future Farmers of America Programs (3) Prereq: consent of instructor.
3460 Methods in Teaching Agriculture (3) Prereq: consent of instructor.
3470 Program Development and Adult Education in Agriculture (3) Prereq: consent of instructor.

4350-60 Student Teaching in Agricultural Education (1, 6) Offered in off-campus centers. Application must be filed not later than final quarter of junior year. Courses must be taken concurrently. Prereq: 3450, 3460, 3470, consent of instructor. Undergraduate credit only. Satisfactory-No Credit.

4510-20-30 Problems in Agribusiness Education (1, 6, 1-8, 1-6) Total not more than 9 hours.

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

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

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

5110-20-30 Current Problems in Agribusiness Education (1, 2, 2)

5150 Evaluation of Research in Business Education (3, 3, 3)

5161-21-31 Problems in Business Education: Typing (3, 3, 3)

5162-22-32 Problems in Business Education: Shorthand (3, 3, 3)

5163-23-33 Problems in Business Education: Bookkeeping and Accounting (3, 3, 3)

5164-24 Problems in Business Education: Clerical Practice (3, 3, 3)

5165-25-35 Problems in Business Education: General Business (3, 3, 3)

5167 Problems in Business Education: Business Law (3, 3, 3)

5168-28-38 Problems in Business Education: Administration (3, 3, 3)

5169 Problems in Business Education: Psychology of Skill-Building (3, 3, 3)

6110-20-30 Current Issues in Business Education (3, 3, 3)

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

6410 Higher Education for Business (3)

Distributive Education (273)

Professor: C.B. Cookley (Chairman), Ph.D. Wisconsin.

Assistant Professor: D.E. McNelley, Ed.D. Missouri.

4110 Student Teaching in Distributive Education (9) Full-time, supervised experience in classroom teaching, coordination, club work, and adult education. Prereq: 4310, 4320. Education 3030, educational Psychology 3810, 4140 or equivalent. Undergraduate credit only. Satisfactory-No Credit.

4120 School and Community Relationships for the Teacher Coordinator (6) Content dependent upon teaching assignment; human relations and human behavior from school, parent, business, and other community contacts. Must be taken with 4110. Undergraduate credit only. Satisfactory-No Credit.

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

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

4310 Organization and Operation of Distributive Education 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 permission of instructor.

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

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

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5110 Administration and Supervision of Distributive Education (3)

5120 Organizing and Teaching Adult Distributive Education (3)

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

5616-26-36 Problems in Distributive Education: Retailing (3, 3, 3)

Home Economics Education (490)

Professor: N.P. Logan (Chairman), Ed.D. Tennessee, I. Brown (Emeritus), Ph.D. Ohio State.

Associate Professor: S.W. Miller, Ph.D. Ohio State.

Assistant Professor: J.H. McInnis, Ph.D. Florida State.

2240 Introduction to Teaching Vocational Home Economics (3) Introductory and exploratory experiences concerned with a teaching career in vocational home economics. Includes observation and participation within various educational and vocational settings.

3240 Strategies of Teaching Home Economics (4) Teaching strategies, methods, techniques and use of media. Field experience included. Prereq: 2240.

4240 Curriculum Development in Vocational Home Economics (3) Planning a program and design of instruction for the classroom. Prereq: 2240, 3240. To be scheduled one of the two quarters immediately preceding student teaching.

4310 Student Teaching (6) Underlying philosophy, techniques, and materials; relation to school program and community. Satisfactory-No Credit.

4509 Field Experience in Home Economics Related Occupations (4) Supervised field experience and seminar in teaching of occupations which utilize home economics skills and knowledge. Prereq: permission of instructor. Satisfactory-No Credit. May be repeated. Maximum 8 hours credit.

4610 Student Teaching (9) Open to seniors or graduate students who have successfully completed one year's study at The University of Tennessee. Off-campus teaching center: minimum of eight weeks). Prereq: 2240, 3240, 4240. Coreq: 4310. Satisfactory-No Credit.

4716-28-38 Honors: Home Economics Education (3, 3, 3) For juniors and seniors showing special ability and interest in home economics education. Prereq: permission of department head.

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5130 Furthering Good Human Relationships in the Classroom (3)

5220 Evaluation in Home Economics (3)

5310 The Problem Method of Teaching (3)

5440 Curriculum Development and Implementation in Family Relationships Instruction (3)

5520 The Teaching of Home Economics in the College (3)

5530 Organization of the Homemaking Curriculum in Secondary Schools (3)

5610 Supervision of Home Economics in the Public Schools (3)
5620 Wage Earning Programs in Home Economics (3)
5710-20-30 Special Problems for Non-Thesis Students (3, 3, 3)
5810-20-30 Problems in Home Economics Education (1-3, 1-3, 1-3)
5910-20 Seminar in Home Economics Education (3, 3)

Industrial Education (547)

Professors: J.L. Reed (Chairman), M.S. Oklahoma; R.W. Haskell, Ph.D. Purdue.
Associate Professors: G.D. Cheek, Ph.D. Kansas; D.V. Brown, P.E., Ed.D. Utah State.

Instructor: A. H. Olson, M.S., Minnesota.

1240 Welding and Cutting Practices (3) Prereq: 1642.
1610 Engine Analysis (3) Designed to give experimental laboratory experience in automotive technology. Engine tune-up and engine overhaul techniques and procedures are studied and practiced.
1620 Graphic Communications (3) Drafting as a means of communication in technology. Orthographic and multi-view drawing, conventional practices, pictorial techniques and applications of photography.
1630 Basic and Applied Electricity (3) Operation and characteristics of electrical systems and devices. Construction of demonstration apparatus and various electrical projects involving function of different types of circuits.
1642 General Metals (3) Basic course dealing with processes, equipment, materials, products, and organization of metal-working industries. Involves processes in machining, foundry, sheet metal, and fabrication.
1661 General Woodworking (3) Basic course dealing with processes, tools, equipment, products, organization of woodworking industry. Stresses importance of safety and using hand tools and basic machine tools.
2010-20-30 Basic Experiences in Trade and Industrial Education (3, 3, 3) Methods and materials of instruction. 3 periods.
2611 Power Mechanics (3) Includes various prime movers, methods of utilization, distribution and transmission of electric power, simple internal combustion engines. Maintenance and repair of small engines is stressed.
2621 Architectural Graphics (3) Introduction to fundamentals of graphic representation and residential architecture. Light construction principles are stressed and working drawings for a residential building are developed. Prereq: 1620.
2631 Fundamentals of Applied Electronics (3) Semiconductors, electrical circuits, including amplifiers, oscillators, switching and timing circuits, applications including sounds in video systems, relays, control and industrial devices. Prereq: 1630.
2641 Machine Tool Processes (3) Introductory course of the function, care, set-up, operation and theory of basic machine tools. Prereq: 1842.
2852 General Plastics (3) Characteristics of thermoplastics and thermal setting materials, methods of determination and resin conversion to finished product.
2960 Furniture and Cabinet Construction (3) Comprehensive study of cases and carcass construction with emphasis placed upon furniture and built-ins. Prereq: 1661.
3010 Related Science, Mathematics, and Technology in Occupations (3) Credit may be earned only through examination. Applicants shall be limited to persons already holding a vocational teaching certificate.
3020 Manipulative Skills in Occupations (3) Credit may be earned only through examination. Applicants shall be limited to persons already holding a vocational teaching certificate.
3030 Knowledge of Related Subjects in Occupations and Personal Qualifications (3) Credit may be earned only through examination. Applicants shall be limited to persons already holding a vocational teaching certificate.
3040-41-42 Physical Testing Technology (3, 3, 3) Skills and techniques involved in radiography, metallurgy, tensile and compression testing, and other destructive and nondestructive testing methods. Undergraduate credit only.
3050-51-52 Welding, Brazing, Cutting, and Related Processes (3, 3, 3) Various types of welding equipment and fundamental techniques of welding. Undergraduate credit only.
3060-61-62 Electronic Technology (3, 3, 3) Basic principles and practical applications of electronics. Undergraduate credit only.
3080-81-82 Machining of Metals (3, 3, 3) Introduction to machine shop theory and procedures which provides information and practice in using basic machine tools. Undergraduate credit only.
3110 History and Philosophy of Industrial Education (3)
3210-20-30 Part-time Programs in Cooperative Industrial Training (3, 3, 3) Principles of organization, methods, and materials.
3310 Shop Organization and Management (3)
3320-30 Materials and Methods for Teachers of Shop and Related Subjects (3, 3)
3340 School Shop Safety (3)
3610 Development and Utilization of Advisory Committees (3) Philosophy and rationale for use of craft advisory committees. Their selection, organization, implementation and utilization.
3612 Automotive Mechanics (3) Advanced laboratory experience in tune-up, overhaul, transmission, and the suspension system. Prereq: 1610.
3621 Industrial Graphics (3) Auxiliary views, sections, conventional practices, fasteners, dimensioning, working drawings and machine drafting. Prereq: 1620.
3632 Industrial Electricity and Equipment Control (3) Involves construction and application of industrial electric equipment both single and polyphase. Production, use and control of electric current. Emphasis placed on circuit tracing, installation, maintenance, and trouble controlling industrial equipment. Prereq: 1630.
3640 Advanced General Metals (3) Provides experiences in areas of hot and cold forming of metals, molding and metal finishing, tool grinding, heat treatment, fabrication and precision measurement. Prereq: 2641.
3651 Plastic Processing (3) Plastics production equipment and related product design and processing of plastics. Prereq: 2652 and 1661.
3662 Construction Methods and Materials (3) Materials and methods of construction and equipment used in residential construction, including location and excavation, foundation, framing, roofs, interior and exterior finishing, acceptable practices in assembly. Prereq: 1661.
4073-74-75 Tool and Machine Design (3, 3, 3) Tool and machine design, calculations, design systems, and designing procedures. Undergraduate credit only.
4090-91 Numerical Control (3, 3) Tooling, manual programming, automatic programming, automatic programming languages and use of automatic programmer as a computer. Undergraduate credit only.
4110 Foremanship Training by the Conference Method (3)
4120-30 Job Analysis (3, 3) Principles, practice, instructional methods.
4210 Methods of Teaching Shop and Related Subjects (3) Undergraduate credit only.
4220 Vocational Technical Laboratory Equipment Maintenance (3) Understanding of preventive maintenance, maintenance and calibration of instruments and power equipment used in industrial education shops.
4310-20 Curriculum Building in Trade and Industrial Subjects (3, 3) Arranging core course material in trade subjects, following up results of job analyses, preparing checking sheets and individual job sheets in both trade and related subjects. Prereq or coreq: 4120.
4350-60-70 Problems in Industrial Education (3, 3, 3)
4410 Directed Teaching (6) Observation of all types of trade and industrial classes; preparation of lesson plans and supplying of student manual. Prereq: Senior standing in industrial education. Prereq or parallel: 4210. 1 hr and 5 periods. Undergraduate credit only. Satisfactory-Not Credit.
4420 Directed Teaching (9) Guided observation and teaching in trade, industrial, and/or technical programs in secondary, area, adult, post secondary, and junior college industrial vocational and technical curricula. Undergraduate credit only. Satisfactory-Not Credit.
4510-11-12 Seminar in Industrial Education (3, 3, 3) Educational innovations, current events, problems, and other topics associated with the field of industrial education.
4520-21-22 New Developments in Industrial Education (3, 3, 3) Developments, pressing problems, and recent trends in field of industrial education as presented by a coordinating instructor in conjunction with knowledgeable resource personnel.
4621 Special Topics in Drafting (3) Industrial practices in specialized areas of drafting selected for the individual student. Prereq: 6 hrs drafting.
4670 Manufacturing Processes (3) The manufacturing processes of industry and their relationship to careers. Prereq: 2621, 2641, 2660, 3651, or permission of instructor.
4671 Materials and Processes (3) Organic and inorganic materials and processes used to produce finished products. Content, curriculum and techniques of laboratory operation. Prereq: permission of instructor.
4682 Power and Energy (3) Development, control, transmission, conversion, interrelationship of power sources, content, curriculum, and techniques of laboratory operation. Prereq: permission of instructor.
4690 Visual Communications in Industrial Arts (3) Methods of developing and transmitting ideas and information as related to industry and society. Content, curriculum and techniques of laboratory operation. Prereq: permission of instructor.
4691 Course Construction in Industrial Arts (3) Advanced work in the selection and arrangement of course content. Emphasis upon instructional objectives, project selection and informational arrangements and evaluation. Prereq: permission of instructor.

GRADUATE
5000 Thesis
5002 Non-Thesis Graduation Completion (3)
5110-20-30 Administration and Supervision of Industrial Education (3, 3, 3)
5140 Organization and Operation of Area Vocational-Technical Schools (3)
5210-20-30 Special Problems in Industrial Education (3, 3, 3)
5310 Methods of Research in Industrial Education (3)
5410 Improving Teachers in Service (3)
5420 Advisory Committees and Apprentice Training (3)
5430 Vocational School Administration and Management (3)
5440 Advanced Methods of Teaching Skills and Technical Information (3)
5510-20-30 Seminar in Industrial Technical Education (3, 3, 3)
5540 New Developments in Industrial Technical Education (3)
The engineer applies mathematical and scientific knowledge in planning economical ways of providing materials and energy in forms that are useful to humankind. In today's technology-based society, everyone feels the effects of the engineer's plans and decisions. Hence, there is a continuing and urgent need for engineering graduates who possess a thorough understanding of mathematical and scientific principles, who can apply these principles to the solution of practical problems, and who can view the solutions in their overall social perspective so that the actions that they recommend will be truly beneficial. It is the purpose of the College of Engineering to educate men and women to the high levels of technical competence and social understanding that will enable them to fulfill their responsibilities as professional engineers.

Graduates of the B.S. curricula offered by the College may enter directly a position in industry, government, or private practice or may pursue advanced study in graduate school. Their professional activities include research, development, design, operations analysis, construction, production supervision, and technical sales. Many practice their profession in Tennessee; but engineering knows no geographical bounds, and graduates of the College serve throughout the nation and in other countries as well.

The College of Engineering had its beginnings early in the history of the University when surveying was introduced into the curriculum in 1838. In 1877 civil engineering was first recognized as a curriculum. The first mechanical course appeared in about 1847; other mechanical courses followed, and in 1877 this body of studies was designated as mechanical engineering. By 1877 mining had found a place in the University, but it was later dropped. Electrical engineering appeared in about 1896, when a Professor of Physics and Electrical Engineering was appointed. Although metallurgy was announced in the catalog as early as 1888, it was dormant until it was revived in the Department of Chemical Engineering shortly after 1940. A separate degree in metallurgical engineering was authorized in 1957. Although the rudiments of chemical engineering appeared in the form of industrial chemistry shortly after 1900, a full chemical engineering program and a department were not established until 1936. Industrial engineering was introduced in 1940, was dropped for a time during the war years, and was reinstated in 1947.

Nuclear engineering was established as a separate curriculum in 1957 in response to the rapidly increasing demand for engineers with a knowledge of nuclear phenomena. Engineering physics, a program operated jointly with the physics department, first appeared as an engineering curriculum in about 1942. Curricula in aerospace engineering and engineering mechanics were added in 1966, and a curriculum in engineering science was added in 1967.

The first Dean of the College of Engineering, Professor Charles E. Ferris, was appointed in 1912. Prior to that time the engineering programs were organized as a school, with a chairman of the faculty. Other former deans are Nathan W. Dougherty, who served from 1940 to 1956, Armour T. Granger, who served from 1956 to 1965, and Charles H. Weaver, who served from 1965 to 1968.

The Cooperative Engineering Program was established at The University of Tennessee in 1926. This institution was one of the early pioneers in this valuable type of education, which originated at the University of Cincinnati in 1903. The Cooperative Engineering Scholarship Program was formally established in 1957, with emphasis on participation by students of superior ability. A conventional cooperative program, open essentially to all students in good standing in the College of Engineering, was re-established in 1967.

The Engineering Experiment Station was established in 1922. The College of Engineering has ten major undergraduate curricula in which a student may specialize: aerospace, chemical, civil, electrical, industrial, mechanical, metallurgical, and nuclear engineering, engineering physics and engineering science.

Agricultural engineering is taught in the College of Agriculture with facilities located on the Agricultural Campus. The agricultural engineering curriculum is offered cooperatively by the College of Agriculture and the College of Engineering. Details of the curriculum may be found in the College of Agriculture section of this catalog.

Facilities

The College of Engineering is housed in Ferris, Estabrook, Perkins, Dougherty and Berry Halls, and the Nuclear Engineering Building, located on the southeastern end of the campus.

Ferris Hall. This building houses the offices, laboratories, and shops of the electrical engineering department and the Water Resources Laboratory. There is also an auditorium with a seating capacity of about 300 persons, and a remote input/output terminal connecting with the University of
Tennessee Computing Center.

Estabrook Hall. Some operations of the Departments of Civil Engineering and Engineering Science and Mechanics, and of the Engineering Experiment Station are carried on in Estabrook Hall.

Perkins Hall. This building houses the Departments of Civil Engineering, Engineering Science and Mechanics, Industrial Engineering, and the Office of the Dean of the College of Engineering. The building contains laboratories, drafting rooms, and a small auditorium with a capacity of about 80 people.

Nuclear Engineering Building. This building houses operations of the nuclear engineering department and it contains laboratories and equipment for monitoring, counting, and investigating various nuclear phenomena; it also houses subcritical reactors.

Nathan W. Dougherty Engineering Building. This building, the most recent and largest of the engineering buildings, houses the Departments of Chemical and Metallurgical Engineering, Mechanical and Aerospace Engineering. In addition to classroom and instructional laboratories, it provides modern facilities for various types of research.

Berry Hall. This building is used by the Department of Civil Engineering and the Engineering Experiment Station.

Tau Beta Pi National Headquarters

The College of Engineering of The University of Tennessee is honored to have the National Headquarters of Tau Beta Pi, the National Engineering Honor Society, housed on its campus. This honor was earned in part through the untiring efforts of R.C. "Red" Matthews, who served as Secretary-Treasurer for the organization from 1905 to 1947. The suite of offices, located in Dougherty Hall, is occupied by Mr. R.H. Nagel, Secretary-Treasurer, and his staff.

Chi Epsilon National Headquarters

The College of Engineering of The University of Tennessee is also honored to have the National Headquarters of Chi Epsilon, the National Civil Engineering Honor Society, located in Perkins Hall. Chi Epsilon was founded in 1922. Dexter C. Jameson, Jr., associate professor of civil engineering, was elected to serve as the first Executive Secretary of Chi Epsilon in 1972.

Cooperative Engineering Programs

Cooperative Engineering Programs

COOPERATIVE ENGINEERING SCHOLARSHIP PROGRAM

The Cooperative Engineering Scholarship Program is rich in honors, opportunities, experience, and, therefore, in educational value. The program was developed during the early 1950's and was formalized and given its present name in 1963. The program is open only to those students who have demonstrated marked superiority in academic work, and in recent years very few have been admitted whose scholastic average has been significantly less than B. In addition the student must maintain academic and work records at levels that are consistent with a scholarship program of this type in order to remain in the program. Companies participating in this program have a high degree of assurance that cooperative students sent to them will be successful in their program. Admission to this program is at the end of the second or third quarter of the freshman year.

A brochure describing in detail all of the principles governing this program may be obtained from the Office of Cooperative Engineering Programs of the College of Engineering.

COOPERATIVE ENGINEERING PROGRAM

The five-year Cooperative Engineering Program is offered to students in the College of Engineering in order to provide a superior engineering education that includes the opportunity to combine significant experience in industry with academic preparation.

Cooperative work assignments differ from part-time or summer employment in that they involve regularly scheduled cycles of full-time academic quarters alternated with full-time work quarters—usually seven, a minimum of five—in career-related, planned assignments of progressive complexity and responsibility. In exposing the student in this manner to the world of work, the College of Engineering and the facilities of industry join together to offer a broader and richer preparation for postgraduate education and for life in general than can be provided by a conventional academic program alone. This experience in an industrial and professional environment contributes to the student's maturity, increases the scope of acquaintances and concepts, and enables the student to define more clearly educational and career interests and objectives. Some of the experience received is at a sub-professional level not available to an engineer after graduation, yet is of great significance in total education and effectiveness.

Admission to the Cooperative Engineering Program is open to any student in the College of Engineering (or majoring in agricultural engineering in the College of Agriculture) who is in good standing, whose record at the University is satisfactory, who is financially dependable, and who is acceptable to a co-op employer. In general work periods begin at the end of the second or third quarter of the freshman year and continue for seven alternating work cycles. Applicants must be able to schedule a minimum of five such cycles before the beginning of their senior work in order to qualify for co-op placement.

Academic schedules for co-op students are shown elsewhere in this section. A brochure with further details may be obtained from the Office of the Coordinator, Cooperative Engineering Program, College of Engineering.

Binary Program

A binary program in engineering education is offered at The University of Tennessee. The College of Engineering has agreements with a number of liberal arts colleges to conduct a five-year program, three years of which will be given at the liberal arts college and the last two years at The University of Tennessee in engineering. At the end of the fifth year, the College of Engineering will give the degree of Bachelor of Science in one of the branches of engineering.

Institutions cooperating with The University of Tennessee in offering this Liberal Arts-Engineering 3-2 Binary Plan include:

- Belmont College, Nashville, Tennessee
- Bethel College, McKenzie, Tennessee
- Carson-Newman College, Jefferson City, Tennessee
- David Lipscomb College, Nashville, Tennessee
- East Tennessee State University, Johnson City, Tennessee
- King College, Bristol, Tennessee
- Knoxville College, Knoxville, Tennessee
- Maryville College, Maryville, Tennessee
- Middle Tennessee State University, Murfreesboro, Tennessee
- Tennessee Wesleyan College, Athens, Tennessee
- Union University, Jackson, Tennessee

Questions about courses to be taken in preparation for transfer to The University of Tennessee may be directed to the Dean of Engineering.

Graduate Program

GENERAL

Graduate programs leading to the degree of Master of Science are offered in all areas of study, and the degree of Doctor of Philosophy is offered in seven major subjects: aerospace engineering, chemical engineering, electrical engineering, engineering science, mechanical engineering, metallurgical engineering, and nuclear engineering. A Master of Engineering degree focusing on engineering design and professional practice is offered in aerospace, civil, electrical, environmental, industrial, mechanical, and nuclear engineering. Information concerning graduate programs is given in the Graduate School Catalog.

MARTER OF SCIENCE PROGRAM IN ENGINEERING ADMINISTRATION

A program leading to the degree of Master of Science in engineering administration is offered with the aim of 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 is emphasized that this is an engineering program, directed toward preparing individuals for work in construction, design, development, manufacturing, etc., where both technical and non-technical factors exert significant influence on the success of a given activity. The program does not provide the opportunity for in-depth study of any of the traditional areas of business administration, and students with such interests are advised to consider graduate programs in business administration. Policy direction and administration of the program are provided by an Engineering Administration Committee, consisting of representatives from participating departments in the College of Engineering and Business Administration, and a chairman appointed by the Dean of Engineering. Further information is provided in the Graduate School Catalog.
Graduate Program at the UT Space Institute

At the University of Tennessee Space Institute near Tullahoma, graduate level courses are offered in engineering fields such as aerospace, electrical, and mechanical engineering, and in mathematics and physics. Current programs lead to the M.S. and Ph.D. degrees. Many members of the faculty of the Space Institute are also members of the faculty of the College of Engineering.

Engineering Experiment Station

F.M. Peveto, Director
William K. Stair, Associate Director

The management of the Engineering Experiment Station is vested in the President of the University, the Dean of Engineering, the Director, and the Associate Director. An advisory committee consisting of the heads of the departments of the College of Engineering and the heads of departments in allied scientific fields may assist in determining policy and procedures. Members of the faculty of the College of Engineering are available for consultation and advice in technical matters. The Station is organized to conduct research underlying engineering practice and to aid in the development of the state’s resources and industries insofar as funds available will permit. Inquiries from industries concerning technical questions which interest them are welcomed.

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.

Bulletins are published from time to time giving the results of various investigations. Upon request, unpublished results of current studies are made available to interested parties.

Curricula in Engineering

NATIONAL ACCREDITATION

Since 1936 engineering programs at institutions of higher learning have been accredited by the Engineers Council for Professional Development, an organization formed by many engineering societies. Currently accredited engineering curricula at UTK include aerospace, agricultural, chemical, civil, civil, electrical, engineering science, industrial, mechanical, metallurgical, and nuclear. The advanced professional programs are also accredited in civil, electrical, environmental, mechanical, and nuclear engineering.

COURSE LOAD

The maximum number of hours which can be taken by an undergraduate without special permission is 19 hours. The Dean of Engineering must give permission to take 20 hours or more.

GENERAL REQUIREMENTS

NOTE: Students are advised to consult the University’s degree requirements as stated in the front section of this catalog as well as the requirements for the college or department.

Inspection Trip. Each candidate for graduation majoring in aerospace, mechanical, chemical, or metallurgical engineering must participate in inspection trips scheduled by the major department.

Transfer Credit. Every attempt will be made to give maximum credit for courses taken elsewhere and transferred to the College of Engineering. Discussions concerning the evaluation of transfer credits should be conducted with the head of the department into which the student proposes to transfer.

Program for Second B.S. Degree. Upon approval by the Dean of Engineering and the Committee on Degrees of a program of study recommended by the major engineering department, a student who already holds a bachelor’s degree may obtain the appropriate first degree in engineering upon completion of a minimum of 45 quarter hours credit. The prevailing University regulations on residence and quality point averages shall apply.

Satisfactory/No Credit Courses. An undergraduate engineering student may count toward a degree up to 12 quarter hours obtained by Satisfactory/No Credit grading. Such courses must be suitable for humanistic-social (non-technical) elective credit in engineering.

Humanities and Social Studies Electives. The College of Engineering assumes an obligation to include in each of the engineering curriculum a means whereby students gain greater insight into their interaction with society, both personally and professionally. For this purpose, a part of each engineering curriculum is devoted to humanistic-social electives. Broadly stated, these electives serve a three-fold need: to provide an expanded sensitivity to the human aspects of the practice of engineering; to enrich the student’s knowledge of the world in which he or she lives—its culture, behavior patterns, history and governance; and to provide a basis for the appreciation of and the ability to deal with complex interactions between technology and society in the contemporary world. An awareness of this interaction is becoming progressively more significant. Future engineers are now working with new constraints that demand a consciousness of the social and political implications of their work. They are interacting more with the public in explaining their work as the public demands greater participation in the decision-making process concerning the utilization of technology. Because of the significance of this technology-society interaction, engineering students are encouraged to seriously consider selecting electives in this area.

Students are urged to plan a non-technical electives program which will enhance their own interests and objectives. It is recognized that, just as engineers show individual preference for concentration in one of the areas of engineering, they differ in their interests in the many areas of the humanities and social sciences. However, considerable personal satisfaction results if subject areas outside one’s own discipline can be pursued with sufficient depth in terms of courses to permit a reasonable level of confidence in the comprehension of the selected areas. In order to increase the effectiveness of this interest and to meet accreditation guidelines, the Humanities and Social Studies Electives Committee on the College of Engineering provides a list of approved courses in the form of thirteen coherent groups of courses identified in three broad areas as follows:

Area I. Human, Economic, and Political Relationships to Engineering

A. Governance and Political Science
B. Economics
C. Sociology and Psychology

Area II. Society—Its Culture, History and Literature

A. Fine Arts
B. American Culture
C. History
D. Literature
E. Anthropology

Area III. Technology and Society

A. Human Habitat
B. Technology Assessment
C. Communication
D. Resources

Courses in the list which follow are selected by the Committee with revisions as course offerings and needs change. They are recommended for satisfying the non-technical (humanistic-social) elective requirement in the various curricula of the College. However, the structure and permissible courses of the non-technical electives content of each engineering curriculum is established by the respective departments. Therefore, individual departments may delete courses from this list, require certain courses, or require selection of courses from specific subgroups.

Students should consult their departments for any restrictions.

It is recognized that individual students may desire to take courses not on the approved list. Those students should discuss their interests and desires with their academic adviser prior to registering for elective courses. Also the catalog may state prerequisites for upper division courses in the list. In such cases, students are encouraged to consult the instructor in the particular course, since prerequisites might be waived. With respect to students desiring deviations from this list are handled by means of a substitution sheet which originates with the adviser.

ELECTIVE OPTIONS IN HUMANITIES AND SOCIAL STUDIES

Area I. Human, Economic, and Political Relationships to Engineering

IA. Governance and Political Science
Business Law 4110
Economics 3340
Geography 3610
History 3795, 4311-21, 4370, 4380
Political Science 2510-20, 3545-46, 3557, 3630, 3710-20-30, 3801-02-03-04, 4535-36, 4540-50, 4580-90, 4665-66
Sociology 3030, 4320, 4330, 4530

IB. Economics
Economics 2110-20-30, 2118-28-38, 3120, 3222, 4240
Geography 2110-20-30, 3410, 4610
Geology 2310
Industrial Engineering 4810

IC. Sociology and Psychology
Geography 2000, 2400, 3860
Sociology and Psychology 3800, 3820, 3830,

Geography 3610
History 3795, 4311-21, 4370, 4380
Political Science 2510-20, 3545-46, 3557, 3630, 3710-20-30, 3801-02-03-04, 4535-36, 4540-50, 4580-90, 4665-66
Sociology 3030, 4320, 4330, 4530

Economics 2110-20-30, 2118-28-38, 3120, 3222, 4240
Geography 2110-20-30, 3410, 4610
Geology 2310
Industrial Engineering 4810

Sociology and Psychology 3800, 3820, 3830,
3430, 4460, 4610, 4900
Sociology 1510, 1520, 3030, 3150, 3430, 4510, 4560, 4610, 4620, 4810

II. Human Values

Geography 3000
History 4640-50-60
Philosophy 2310, 2410, 3111-21-31-41, 3311-12, 3440, 3690, 3910
Religious Studies 2610, 3650, 3630

Area II. Society—Its Culture, History and Literature

IIA. Fine Arts (Note: No more than 8 quarter hours may be taken in the Performing Arts - Voice, Instrumentation, Band, Chorus, etc.)
Art 1815-25, 3735, 3736, 3745, 3746, 3765, 3945
English 2660, 3411-12-20-30
Music 1xxx (Applied Music, Ensemble, etc.)
Music 1210-20, 1340, 2310-20-30-40, 3350
Theatre 1510, 3252-53-54

IIB. American Culture

American Studies 3010
Art 3710, 3711, 3720, 3730
Black Studies 4830
English 2530, 2540, 2640-50, 3010-20-30, 3080, 3140, 3310, 3430, 4050-60, 4620, 4651-52
Geography 3430, 3450, 3660, 3910, 3920, 4240
History 1950-60, 2350, 2510-20, 3610-20, 3670, 3680, 4280, 4290, 4640-50-60
Music 1210-20, 1340, 2310-20-30-40, 3350
Philosophy 1510-20, 3311-12, 3315, 3440, 3690, 3720
Political Science 3801-02-03-04
Religious Studies 3510-20
Speech 4910-20-30
Theatre 3282-63
University Studies 3010

IIC. History

Geography 4240
History 2350, 2510-20, 3061-71, 3140-50-60, 3411-12-13, 3431-32-33, 3610-20, 3630-40-50, 3750, 3760, 3770,
3780-90, 3795, 3870-80-90, 4120-30, 4250-60-70, 4280, 4290, 4311-21, 4370, 4380, 4640-50-60
Religious Studies 2011

IID. Literature

Classics 3210-20-30
Comparative Literature 3010
English 2530, 2540, 2560-70-80, 3010-20-30, 3070, 3080, 3140, 3940, 4010-20, 4050-60, 4310-20-30-40, 4620, 4651-52, 4720, 4730
German 3210-20-30
Religious Studies 3710
Russian 3210-20-21-30

IIE. Anthropology

American Studies 3010
Anthropology 2510-20-30, 3410, 4420
Asian Studies 2510-20
Geography 3660
History 1950-60, 2450-60-70, 4640-50-60

Area III. Technology and Society

IIIA. Human Habitat

Agricultural Economics 4330
Anthropology 4430
Botany 3090
Environmental Engineering 3000
Geography 2400, 3490, 3520, 3530, 3910
Journalism 4410
Nutrition 2000
Political Science 3557
Psychology 4900
Public Health 3320
Sociology 1510-20, 3130, 4030, 4110, 4320, 4330, 4510, 4610

IIIB. Technology Assessment

Biology 3130
Botany 3090
Economics 4240, 4260
Environmental Engineering 3000
Geography 2110-20-30, 3430, 3490, 4240
Geology 2310, 3510
Nuclear Engineering 3040
Philosophy 3720, 3770
Political Science 3557, 3810-20-30-40
Psychology 4340, 4900
Rural Sociology 4450

*No more than two courses (6-8 credit hours) carrying engineering college course numbers may be used to satisfy the non-technical electives requirement.

Technical Electives. Technical electives are to be selected with the advice and approval of the student's major department. In some of the curricula tabulations a choice of such electives is indicated, and regulations in regard to their selection are stated.

The Voluntary ROTC Program.
Engineering students may participate in the ROTC Program. Advanced ROTC courses (3000 and 4000 series) may be counted as technical elective credit toward an engineering degree up to a total of nine (9) quarter hours. No ROTC course can be used as a humanistic-social elective. Individual departments determine the appropriate substitutions. Although every effort is made to accommodate engineering students in the ROTC Program, only the 9 hours described above may count towards the degree.

Approval of Electives and Substitutions.
Not later than the beginning of the third quarter prior to anticipated graduation, each student shall discuss with an adviser the status of the program of study. Any necessary additions to or substitutions in the program, or electives requiring special approval, shall be cleared in written form at that time, and it is each student's responsibility to see that all necessary approvals are secured.

CURRICULA, TABULAR VIEW

In the following pages are given the course requirements for the various engineering curricula. With no deficiencies in entrance requirements and with careful scheduling of courses, students should complete the regular curricula in four academic years, or the cooperative curricula in five years.

In the following tabulations, the numbers immediately following the names of the courses refer to the description of the courses under "Departments of Instruction." The numbers in the column indicate the number of quarter hours of credit applicable to each course. Non-technical electives are normally the same as humanities-social-studies electives.
### Aerospace Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
<th>Credit</th>
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<tr>
<td><strong>Freshman</strong></td>
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<tr>
<td>Math 1840-50-60</td>
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<td>English 1510-20</td>
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<tr>
<td>Graphics 1310-20-30</td>
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<tr>
<td>Basic Engr. 1410</td>
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<tr>
<td><strong>Sophomore</strong></td>
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<td>Aero. Engr. 2040</td>
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<td>Math 2840-50-60</td>
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<tr>
<td>Physics 2310-20-30</td>
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<tr>
<td>Humanities/Social Studies Electives</td>
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</table>

- Required for pre-medical, pre-dental, and pre-veterinary medicine programs.
- Humanities/Social Studies courses approved by the department.
- Appropriate courses in the College of Engineering approved by the department.
- Courses in mathematics, statistics, natural science, or engineering approved by the department.

**TOTAL:** 202 Hours

### Chemical Engineering

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credit</th>
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<tbody>
<tr>
<td><strong>Freshman</strong></td>
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<td>Math 1840-50-60</td>
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<td><strong>Sophomore</strong></td>
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<tr>
<td>Humanities/Social Studies Electives</td>
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</tbody>
</table>

**TOTAL:** 199 Hours

### Biomedical Engineering

**Available in Engineering Science Degree Program**

### Civil Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
<th>Credit</th>
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<tbody>
<tr>
<td><strong>Freshman</strong></td>
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<td>Basic Engr. 1410</td>
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</tbody>
</table>

**NOT REQUIRED in the cooperative program**

**NOT REQUIRED in the cooperative program**

During the third quarter of the junior year the student, in consultation with the adviser, should choose one of the following areas of interest. Courses marked with footnote 1 may be replaced by other courses approved by the student's area adviser. Notice that any given senior course is offered only once every third quarter including the summer quarter.
### SENIOR YEAR—AREAS OF INTEREST

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**TOTAL: 202 Hours**

### Energy Conversion and Power Systems

| Electr. Engr. 4410-20-30                   | 3           |
| "Electr. Engr. 4370                      | 3           |
| "Electr. Engr. 4790                      | 3           |
| "Electr. Engr. 4870                      | 3           |
| "Electr. Engr. 4690                      | 3           |
| Nuclear Engr. 4610                       | 3           |
| Electr. Engr. 4020                       | 3           |
| Electr. Engr. 4810                       | 3           |
| Economics 2110                            | 3           |
| Non-Technical Electives                   | 4           |

**TOTAL: 202 hours**

### Plasma and Electro-Optics Engineering

| "Electr. Engr. 4460, 4470, 4480           | 3           |
| "Electr. Engr. 4020, 4490, 4500          | 3           |
| Economics 2110                            | 3           |
| Tech. Elective                           | 3           |
| Non-Technical Electives                   | 4           |

**TOTAL: 202 hours**

### Systems and Networks

| Electr. Engr. 4810                       | 3           |
| Electr. Engr. 4830                       | 3           |
| Electr. Engr. 4350                       | 3           |
| Economics 2110                            | 3           |
| Non-Technical Electives                   | 4           |

**TOTAL: 202 hours**

### Computer Engineering

| Electr. Engr. 4680                       | 3           |
| Electr. Engr. 4630                       | 3           |
| Electr. Engr. 4700                       | 3           |
| Electr. Engr. 4610                       | 3           |
| "Math 4420 or                           | 3           |
| "Electr. Engr. 4820                      | 3           |
| Electr. Engr. 4620                       | 3           |
| "Electr. Engr. 4350                      | 3           |
| "Math 4710 or 4510                      | 3           |
| Electr. Engr. 4100                       | 3           |
| "Electr. Engr. 4200                      | 3           |
| Economics 2110                            | 3           |
| Math 4430 or                             | 3           |
| "Electr. Engr. 4830                      | 3           |
| Non-Technical Electives                   | 4           |

**TOTAL: 202 hours**

### Electronics and Instrumentation

| Electr. Engr. 4680-90, 4700              | 3           |
| Electr. Engr. 4740                       | 3           |
| "Electr. Engr. 4660                      | 3           |
| "Electr. Engr. 4100                      | 3           |
| Electr. Engr. 4370                       | 3           |
| "Electr. Engr. 4350                      | 3           |
| "Electr. Engr. 4480                      | 3           |
| "Electr. Engr. 4600                      | 3           |
| Economics 2110                            | 3           |
| Non-Technical Electives                   | 4           |

**TOTAL: 205 hours**

### Bioelectric Option

| Biology 1210-20-30                       | 4           |
| Chemistry 2230                          | 4           |
| Electr. Engr. 4660                       | 4           |
| Zoology 3080-3089                        | 5           |
| Electr. Engr. 4850                       | 3           |
| "Electr. Engr. 4600                      | 3           |
| "Electr. Engr. 4800                      | 3           |
| "Electr. Engr. 4370                      | 3           |
| "Electr. Engr. 4820                      | 3           |
| Non-Technical Electives                   | 4           |

**TOTAL: 205 hours**

### Engineering Physics

#### Freshman

| Math 1840-50-60                          | 4           |
| English 1510-20                          | 4           |
| Physics 1310-20-30                      | 3           |
| Physics 1310-20-30 (or 1318-28-38)       | 3           |
| *Engineering Electives                   | 3           |

**TOTAL: 195 hours**

### Sophomore

| Physics 2310-20-30                       | 3           |
| *Non-Technical Elective                  | 3           |
| Physics 2310-20-30 (or 2318-28-38)       | 3           |

**TOTAL: 180 or 199 hours**

### Junior

| Math Electives                           | 3           |
| Physics 3210-20-30                       | 3           |
| Physics 4210-20                          | 3           |
| Physics 4110-20-30                       | 3           |
| *Engineering Electives                   | 3           |

**TOTAL: 199 hours**

### Senior

| Mathematics-Social Sciences Electives    | 3           |

### Industrial Engineering

#### Freshman

| Math 1840-50-60                          | 4           |
| English 1510-20                          | 4           |
| Physics 1310-20-30                       | 3           |
| Physics 1310-20-30 (or 1318-28-38)       | 3           |
| *Engineering Electives                   | 3           |

**TOTAL: 204 hours**
### Mechanical Engineering

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*Not required in the cooperative program.

*A minimum of one-half (12 quarter hours) of the non-technical electives must be taken from a simple group under one of the three areas of the Humanities and Social Studies electives.

### Nuclear Engineering

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*Humanities/Social Studies Electives: minimum of 20 hours required.

*Mechanical Engr. Electives: Senior courses in mechanical engineering not otherwise required.

*Technical Electives: Upper-division courses in engineering, mathematics, or physics as approved by the department.
## Cooperative Curriculum in Aerospace Engineering

**Students Working Spring and Fall Quarters—Group A**

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**TOTAL: 202 hours**

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## Students Working Summer and Winter Quarters—Group B

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**TOTAL: 202 hours**

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1Humanities/Social Studies Electives; minimum of 20 hours required.

Technical Electives; upper division courses in engineering, mathematics or physical science as approved by the Department.
### Cooperative Curriculum in Agricultural Engineering (See College of Agriculture Section)

#### Cooperative Curriculum in Chemical Engineering

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**TOTAL: 199 Hours**

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**Students Working Summer and Winter Quarters—Group B**

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**TOTAL: 199 Hours**

*1A minimum of one-half (12 quarter hours) of the non-technical electives must be taken from a single group under one of the three areas of the Humanities and Social Studies electives.*
### Cooperative Curriculum in Civil Engineering

**Students Working Spring and Fall Quarters—Group A**

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*Humanitarian-Social Studies Courses approved by the department.
*Math/Science Courses approved by the department.
'Technical Electives must be approved by the student's advisor and the primary and one secondary area must come from the departmental list of approved courses for 15 credits and 6 credits respectively.*
### Cooperative Curriculum in Electrical Engineering

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**FIFTH YEAR**  
See Senior Year Areas of Interest, page 121.  

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**FIFTH YEAR**  
See Senior Areas of Interest, page 121.  

TOTAL: 204-205 Hours
## Cooperative Curriculum in Engineering Physics

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1. To be taken from Liberal Arts trials of Language, Literature and Arts, or History and Society, with at least 16 hours from courses approved for Language, Literature and Arts.
2. The Honors sequence (Physics 1318-28-38) is recommended for qualified majors.
3. To be taken in College of Engineering.
5. From engineering, mathematics, computer science, physics, chemistry, or astronomy.
6. Students not planning to pursue graduate studies may substitute 3710-20-30.
Cooperative Curriculum in Engineering Science
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1 Humanities/Social Studies courses approved by the Department.
2 Appropriate courses approved by the Department.
3 Appropriate courses in the College of Engineering approved by the Department.
4 Upper division courses in mathematics; statistics; natural science; or engineering approved by the Department.
Cooperative Curriculum in Industrial Engineering

Students Working Spring and Fall Quarters—Group A

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**Note:**
- Humanities-Social Studies Electives: minimum of 20 hours required.
- Mechanical Engineering Electives: Senior Courses in mechanical or aerospace engineering not otherwise required.
- Technical Electives: Upper Division Courses in engineering, mathematics or physics as approved by the Department.
## Cooperative Curriculum in Metallurgical Engineering

**Students Working Spring and Fall Quarters—Group A**

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**TOTAL: 198 Hours**

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**TOTAL: 198 Hours**

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*A minimum of one-half (12 quarter hours) of the non-technical electives must be taken from a single group under one of the three areas of the Humanities and Social Studies electives.*
### Cooperative Curriculum in Nuclear Engineering

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**TOTAL:** 195 Hours

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**TOTAL:** 195 Hours
Agricultural Engineering
(See College of Agriculture)

Basic Engineering and Graphics
(Non-Departmental Unit)

Basic Engineering (179)
Coordinator: W.T. Snyder
1310 Basic Mechanics, I (4) Forces, vector quantities, and moments; resultants of force systems; simple static equilibrium. Required of all engineering except engineering physics majors. Coreq: Math 1840. 3 hrs and 1-3 hr lab.
1320 Basic Mechanics, II (4) Displacement vectors; particle kinematics and projectile motion; kinetics of particles using Newton's laws, frictional forces, and impulse and momentum. Required of all engineering students except engineering physics majors. Preq: 1310; Coreq: Math 1850. 3 hrs and 1-3 hr lab.

Coordinator: P.F. Pasqua
1330 Basic Thermodynamics (4) Work and kinetic energy; temperature, heat: first law of thermodynamics: kinetic theory of gases. Required of all engineering students except engineering physics majors. Preq: 1320; Coreq: Math 1860. 3 hrs and 1-3 hr lab.

1410 Engineering Computations (2) Presentation of data; elementary problem solving; use of slide rule and digital computer; treatment of error; empirical methods. Coreq: Math 1310. 1 hr plus open computation lab.

Graphics (443)
Coordinator: J.N. Snider
Professor: C.A. Newton (Emeritus), M.S. Syracuse. Associate Professors: E.K. Boyce, M.S. Tennessee; W.A. Lyday, Jr., M.S. Tennessee.

1210-20-30 Fundamentals of Engineering Graphics (2, 2, 2) Graphical representation of three-dimensional shape and size by orthographic and pictorial projection; sketching and dimensioning; tolerances. Problem solving utilizing spatial relationships and graphical vector analysis, and graphic presentation of engineering data. Must be taken in sequence. Two 3-hr periods or three 2-3 hr periods.

1410-20 Fundamentals of Engineering Graphics (3, 3) Graphical representation of three-dimensional shape and size; space relationships. Graphical presentation of engineering data. Required of all engineering students. Must be taken in sequence. One lecture and two 2-3 hr periods or two 3-hr periods.

1415-25 Fundamentals of Engineering Graphics (3, 3) Graphical representation of three-dimensional shape and size; space relationships. Self-study course with tutorial assistance for those who have had high school mechanical drawing and/or other related experience. A pass/fail grade is permitted if coordinators give permission to coordinator. Must be taken in sequence. May be interchanged with Graphics 1410-20 courses.

Engineering Studies
(Non-Departmental Unit)

Engineering Studies (338)
Coordinator: E.E. Stanberry
2100 Introduction to Engineering Methodology (4) Designed to introduce non-engineering students to representative methods utilized in engineering design, development, operation, and evaluation of processes and products for society; use of physical laws and examples of techniques such as modeling, systems analysis, economic balances; problems of resource use and technology control; thematic approach may be used.
4100 History of Engineering (4) History of technology and engineering with emphasis on identification of and developments in major areas such as transport, communication, design, and materials. Relationship to social and political structures of historical periods. Open to all students.
4200 Technology Forecasting and Assessment (4) Procedures and problems in forecasting of consequences of existing and new technologies; assessment of data and decisions on use of these technologies. Social, political, economic, and technological implications of consequence-based assessment and control of technology. Open to all students.
4300 The Interaction Between Science and Engineering (4) Historical-to-current analysis of interactions between science and engineering—patterns of mutual stimulation and of distinction. Open to all students.

Chemical and Metallurgical Engineering

Professors: H.F. Johnson (Head), D. Eng. Yale, P.E.; D.C. Bogle, Ph.D. Delaware; B.S. Borie, Ph.D. Massachusetts Institute of Technology; manufacturing, design, and materials. Relationship to social and political structures of historical periods. Open to all students.

Assistant Professors: D.D. Bruns, Ph.D. Houston; P.J. Meschter, Ph.D. Pennsylvania.

BACHELOR OF SCIENCE PROGRAM
Separate complete curricula are offered in chemical engineering and in metallurgical engineering. However, the first two years of these curricula are identical and a decision as to choice can be made in the third year. Both curricula are based on the introduction of the subject. Coreq: Math 1130, Coreq: Math 1130, 3 hrs and 1-3 hr lab.

3040 Process Principles and Materials IV (4) Application of the principles of thermodynamics to physical and chemical processes and thermodynamic cycles; application of the Gibbs function to one, two and three phase chemical systems; use of tabular and graphical data in equilibrium calculations. Coreq: Math 1130, Coreq: Math 1130, 3 hrs and 1-3 hr lab.

3100 Introduction to the Materials of Technology (4) Examination of sources, processing, and properties of metallic, ceramic, polymeric, and composite materials based upon a historical perspective and advances in technology, architecture, and art. Lectures and demonstrations. Open to students in all colleges. Prereq: Introductory science course.

4310, 20 Seminar (1, 1) Presentation and discussion of economic, political, humanistic, and other topics of interest to chemical and metallurgical engineers. Satisfactory-No Credit.

Chemical Engineering (226)

3101 Industrial Inspection Trips (1) Technology of chemical process industries emphasizing Tennessee industry, plant trips. Satisfactory-No Credit.

3410 Flow of Fluids (4) Differential and integral momentum balances, mechanical energy balances; flow in tubes, piping systems, and packed beds; metering devices, pumps. Prereq: Chemet. Engr. 2020, Math 2680. 3 hrs and 1 lab.

3420 Heat Transfer (4) Differential and overall energy balances; steady and unsteady state, heat conduction in simple geometries; heat transfer in tubes and heat exchangers; condensation and boiling. Engr. 3410. 3 hrs and 1 lab.


3450 Diffusional Operations (4) Diffusion simultaneous heat and mass transfer, applications in distillation and absorptions, extraction. Prereq: Chemet. Engr. 3040.

3610 Introduction to Process Dynamics and Control (3) Introduction to concepts of process dynamics and control. Steady-state analysis of chemical process control systems. Unsteady state nature of chemical processes. LaPlace transform techniques. Block diagram algebra and transfer functions. Mathematical models for several process examples are developed and analyzed in detail. Prereq: Mathematics 2680.

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

4010-20 Thesis (3, 3) Investigation and report of elementary chemical engineering problem.

4110 Chemical Engineering Data Analysis (3) Analysis of data and presentation of results and identification of system extremes; statistical properties of samples and process data; empirical modeling of processes; statistical process control. Prereq: Chemet. Engr. 3420, Math 3150.


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

4220 Chemical Engineering Laboratory (3) Laboratory investigations of controlling factors in chemical engineering operations. Prereq: 3440-50, 3620, 4530.

4230 Project Laboratory (3) Laboratory investigation of chemical engineering problem, stressing techniques of group effort.


4420 Process Design and Economic Analysis (3) Development of total information on a process into an integrated plant design, considering mass and energy balances. Product specifications, equipment characteristics, capital investment, operating costs and economic merit. Prereq: 4410, 4530.

4430 Special Problems in Design and Economics (3) Extension of 4420 for student participation in A.I. CHE. annual contest problem; other advanced design projects. Prereq: 4420.

4450 Hydrocarbon Processing (3) Study of specialized characteristics of physical properties of fossil fuel raw materials and products, and processes for conversion of fossil fuel raw materials into products needed in industrial energy, industrial raw material and consumer markets. Prereq: 3440.

4530 Chemical Engineering Reaction Kinetics (3) Chemical reaction rates, mass transfer in flows, interpretation of laboratory and pilot plant data; reactor design. Prereq: 3420, Chemet. Engr. 3040, Chemistry 4040.

4540 Fluid-Solid Operations (3) Heat and mass transport in fixed and fluidized beds; applications include adsorption, ion exchange, crystallization. Prereq: 3440-50.

4620 Process Modeling, Simulation and Control of Chemical Processes (3) Development of process models, experimental process identification, process computer simulation, conventional and nonconventional feedback control, advanced control concepts. Prereq: 3620 or equivalent background in basic control theory and differential equations.

4730 Mass and Energy Flow in Biological Systems (3) Basic principles of transport and flow systems; structure and role of chemical processes; transport and equilibrium in biological systems. Discussion of Volterra's equation and biological clocks, etc. Prereq: Consent of instructor.

4740 Introduction to Transport Phenomena in Biological Systems (3) Application of principles of transport phenomena to biological systems. Transfer of chemical energy in various cellular active processes; structures and function of cells and tissues; fluid mechanics, membrane and interfacial phenomena; applications. Prereq: Consent of instructor. Prereq: 3440 and 3450 or consent of instructor.

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

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

4781-82-S3 Topics in Chemical Bioengineering (3, 3, 3) Problems of interest in chemical bioengineering. Prereq: Consent of instructor.

4810-20-30 Special Problems in Chemical Engineering (3, 3, 3) Chemical engineering problems related to recent developments in industrial practice. Prereq: Consent of instructor.

GRADUATE

5000 Thesis

5010 Graduate Seminar (1)

5111 Chemical Engineering Analysis (3)

5120 Heat Convection (3)

5130 Methods of Optimization (3)

5210 Process Dynamics (3)

5250 Chemical Process Industry Economics (3)

5310 Thermodynamics of Heterogeneous Equilibria (3)

5320 Statistical Thermodynamics (3)

5410-20-30 Research and Design in Chemical Engineering (3, 3, 3)

5510 Chemical Reactor Design (3)

5610 Stagewise Mass Transfer Operations (3)

5620 Differential Mass Transfer Operations (3)

5810 Mechanics of Viscous Flow (3)

6000 Doctoral Research and Dissertation

6130 Process Optimization (3)

6210 Advanced Diffusional Operations (3)

6250 Venture Analysis in the Process Industries (3)

6310 Thermodynamics of Irreversible Processes (3)

6320 Statistical Thermodynamics of Non-equilibrium Systems (3)

6410 Stability Phenomena in Chemical Engineering: Discrete Systems (3)

6420 Stability Phenomena in Chemical Engineering: Continuous Systems (3)

6510 Applied Chemical Reaction Kinetics (3)

6520 Catalytic Reactor Design (3)

6610 Special Topics in Chemical Engineering (3)

6710 Process Dynamics (3)

Metallurgical Engineering (679)

2110 Engineering Materials (3) Introduction to the atomic, crystal, and microstructure of metals, and mechanical, physical, and chemical properties of engineering significance. 3 hrs or 2hrs and 1 lab.

2210 Electron Microscopy (1) Designed to present to science and engineering students a brief introduction to the function and use of the transmission electron microscope and its applications to scientific problems. Prereq: Physics 2510-20. 3 hr lab. Satisfactory-No Credit.

3010 Industrial Inspection Trips (1) Technology of metallurgical industries, emphasizing Tennessee industry, plant trips. Satisfactory-No Credit.

3110 Engineering Materials I (4) Introduction to the atomic, crystal, and microstructure of metals with mechanical, physical, and chemical properties of engineering significance. 3 hrs and 1 lab.

3120 Engineering Materials II (3) Extension of 2110 with emphasis on control of mechanical properties of materials by specification of composition, thermal, and mechanical treatment; correlation of resultant properties with service performance. Suggested for mechanical, civil, and industrial engineering students.

3130 Engineering Materials III (3) Extension of 2110 with emphasis on control of electrical and magnetic properties of materials by specification of composition, thermal, and mechanical treatment; correlation of resultant properties with service performance. Suggested for electrical engineering students.

3140 Engineering Materials IV (3) Extension of 2110 with emphasis on control of materials processing, specification and evaluation. Suggested for mechanical and industrial engineering students.

3150 Engineering Materials V (3) Extension of 3110 with emphasis on mechanisms and control of reactions of engineering materials with aqueous, non-aqueous, and gaseous environments. Prereq: 3110 or 2110 or Chemet. Engr. 2030.

3160 Engineering Materials VI (3) Extension of 2110 with emphasis on materials of significance in nuclear engineering, nuclear reactor construction materials, nuclear fuel materials, and interaction of radiation with solids to produce changes in engineering properties. Suggested for nuclear and mechanical engineers.

3170 Engineering Materials VII (3) Extension of 2110 to biomedical applications of materials. Engineering materials in biomedical applications; metals, polymers and ceramics; prosthetic devices; dental applications; corrosion problems; failure analysis; fabrication. Prereq: 2110 or equivalent.

Polymer Engineering (805)

4910 Applied Polymer Science (3) First course in physical properties of polymers. Polymer structure, crystalline and glass transitions, physical properties of amorphous and crystalline polymers, crystallization kinetics and mechanical properties are discussed. Prereq: Senior standing in engineering or science.

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

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

4940 Plastics Fabrication Operations (3) Lecture and laboratory course treating unit operations of plastics industry. Types and mechanisms of operation of machinery used and structure and properties of fabricated parts. Operations to include: extrusion, co-extrusion, injection molding including structural foam, thermforming, blow molding, rotational molding, etc. Prereq: Senior standing in engineering or science.

GRADUATE

5000 Thesis

5010 Graduate Seminar (1)

5110 Structural Characterization of Polymers (3)

5210 Non-Newtonian Fluid Mechanics (3)

5230 Mechanical Behavior of Solid Polymers (3)

5310 Polymer Solution Properties and Characterization (3)

5510 Modern Research Tools and Instruments for Polymer Science (3)

5710 Phase Transformations in Polymer Systems (3)

5910-20-30 Selected Topics in Polymer Science (3, 3, 3)

6000 Doctoral Research and Dissertation

6110 Optical Properties of Polymers (3)

6150 Advanced X-Ray Diffraction Methods for Characterization of Macromolecules (3)

6210 Advanced Continuum Mechanics (3)

6220 Advanced Methods in Polymer Processing (3)

6230 Advanced Mechanical Behavior of Polymers (3)

6610 Advanced Industrial Polymer Chemistry (3)

6910-20-30 Recent Advances in Polymer Science and Engineering (3, 3, 3)

Civil Engineering

Including Environmental Engineering


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

3330 Phase Transformations (4) Thermodynamic and structural factors governing binary equilibrium. Ternary systems. Kinetics and morphology of precipitation and phase transformations in simple and complex systems. Prereq: 3220. 3 hrs and 1 lab.

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

3520 Materials Behavior and Chemical Process Equipment Design (3) Mechanical, metallurgical and chemical considerations in design of chemical processing equipment. Prereq: Chem. Engr. 2300 or equivalent; 3150; and Chem. Engr. 3420. (Same as Engineering Mechanics 3520.)

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

4010-20 Thesis (3-6, 3-6) Investigation and report on metallurgical engineering problem.

4230 Project Laboratory (3) Group or individual investigation of problems related to metallurgical engineering or materials science. May be repeated for a maximum of 9 credits. Prereq: Minimum of one course beyond 2110, 3110 or Chemet. Engr. 2030.

4240-50 Design and Analysis (3, 3) Design and laboratory sessions on analysis of materials requirements and performance in engineering structures and components. Prereq: 3120 or 4730.

4510-20 X-Ray Diffraction and Crystallography (3, 3) Lectures and laboratory work in crystallography, x-rays, diffraction phenomena and techniques, introduction to structure determinations. First quarter serves as introduction to subject. Prereq: 3 and 1 lab.

4540 Fracture-Safe Design (3) (Same as Engr. Sci. and Mech 4540.)

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

4710 Production Metallurgy (3) Thermodynamic and kinetic principles of roasting, smelting, refining. Prereq: Chemet. Engr. 3040.

4730 Mechanical Metallurgy I (3) Elastic behavior. Description of stress, strain, and elastic constitutive relations. Effects of composition, microstructure, and loading on mechanical behavior. Failure by yielding, 2 hrs and 1 lab or 3 hrs. Prereq: 2110 or 3110 or Chemet. Engr. 2030. Also suggested for mechanical engineering, engineering mechanics, and engineering science students.

4740 Mechanical Metallurgy II (3) Ductile and brittle fracture, creep and stress rupture, fatigue, and residual stresses. Effects of state of stress, loading rate, time, temperature, and metallurgical structure. 2 hrs and 1 lab or 3 hrs. Prereq: 3120 or 3230, and 4730 or Mech. Engr. 3650 or consent of instructor. Also suggested for mechanical engineering, engineering mechanics, or engineering science students.

4760 Casting and Welding (3) Principles and processes of casting and welding: Heat transfer, solidification, segregation, gas-metal and slag-metal interactions, thermal treatments, as-cast stresses. Prereq: 3120 or 3230. 3 hrs or 2 hrs and 1 lab.

4770 Mechanical Metallurgy III (3) Finite plastic strain. Plastic stress-strain relations. Principles of fabrication: forging, swaging, extrusion, rolling, deep drawing, 2 hrs and 1 lab or 3 hrs. Prereq: 4730 or consent of instructor. Also suggested for mechanical engineering, engineering mechanics, and engineering science majors.

GRADUATE

5000 Thesis

5010 Graduate Seminar (1)

5110 Point Defects and Dislocations (3)

5120 Plastic Deformation I (3)

5130 Plastic Deformation II (3)

5140 Diffusion and Annealing in Solids (3)

5150 Phase Transformations (3)

5170-80 Plastic Deformation (3, 3)

5210-20-30 Welding Metallurgy (3, 3, 3)

5310 Solidification and Crystal Growth I (3)

5410-20 Advanced X-Ray Diffraction (3, 3, 3)

5510-20 Applied Properties of Solids (3, 3)

5540-50 Electron Microscopy I and II (3, 3)

5610-20 Radiation Effects on Materials (3, 3)

5750 Corrosion (3)

5810-20-30 Special Topics in Metallurgy (3, 3, 3)

5840-50 Metallurgy of Deformation and Fracture (3, 3)

5910-20-30 Metallurgical Thermodynamics (3, 3, 3)

6000 Doctoral Research and Dissertation

6110-20-30 Theoretical Metallurgy (3, 3, 3)

6210-20-30 Rate Processes in Metallurgy (3, 3, 3)

6320-30 Solidification and Crystal Growth II and III (3, 3)

6410-20 Thermodynamics of Solids (3, 3)

6810 Mechanical and Physical Properties of Crystals (3)

6820 Mechanical and Physical Properties of Crystals II (3)

6830 Seminar in Anisotropic Properties of Crystals (3)
3310 Physical Properties of Soils (3) Introduction to soils as a construction material, determination of physical properties of soils, factors affecting physical properties of soils, testing of soils, lecture and 1 lab. Prereq: Engl. Math. 3110 and 3310.

3320 Seminar (1) Presentation and discussion of topics related to civil engineering.

3360 Surveying Practice (3) Route surveying procedures. Two three-hour labs. Coreq: 2360.

3600 Transportation Planning (3) Emphasis on transportation problems and perspectives, both rural and urban; use of the planning process to establish existing travel patterns, modeling of demand, proposing alternatives and their evaluation, and plan implementation. Prereq: Junior standing.

3610 Transportation Engineering (3) Introductory course on traffic, maintenance and operation of various transportation modes, their guideways and terminals. Prereq: Junior standing.


4110 Concrete Design (3) Reinforced concrete beams and columns; use of standard specifications. Prereq: 3160 and 3710.

4120 Concrete Design (3) Reinforced concrete elements due to overloading, footings, and retaining walls. Prereq: 4110 and 4410.

4220 Foundations and Substructures (3) Foundation explorations; principles of design of dry and subaqueous foundations. Prereq: 3310.

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

4240 Structural Design (3) Plastic theory, eccentric connections, industrial building design, timber design. Two 3-hr periods. Prereq: 3330 and 4410.

4260 Photogrammetry (3) Methods of plotting maps from aerial photographs; stereoscopic plotting instruments; applications. Prereq: 2360, or Forestry Summer Camp for forestry majors.

4320-30 Seminar (1, 1) Selected topics dealing with historical, modern, and professional aspects of civil engineering. Prereq: Senior standing.

4410 Deflections and Statically Indeterminate Structures (3) Deflections of beams and trusses; analysis of statically indeterminate trusses, beams and frames. Prereq: 3210 and 3160.

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.

4430 Construction Methods and Equipment (3) Fundamental operations in construction and selection of equipment, production rates, balancing of equipment, and cost estimates. Prereq: Senior standing.

4460 Land Surveying (3) Procedures of locating property; evaluating evidence; procedures to describe property, to create land divisions, and to prepare plots; laws of land surveying. Prereq: 2260 or equivalent.

4510-20 Advanced Structural Design (3, 3) Plastic design in steel in 4510; design of typical short span highway bridges in 4520. Prereq: 3320 for 4510; 3230 and 4110 for 4520.

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

4540 Computer Utilization (3) Computer use, economic justification, and extent of use by industry. Utilization of computers for solution of civil engineering problems. Prereq: 3230 or registration therein.

4550 Engineering Behavior of Soils (3) Plastic and elastic behavior of soils, determination and use of engineering properties of in-situ soils. 2 hrs lecture and 1 lab. Prereq: 4560 or consent of instructor.

4560 Stabilization of Soils (3) Mechanical stabilization of soils by compaction, mixing, and blending; chemical stabilization of soils with admixtures; water-proofing and reinforcing soils with additives. 2 hrs lecture and 1 lab. Prereq: 3310.

4600 Highway Engineering I (3) Design, construction, operation and maintenance of highway facilities. Includes integration of system planning and project planning to design and construction procedures. Prereq: 2360, 3600 and 3610.

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

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

4650 Highway Engineering II (3) Integration and application of various engineering principles and techniques to project planning, locating and design of highway facility through comprehensive team project. 1 lecture and 2 labs. Prereq: 4600.

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

4720 Asphalt and Bituminous Concrete (3) Properties and tests of asphalts and asphaltic mixes, mix designs of bituminous concrete. Emphasis on use of asphalt in transportation construction projects. 2 lectures and 1 lab. Prereq: 3710.

4731-32 Earthquake Resistant Structure I, II, (4, 4) (Same as Architecture 4731-32.)

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

4880 Civil Engineering Systems Design and Management (3) Introduction to basic systems engineering concepts; discussion of the role of decision maker and use of optimal principles in engineering planning. Prereq: Computer Science 3150.

4910-20 Special Topics (3, 3) Problems relating to recent developments and current practice in civil engineering. Prereq: Consent of Instructor.
5250 Advanced Properties of Materials: Bituminous Substances and Mixtures (3)
5270 Planning and Transportation (3)
5310 Engineering Practice (3)
5330-30 Engineering Practice Applied to Administration of Engineering Projects (3, 3)
5420 Structural Model Analysis (3)
5550 Soil Mechanics-Plastic Equilibrium (3)
5560 Soil Mechanics-Elastic Behavior (3)
5570 Soil Mechanics-Seeage (3)
5610 Behavior of Steel Structures (3)
5730 Prestressed Concrete (3)
5740 Behavior of Reinforced Concrete Members (3)
5800 Urban Systems: Engineering and Management (3)
5810 Traffic Engineering—Characteristics (3)
5820 Traffic Engineering—Operations (3)
5840 Geometric Design (3)
5850 Functional Design of City Streets and Urban Freeways (3)
5860 Urban Transportation Planning (3)
5870 Public Transit Planning (3)
5890 Traffic Accident Reconstruction (3)
5900 Special Problems in Civil Engineering (1-9)
5910-20-30 Special Topics (3, 3, 3)
6000 Doctoral Research and Dissertation
6610 Behavior of Steel Bridges and Buildings (3)
6740 Behavior of Reinforced Concrete Beams and Frames (3)
6750 Behavior of Reinforced Concrete Slabs (3)
6830 Traffic Flow Theory (3)
6860 Statewide Passenger Transportation Planning (3)
6870 Future Transit Technology and Research (3)
6880 Planning Models for Transportation Systems I (3)
6890 Planning Models for Transportation Systems II (3)
6910-20-30 Special Topics in Civil Engineering (3, 3, 3)

Environmental Engineering (344)

3000 Introduction to Environmental Engineering (3) Introduction to man's interaction with the air, water, and land environment in which he lives; role of engineering in environmental control. Prereq. Junior standing.
3120 Hydraulics (3) Application of basic and developed principles of hydraulics. Flow measurement; flow in closed conduits; uniform and nonuniform flow; open channel flow; pumps and turbines; basic hydrodynamics; flow similitude and models. 2 lectures and one 3-hour lab. Prereq. Engr. Mech. 3110.
4150 Urban Water Management (3) Introduction to urban water modeling; evaluation of optimum urban water policies; formulation of system constraints and analysis of decision-making process; management of storm water for beneficial use. Prereq. 3000 and 3330.
4210 Water Resources Engineering Design (3) Elements of water resources structures and systems, including reservoirs, dams, control works, and open channel design. Dam safety control, environmental impact of reservoir projects. Prereq. 3330 or permission of instructor.
4220 Water Resources Engineering Development (3) Multi-objective 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.
4330 Hydrologic Design (3) Application of frequency and regression analysis to hydrologic design of water resources systems; unsteady surface runoff and streamflow modeling; urban peak runoff design using kinematic wave theory; evaluation of effects of land use changes on stream flow quantity and quality. Prereq. 3330.
4510 Elements of Water and Wastewater Transport Systems (3) Introduction to theory and design of water transportation and distribution systems and wastewater collection systems. Prereq. 3000, 3120 and 3330.
4520 Elements of Water and Wastewater Treatment Systems Design (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.
4530 Sanitary Engineering Laboratory (3) Physical, chemical, and bacteriological analysis of water and wastewater. Prereq. 4030. 3 labs.
4600 Solid Waste Management (3) Quantities and characteristics of solid wastes; collection methods and equipment; disposal and recycle techniques; economics; planning and management. Prereq. 3000.
4700 Air Pollution-Air Resource Management (3) Introductory course on concepts of air pollution; analysis of kinetic and thermodynamic emission sources, meteorology and topographic factors, and adverse effects on receptors; engineering approaches for air pollution control. Prereq. Senior standing.
4810 Water Law (3) (Same as Law 8975 and Water Resources Development 4810.)
4820 Environmental Engineering Law (3) Legal aspects of water and air pollution, drainage, land use controls and environmental impact statements with emphasis upon federal-state relations, recent legislation and court decisions, and enforcement. Prereq. Senior standing.
4910-20-30 Special Topics in Environmental Engineering (3, 3, 3) Topics related to recent developments and current practice in environmental engineering. Prereq. Consent of instructor.

GRADUATE
5000 Thesis
5002 Non-Thesis Graduation Completion (3)
5150 Water and Urban Welfare (3)
5160 Planning and Utilities (3)
5200 Water Resources Systems (3)
5210 Advanced Water Resources Engineering (3)
5230 Surface Water Transport Processes (3)
5232 Sediment Transportation (3)
5240 Flood Control Hydraulics (3)
5261 Basic Principles of Remote Sensing (3)
5262 Remote Sensing Data Acquisition (3)
5263 Remote Sensing Data Analysis and Interpretation (3)
5301 Stormwater Modeling I (3)
5302 Stormwater Modeling II (3)
5310 Groundwater Transport Processes (3)
5330 Descriptive Hydrology (3)
5501 Water and Wastewater Treatment Theory I (3)
5502 Water and Wastewater Treatment Theory II (3)
5513 Advanced Water and Waste Treatment Systems (3)
5530 Environmental Engineering and Natural System Behavior (3)
5551 Water Quality Management (3)
5561 Aquatic Environment Pollution (3)
5582 Microbiology for Sanitary Engineers (3)
5593 Advanced Sanitary Engineering Laboratory (3)
5600 Solid Wastes (3)
5610 Solid Waste Disposal (3)
5620 Solid Waste Collection Systems (3)
5700 Planning and Air Pollution Control (3)
5710 Air Pollution Control Engineering (3)
5720 Air Pollution Particle Collection Theory (3)
5730 Air Pollution Control Device Design (3)
5740 Dynamical and Physical Meteorology (3)
5750 Turbulence in the Atmosphere (3)
5760 Diffusion in the Atmosphere (3)
5900 Special Problems in Environmental Engineering (1-9)
5910-20-30 Special Topics (3, 3, 3)
5990 Environmental Engineering Seminar (1)
6110-20 Advanced Topics in Fluid Mechanics and Convective Transport (3, 3)
6230 Kinematic Wave Theory (3)
6500 Industrial Waste Treatability and Process Control (6)
6820 Advanced Theory and Applications in Water Resources Energy Systems I (3)
6910-20-30 Special Topics in Environmental Engineering (3, 3, 3)

Electrical Engineering (320)

Professors:

Associate Professors:
A.O. Bishop, Jr., Ph.D. Ciensson; R.C. Gonzalez, Ph.D. Florida; E.L. Hall, Ph.D. Mississippi; H.M. Long, Ph.D. Oxford (England); H.P. Nett, Ph.D. Auburn; P.E.; M.O. Pace, Ph.D. Georgia Institute of Technology; D. Rosenberg, Ph.D. England; E. Sc. New York; F.W. Symonds, Ph.D. Nottingham (England).
UNIVERSITY OF WASHINGTON

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

Graduate work leading to the Master of Science degree may be continued during one academic year of full-time study or the degree may be completed in two or three years of study in the evening.

Graduate assistantships and scholarships are available for outstanding students. Graduate assistants may obtain the Master's degree in one calendar year.

Course work leading to the degree of Master of Science in Electrical Engineering is offered in the evening. Each course meets for two and a half hours each week.

THE DOCTORAL PROGRAM

Graduate work leading to the degree of Doctor of Philosophy with a major in electrical engineering is offered. The department also participates in the engineering science doctoral program.

Network theorems. Coreq: Math 2610. 3 hrs including biweekly lab.
2030 Circuits III (3) Polyphase networks considered as networks with more than one source. Magnetically coupled circuits. Transient analysis of circuits containing magnetic elements with single and multiple source elements using classical methods. Steady-state analysis of networks containing sinusoidal sources of more than one frequency. Prereq: 2020, Math 2850 concurrently. 3 hrs including biweekly lab.
3010 Transient Analysis (3) Analysis of transient response of networks and systems; Laplace transform method and classical differential equation methods for system analysis; complex frequency concept and pole-zero concepts; application to engineering problems. Prereq: 2030.
3050 Basic Field Theory (3) Forces between charged particles, electromagnetic laws, Gaussian and divergence, potential and line integrals, materials, bodies, polarization, magnetic circuits, Maxwell's equations for potentials. Prereq: Math 2860.
3060 Propagation I (3) Plane waves, reflection, guided waves, transmission line, standing waves, impedance, impedance matching, graphical methods, transmission line guides. Prereq: 3050. 3 hrs including biweekly lab.
3080 Energy Conversion (3) Magnetic circuits, transformer theory and operation, principles of electromagnetic energy conversion with emphasis on input-output characteristics; steady-state analysis of induction motors and d. c. machinery. Prereq: 3060. Includes a biweekly lab.
3090 Energy System Operation (3) Synchronous machines, transmission lines, and transformers as power system elements; power system representation, per unit calculation, symmetrical components, and fault studies. Prereq: 3080. Includes a biweekly lab.
3110 Basic Electrical Engineering-Circuits and Fields (3) For nonelectrical engineering majors. Prereq: Math 2850, Physics 2310-20. 3 hrs including biweekly lab.
3120 Basic Electrical Engineering-Electronics (3) For nonelectrical engineering majors. Prereq: 3110. 3 hrs including biweekly lab.
3130 Basic Electrical Engineering-Machinery (3) For nonelectrical engineering majors. Prereq: 3110. 3 hrs including biweekly lab.
3135 Basic Electrical Engineering-Circuits-Instrumentation (3) For non-electrical engineering majors. Use of operational amplifiers for signal processing, logic gates, analog and digital applications, signal conditioning, input-output devices, relays, recorders, oscilloscopes; automated data collection; safety and grounding requirements. 2 labs. Prereq: 3120.
3180 Logic Design of Digital Systems (3) Introduction to boolean algebra and design of combinatorial circuits. Presents gate and flipflop characteristics. Design of combinational and sequential circuits and other systems containing memory. Introduction to microcomputer architecture and system components to include basic arithmetic and function of Arithmetic, Storage, Input/Output, and Control Systems. Instruction set capabilities and machine language programming. Prereq: 3010, Computer Science 3150. 3 hrs including biweekly lab.
3190 Plasma I (3) Engineering applications of physical electronics, plasma effects and devices. Topics include: plasma, plasma devices, and plasma light sources, laser operation and applications (electro-optics), and MHD, controlled thermo-nuclear and other theories of advanced power production. 3 hrs biweekly lab. Prereq: Physics 2310-20.
3720 Linear Systems Analysis (3) Steady-state and transient analysis, frequency, gain-phase, and polar plots; block diagrams, Nyquist flow graphs; analogous systems; properties of second order systems; introduction to feedback theory, stability criteria. Prereq: MATH 310, MATHEMATICS 3150. Coreq: 3180. 3 hrs including occasional labs.
3810 Electronics I—Basic Electronic Processes (3) Current conduction in semiconductors and high vacuum; theory of p-n junctions, characteristics of diodes; rectifiers and diode switches. Prereq: 3040 concurrently. 3 hrs including biweekly lab.
3820 Electronics II—Basic Electronic Devices (3) Characteristics and equivalent circuits of vacuum tubes and transistors with application to amplifier and control circuits. Prereq: 3810. 3 hrs including biweekly lab.
3830 Electronics III—Basic Electronic Amplifiers (3) Vacuum tube and transistor R-C coupling, amplifiers, tuned amplifiers; basic power amplifiers; bias stabilization, feedback. Prereq: 3820 Coreq: 3830. 3 hrs including biweekly lab.
4020 Direct Electrical Energy Conversion (3) Basic principles, typical devices and applications for production of electrical energy by thermoelectric effects, thermionic conversion, magnetohydrodynamics, solar cells, and fuel cells. Laboratory demonstrations. Prereq: 3050, 3190 and 3810.
4080 Microwave Circuits and Electronics (3) Circuits represented by wave scattering, isolators, gyrometers, couplers, microwave vacuum diodes and klystrons, crossed field devices, parametric amplifiers, power generator semiconductors, varactor semiconductors. Prereq: 3060. 3 hrs including biweekly lab.
4090 Propagation II (3) Metal tube, dielectric rod, and stripline waveguides. Waveguide resonators and other loading components. Design of structures utilized for microwave power transmission and microwave integrated circuits. Prereq: 3060. 4 labs.
4200 Electromagnetic Field Transients (3) Pulse propagation on lines, reflection of pulses, time domain reflectometry, radiation of pulses from antennas. Prereq: 3060, including biweekly lab.
4730 Introduction to Feedback System Design (3) Mathematical formulation of control systems; steady-state error, root-locus methods; optimum gain adjustment; compensation networks; introduction to compensation. Prereq: 3190.
4410 Power System Components and Control (3) Analysis of power system components and their interconnection. Studies in control of power and frequency as well as voltage and reactive power. Prereq: 3090.
4420 Power Systems Analysis (3) System studies including load flow, faults, and stability. Prereq: 3090.

4430 Transmission, Distribution, and Protection (3) Studies in underground and d.c. transmission; consideration of over-voltage and insulation coordination; system protection against faults. Prereq: 3090.


4470 Plasma II (3) Magnetohydrodynamics. Prereq: 3190.

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


4500 Electro-Optic Detection and Instrumentation (3) Sensitivity, resolution (frequency response) and noise considerations. Analysis and design of optical and optical recording data for both spatial and recording media (e.g. photographic emulsions) and temporal detectors (e.g. photodiode detectors). Last third of the course will be devoted to selected electro-optic instrumentation systems (e.g. laser light scattering, optical data processing, holographic interferometry). Prereq: 3190.


4600 Instrumentation Transducers and Signal-Conditioning Electronics (3) Study of various sensors and transducers utilized for parameter measurement. Use of operational amplifier in signal-conditioning; design examples such as active filters, amplifiers, attenuators, and function generators. Analysis of interfacing problems between transducer and signal-conditioner. Applications to environmental monitoring instrumentation. Prereq: 3120 or 3830.

4610 Analog-Digital Systems (3) Principles of analog to digital conversion. Applied to analog computing to include problem set-up and scaling. Characteristics of analog multipliers, dividers and frequency multipliers are developed. Present comparators, digital to analog conversion, and analog to digital conversion techniques. Prereq: 3180 and 3830. 3 hours including biweekly lab.


4650 Digital System Organization and Design (3) Considers system organization of digital systems including minicomputer and microprocessor architecture and comparison. Characteristics of ALU and CPU structures, storage systems (RAM, ROM, and PROM building blocks), and Input/Output systems are developed. Control Unit organization to include serial - parallel mode of operation, synchronous - asynchronous sequencing and microprogramming of control functions. Prereq: 3180. 3 hours including biweekly lab.

4660 Bioelectric Instrumentation (3) Nature and origin of bioelectric potentials, transducer amplifier requirements, recording systems and noise problems. Prereq: Senior standing.

4680 Electronic Power Amplifiers (3) Transistor and vacuum-tube power amplifiers; distortion, thermal considerations; rf. power amplifiers; regulators. Prereq: 3830. 3 hrs including biweekly lab.

4690 Communications Electronics (3) Oscillators, modulation, demodulation; basic communication systems. Prereq: 3830. 3 hrs including biweekly lab.

4700 Switching Circuits (3) Pulse amplification, gating circuits, multivibrators, wave shaping circuits, trigger circuits. Prereq: 3010, 3830. 3 hrs including biweekly lab.

4740 Integrated Circuits (3) Processing and fabrication of active and passive components for monolithic and hybrid circuits. Design of linear and digital and large scale integration. Prereq: 3830.


4800 Hardware-Software Interface in Minicomputer and Microprocessor System Design (3) Presents minicomputer and microprocessor interface design. Hardware-software interaction and trade-off. Priority interrupt systems are discussed and utilized. Telecommunications interface systems are developed. Project oriented, contract course. Completion of two projects, one utilizing a microcomputer and the other a minicomputer. Prereq: 3180.

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

4820 Introduction to Pattern Recognition (3) Role of pattern recognition within framework of artificial intelligence. Topics dealing with the design of learning and adaptive machines. Typical applications of pattern recognition to problems of practical significance. Computer simulation of elementary pattern recognition problems. Prereq: Either 3100 and Computer Science 3150, or Statistics 3450 and Computer Science 1510. (Same as Computer Science 4825.)

4830 Digital Image Processing (3) Principal methods of coding, storing, and processing images by means of digital computer. Computational algorithms for image operations. Prereq: 3100 and Computer Science 3150, or Statistics 3450 and Computer Science 1510. (Same as Computer Science 4830.)

4850 Small Computer Systems (3) Basic structure of small computer systems, input-output techniques, interrupt structures, peripheral devices, system software and assembly language programming. Course is project oriented. Prereq: Basic Engineering 1410, Computer Science 1510 or 3150 or permission of instructor. (Same as Computer Science 4850.)

4910-29-39 Special Electrical Engineering Problems (3, 3, 3) Problems in electrical engineering involving library and experimental research.

GRADUATE

5000 Thesis

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

5070-80 Modern Transform Methods (3, 3)

5110 Introduction to Network Analysis (3)

5120 Introduction to Network Synthesis (3)

5130 Advanced Network Analysis (3)

5170 Bioengineering Systems I: Models, Systems Analysis and Simulation (3)

5180 Bioengineering Systems II: Bioelectric Phenomena (3)

5190 Bioengineering Systems III: Instrumentation and Analysis (3)

5210-20 Advanced Electrical Machinery (3, 3)

5230 Advanced Electrical Machinery Applications (3)

5240-50-60 Control Systems (3, 3, 3)

5310 Basic Requirements for Plasma Fusion (3)

5320 Diagnostics for Fusion (3)

5330 Engineering of Fusion (3)

5340 Introduction to Quantum Electronics (3)

5350 Properties of Quantum Devices (3)

5360 Application of Quantum Electronic Devices (3)

5370 Advanced Direct Electrical Energy Conversion I (3)

5380 Advanced Direct Electrical Energy Conversion II (3)

5390 Advanced Direct Electrical Energy Conversion III (3)

5410 Power System Networks (3)

5420 Fault and Load Flow Studies (3)

5430 Power System Stability and Control (3)

5440 Distribution Systems (3)

5460 Selected Topics In Power Systems (3)

5510-20-30 Linear Active Circuits (3, 3, 3)

5570-80-90 Electronic Switching Circuits (3, 3, 3)

5610-20 Logic Design and Finite Automata Theory (3, 3)

5615-25 Introduction to Switching Theory and Logic Design (3, 3)

5630 Digital System Architecture (3)

5635 Introduction to Digital Computer and Analog Systems (3)

5650-60 Electronic Communication Systems (3, 3)

5670-80 Pattern Recognition (3, 3)

5690 Introduction to Artificial Intelligence (3)

5710 Random Process Theory for Engineers (3)

5720-30 Prediction, Filtering and Detection Theory (3, 3)

5740 Digital Processing of Signals (3)

5750-60 Radar Systems Analysis (3, 3)

5770 System Identification (3)

5800 Power Transmission Lines (3)

5810-20 Electromagnetic Fields (3, 3)

5830 Linear Antennas and Antenna Arrays (3)

5840 Aperture Antennas (3)

5850 Microwave Electronics (3)

5860 Electromagnetic Wave Propagation (3)

5870 Introductory Microwave Networks (3)

5940-50 Advanced Small Computer Systems (3, 3)

6000 Doctoral Research and Dissertation

6240 Advanced Systems Theory (3)

6250 Stochastic Processes in Engineering Systems (3)

6260 Modern Control System Design (3)

6270-80-90 Special Topics in Control Systems Theory (3, 3, 3)
Engineers need a strong background in engineering science, mathematics, and physical (or biological) science. Such a program should prepare students for a career in engineering development and research, professional education at the M.S. level, or additional graduate study leading to the master's or the doctoral degree. The curriculum will provide students with the broad engineering education which permits a strong emphasis on engineering principles and basic science.

In the first two years students in the engineering science program study engineering science, mathematics, and physical science. The engineering science program in the upper division years is essentially an elective curriculum in which the special interests of students can be met which cannot be accommodated in the introductory programs. Examples of special interest elective groups presently available in the engineering science program are biomedical engineering, engineering mechanics, engineering analysis and synthesis, environmental sciences, and engineering materials. Other elective groups are currently being developed and will be available in the future.

The biomedical engineering elective group provides the basic background for an engineer to contribute to the fields of biology and medicine in such technical areas as the design of research and diagnostic equipment, the design of artificial organs, and the application of the principles of engineering sciences to the biological systems. With some modifications, the program can emphasize other areas such as the design of computer systems to automate hospital operations, to analyze medical data, and to contribute to the broad area of health care delivery systems. Interested and qualified students may choose to use this program as a background for graduate study in engineering or in medicine. The program includes the courses required for entrance into most medical schools, including The University of Tennessee Center for the Health Sciences in Memphis.

The engineering mechanics elective group focuses on analytical and experimental methods used in investigating the interaction of forces and matter. It is designed especially to develop engineers capable of engaging in research and development in industrial and governmental research laboratories. Because such preparation involves emphasis on the principles of both the sciences and the engineering sciences, the engineering mechanics elective group provides a good theoretical background for students wishing to pursue graduate engineering study.

The engineering analysis and synthesis elective group focuses on the application of such mathematical techniques as numerical analysis and simulation for the solution of practical engineering problems. As such, heavy emphasis is placed on the use of digital computers.

The environmental sciences elective group introduces the student to some of the areas of knowledge and to some of the basic skills involved in solving environmental and ecological problems. This program gives the necessary background in both stress/structural analysis and higher level of competence in this specialty during professional practice or through formal graduate study.

The engineering materials elective group provides background in the use of materials in the solution of engineering problems. This includes the selection of the proper materials to support the anticipated loads and consideration of the environmental conditions that are expected to exist during the design life of the material. There is a special need in industry for individuals with background in both stress/structural analysis and material properties. The engineering materials elective group provides the student an opportunity to acquire this background.

The basic engineering sciences curriculum provides an opportunity to study significant blocks of the engineering science areas recognized in the Committee on Society for Engineering Education such as (1) mechanics, (2) electrical science, electric and magnetic fields, circuits, and electronics; (3) thermodynamics and statistical mechanics; (4) materials science; (5) information science; (6) transfer and rate processes such as heat, mass, and momentum transfer. Other engineering fields which may be studied in the engineering science option are the space sciences and the environmental sciences. It is not expected that students will study all the engineering sciences but will structure a course plan to provide depth in some of the engineering sciences.

At the time of this publication, students in the engineering science program are required to develop a course plan to provide depth in some of the engineering sciences. Because of the large number of elective courses to be selected in the engineering science degree program, faculty advising plays an essential role in the process of development of the student's course of study. Before the end of the sophomore year students in the engineering science program are required to develop, in concert with a faculty advisor, a statement of objectives and a course plan for the upper division years. This course plan must be filed with the Office of Admissions and Records before the student's senior standing sheet can be prepared.

MASTER OF SCIENCE AND DOCTORAL PROGRAMS

Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in engineering science are available to graduate students in recognized curricula in engineering, mathematics, or one of the physical or biological sciences. Program options include solid mechanics, fluid mechanics, biomedical engineering, and other engineering sciences.

In the biomedical and engineering science option, interdisciplinary programs are arranged to meet individual needs and interests. Each applicant is advised as to any prerequisite courses before entering a program; the student's program of study must be approved by his or her advisory committee, and must comply with the requirements of the Graduate School. The student's major professor may be selected from a department other than the Department of Engineering Science and Mechanics.

The flexibility and interdisciplinary aspects of the program options are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering, or can best be met by interdisciplinary study in engineering. The department's course offerings and research activities are also intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mathematics, or in related interdisciplinary studies such as biomechanics.

General policies of the Graduate School relating to admission, residence, examinations, and degrees are described in the Graduate School Catalog.

Engineering Science and Mechanics (335)

2705 Elementary Statics and Dynamics (3) Resolution and composition of the systems of forces; moments; resultant forces of force systems; free body diagrams and co-planar equilibrium; friction; particle dynamics (primarily for transfer students). Prereq: College Physics (Mechanics). Coreq Math 1830 or equivalent.

2710 Statics (3) Resultants of space force systems.
static equilibriurn of structural elements and space frames; belt friction; first and second moments. Prereq: 2705 or Basic Engineering 1310, Math 1830.

2720 Dynamics (3) Absolute and relative kinematics of rigid bodies; kinetics of rigid bodies using Newton's laws of motion and impulse-momentum. Prereq: 2705 or Basic Engineering 1303, Math 2100.

3110-20-30 Fluid Mechanics (3, 3, 3) Basic laws of fluid mechanics; control volumes; irreversibility; empirical analysis; Navier-Stokes equations; boundary-layer concepts; potential flow. Must be taken in sequence. Prereq: 2720 and Math 2101. Coreq for 3120: Mech. Engr. 3311 or equivalent.


3311 Mechanics of Materials (4) Concepts of stress and strain; stress-strain relations and Mohr's circle; static analysis of members; moment of inertia; stress analysis by application of computer programs. Prereq: Basic Engineering 1330, Math 2101; Coreq: Math 2580 or equivalent.

3410 Introduction to Biomedical Engineering (4) Designed to introduce the fundamental concepts of engineering design and the use of materials, methods, and processes in the development of medical devices and systems. Coreq: Math 2580 or equivalent.

3420 Introduction to Clinical Engineering (3) Describes the role of medical and biological engineers in the design and application of medical devices and systems. Prereq: Basic Engineering 1330, Coreq: Math 2580 or equivalent.


3520 Materials Behavior and Chemical Process Equipment 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; Coreq: Math 2850.

3710 Intermediate Dynamics (3) Three-dimensional dynamics of particles and rigid bodies; dynamics of bodies with varying mass and central forces; Lagrange's equations. Prereq: 2720. Math 2820.

4010 Project in Design and Development (4) Investigation, design, and report of an engineering science project. Prereq: Senior standing.

4011 Project in Design and Development (1) Investigation, design, and report of an engineering science project. Prereq: Senior standing.

4240 Engineering Aspects of Infection Control (3) Biomedical engineer's role in infection control will be studied in hospital and clinical activities. Fluid and flow phenomena, pressure measurement methods, and basic bacteriological and mycological tests will be demonstrated. Course identifies new and critical role for biomedical engineering in infection control, and includes analysis of hospital facilities and monitoring systems. Prereq: 3410, or consent of instructor.

4300 Orthopaedic Biomechanics (3) Introduction to orthopaedic biomechanics and rehabilitation. Topics include statics, Newton's laws of motion, stresses in simple sections, engineering materials, and biological materials. Prereq: Consent of instructor.

4500 Applied Mechanics for Life Scientists (4) Concise and broad coverage of basic principles and concepts of mechanics. Fundamental concepts, statics, vibrations, continuum mechanics and properties of materials. Applications in engineering and medicine. Prereq: Math 1820-30 or consent of instructor.

4520 Biomedical Fluid Mechanics (3) Discusses the role of fluid mechanics in the development of biomedical fluid mechanics. Prerequisites: Basic Engineering 1330, Math 2101. Coreq: Basic Engineering 1303, Coreq: Math 2580 or equivalent.

4525 Biomedical Fluid Mechanics Laboratory (2) Measurement and recording of flow characteristics in biological systems. Project and/or term paper required. Coreq: Math 2580 or equivalent.

4530 Biomechanics (3) Discusses the role of fluid mechanics in the development of biomedical fluid mechanics. Prerequisites: Basic Engineering 1330, Math 2101. Coreq: Basic Engineering 1303, Coreq: Math 2580 or equivalent.

4540 Fracture-Safe Design (3) A critical review of the mechanical properties of materials that are indicative of fracture resistance, including fracture toughness, fracture mechanics, and fatigue. Prereq: Consent of instructor.

4550 Fracture-Safe Design (3) A critical review of the mechanical properties of materials that are indicative of fracture resistance, including fracture toughness, fracture mechanics, and fatigue. Prereq: Consent of instructor.

4570 Stress Analysis (3) Advanced techniques in the analysis of stress and strain in structures. Prereq: Math 2580 or equivalent.

4580 Principles of Nondestructive Testing (3) Basic concepts in photoelasticity, photoelastic coating method, Moiré method, interferometry, and holography. Prereq: 3310, Physics 2320 or equivalent.

4610 Experimental Stress Analysis (3) Basic concepts: theory, techniques, and instrumentation of stress analysis. Prereq: 3310 or 3110, 3 hrs and 4-3 hr lab.

4620 Dynamic Data Acquisition (4) Instrumentation and techniques for measuring and analyzing dynamic data. Prereq: 3310, EE 2300 or 3110, 2.5 hrs and 1.5-hr lab.

4630 Advanced Thermodynamics (3) Advanced topics in thermodynamics, including the analysis of engines and mechanical systems. Prereq: 3310, Elect. Engr. 3120 or equivalent.

4650 Introductory Photomechanics (3) Introduction to photoelasticity, photoelastic coating method, Moiré method, interferometry, and holography. Prereq: 3310, Physics 2320 or equivalent.


4780 Engineering Acoustics (3) Concepts of acoustics and the design of loudspeakers and microphones; psychoacoustics; noise generation and transmission. Prereq: 2720, Math 2830.


4850 Elementary Structural Matrix Methods (4) (Same as Architecture 4850 and Civil Engineering 4850).
2310 Seminar (1) Introduction to the industrial engineering profession, its history and current trends. Plant trips and lectures by the faculty. Prereq: senior standing.


3210 Motion and Time Study (3) Design of work methods, including analysis, improvement, timing of work. Experimental methods. Laboratory work included. Prereq: Non-industrial engineering students. Prereq: Junior standing.

3220 Work Methods and Design (3) Job analysis, job evaluation, design of wage structures, design of work-place layouts, flow charting, and accounting of data. Analysis and methods improvement. Laboratory work included. Prereq: 2310.

3230 Work Measurement (3) Use of work measurement tools such as time study, predetermined time systems, work sampling, historical data analysis. Construction of time formulas, determination of standard time data, use of learning curves, and design of wage incentive systems. Laboratory work included. Prereq: 3220 and Statistics 3400.

3410 Textile Industry Systems (3) History, basic operations, products and economics of the industry; the application of industrial engineering techniques. Prereq: 2310 and consent of instructor.


3440 Quality Control (3) Application of statistical methods to control quality of manufactured parts and techniques of inspection. Prereq: 3430.

3510 Introduction to Operations Research I (3) Introduction to methodology of operations research and its application to industrial problems. Topics covered include statistical analysis, decision theory, and queuing theory. Prereq: 3430 and Computer Science 3150.

3520 Introduction to Operations Research II (3) Network optimization problems, including transportation and distribution theory. Prereq: 3510.

3530 Introduction to Operations Research III (3) Introduction to random processes and use of probabilistic concepts in economic and industrial analysis. Prereq: 3430 and 3510.


4060 Production and Inventory Systems (3) Fundamentals and applications of statistical forecasting, production planning, inventory analysis and control techniques, production planning procedures, economic order quantity, and production scheduling and control models. Overall production process as an integrated system. Prereq: 3510 and 3520.

4080 Forecasting Methods in Industrial Engineering (3) Application of linear, forecasting techniques to industrial engineering problems. Includes moving averages and exponential smoothing, linear and polynomial regression models, autocorrelated time-series analysis, Delphi methods and other selected industrial forecasting methods. Prereq: 3510.

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


4200 Production Facilities Planning (3) Facilities planning including plant layout, materials handling and service area design. Prereq: 4500, 3230, 3510.

4230 Scheduling Systems (3) Performance measures for job shop and flow shop scheduling, including both static and dynamic conditions, as well as techniques for use in the development of production schedules. Deterministic and probabilistic dispatching conditions. Prereq: 3520.

4240 Predetermined Time Systems (3) Work design and measurement using a predetermined time system such as Methods Time Measurement, Basic Motion Time-Study, or Work Factor. Theory and application. Prereq: 3230.

4250 Work Measurement Applications (3) Application of measurement theory, standard data methods and incentive systems to the design of industrial work situations. Prereq: 3230.

4310 Seminar (1) Discussions, lectures, and trips to study advanced topics in industrial engineering. Prereq: Senior standing in industrial engineering.

4520 Engineering Economy (3) Methods and problems in selection or replacement of equipment. Decision making in engineering alternatives, involving capital recovery, economic life of equipment, and rate of return on investment.

4530 Case Studies in Engineering Economy (3) Extension of basic engineering economy principles to actual problems faced by competitive firms and regulated industries. Case studies taken from literature or form basis of classroom discussion. Out-of-class assignment which involves working with local companies to evaluate make or buy options, lease versus purchase contracts, equipment replacement studies, energy source economics, etc. Prereq: 4520.

4540 Industrial Development (3) Factors other than mechanical or chemical which enter into successful establishment of manufacturing enterprises. Cost and location studies and market analysis to determine the commercial feasibility of new plants or projects.


4800 Human Factors in Work Design I (3) Human capabilities and limitations which must be reflected in work place layout, working environment specifications; tool, equipment and vehicle design; and in design of industrial communication-control systems. Prereq: Junior standing in College of Engineering or permission of instructor.

4810 Human Factors in Work Design II (3) Human capabilities and limitations affecting work place layouts, working environment, design of tools and equipment, and control response in man-machine systems. Prereq: 3430 and Computer Science 3150.

4830 Health Systems Engineering (3) Hospital management systems and means by which they may be improved through applications of modern industrial engineering principles and techniques.

4840 Industrial Plant Problems Analysis (3) Industrial problem analysis; application of industrial field engineering, field assignment in local industry, problem definition, analysis and presentation. Prereq: 3230, 3440, 3510, 4520, 4520, 4840.

4860 Industrial Systems Analysis (3) Matrices and linear vector spaces for industrial systems work. Laplace and Z transform techniques and applications. General system description and model-
ing. Applications to industrial processes and systems.
Prereq: 3510, 3520, Math 2860 and 4050.

4910-20-30 Special Industrial Engineering Topics (3, 3, 3) May be repeated for credit. Prereq: Permission of instructor.

4950 Industrial Safety (3) Development of organization and programs for prevention and control of accidents with emphasis on OSHA Rules and Regulations. Prereq: Senior standing.

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5110 Work Design (3)

5210 Advanced Work Measurement (3)

5240 Facilities Planning and Design (3)

5250 Advanced Scheduling (3)

5260 Information Systems Design (3)

5340 Applied Decision Theory (3)

5360 Statistical Methods in Industrial Engineering (3)

5360 Seminar (3)

5420 Reliability Engineering (3)

5520 Advanced Engineering Economy (3)

5600 Human Factors Engineering (3)

5610 Human Factors Engineering (3)

5700 Optimization Methods in Industrial Engineering (3)

5710 Linear, Quadratic and Dynamic Programming (3)

5720 Queuing Models, Inventory, and Simulation (3)

5730 Game Theory and Random Processes (3)

5810 Theory of Industrial Automatic Control (3)

5820 Health Systems Engineering II (3)

5840 Air Traffic Control Systems (3)

5850 Dynamic System Simulation (3)

5860 Industrial Systems Engineering (3)

5900 Design Project (1-9)

5910-20-30 Special Topics in Industrial Engineering (3, 3, 3)

6400 Probabilistic Methods in Engineering Systems (3)

6520 Operations Research Models in Engineering Economy Decisions (3)

6700 Nonlinear Programming (3)

6730 Dynamic Programming (3)

6740 Advanced Topics in Optimization and Dynamic Systems (3)

6910 Advanced Topics in Industrial Engineering (3)

Mechanical and Aerospace Engineering

Professors:
M.W. Milling (Head), Ph.D. Tennessee, P.E.;
J.F. Bailey, Ph.D. Leigh, P.E., G.W. Braun* (Emeritus), Ph.D. Georgia Institute of Technology; J.W. Hodges, P.E., Ph.D. Georgia Institute of Technology, P.E.;
R.W. Holland, M.S. Tennessee, P.E.;
H. Liston, Jr. (Associate Vice Chancellor for Academic Affairs), M.E.A. George Washington;
E. Lumdsaine, Ph.D. New Mexico State;
R.C. Matthews (Emeritus), B.S. Illinois;
R.L. Maxwell, M.S. Case, P.E.;
M.K. Newman (Emeritus), Ph.D. Columbia, P.E.;
F. Shahrokh*, Ph.D. Oklahoma;
F.H. Speckhart, Ph.D. Georgia Institute of Technology, P.E.;
W.K. Stair, M.S. Tennessee;
W.W. Thomas, Jr. (Emeritus), B.S. Tennessee, P.E.;
J. Wu*, Ph.D. Georgia Institute of Technology;
Y.L. Wu*, Ph.D. California Institute of Technology;
R.L. Young*, Ph.D. Northwestern, P.E.

Associate Professors:
S.E. Becker, Ph.D. North Carolina State, P.E.;
C.W. Brown, M.S. Tennessee, P.E.;
S.N. Chauduri*, Ph.D. Indian Institute of Science;
F.G. Collins, Ph.D. Berkeley, P.E.;
P.W. Cogling, Ph.D. Georgia Institute of Technology, P.E.;
W.S. Johnson, Ph.D. Clemson, P.E.;
R.J. Kranie, Ph.D. Oklahoma;
J.R. Maas, Jr., Ph.D. North Carolina State;
W.S. Norman, Ph.D. Purdue*, Y. Pant*,
Ph.D. Brown, J.W. White, Ph.D. Stanford;
H.J. Wilkerson, Ph.D. Tennessee, P.E.

Assistant Professors:
R.V. Arimilli, Ph.D. Virginia Polytechnic Institute, A.I.A., Ph.D. Purdue, T. Feigin*,
Ph.D. Texas, T.H. Moulden*, Ph.D. Tennessee;
C.D. Nelson, Ph.D. Clemson, O.T. Patterson,
Ph.D. Tennessee, T.C. Powell*, Ph.D. Kentucky;
G.V. Smith, Ph.D. Pennsylvania State;
V.K. Smith*, Ph.D. Georgia Institute of Technology.

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

BACHELOR OF SCIENCE PROGRAM

Separate, complete curricula are offered in aerospace engineering and mechanical engineering; however, the first two years of these curriculums are identical. During the first two years, the curricula provide for training and study in the basic sciences of physics, mathematics and chemistry and engineering computer science. The first year of both programs continues with the development of the particular engineering sciences of the aerospace and mechanical engineering fields. In the senior year an opportunity is provided to acquire the fundamental knowledge to mechanical or aerospace engineering problems. Both curricula are arranged with flexibility in the upper division years to permit emphasis on preparation for graduate study or technical employment.

Aerospace engineering has scientific foundations close to those of mechanical engineering. The aerospace engineer, however, devotes attention particularly to the research, development, design, testing, and production of aerospace vehicles—aircraft, spacecraft, missiles; auxiliary systems—heating, cooling, guidance, control; and propulsion systems—piston engines, turbo-jets, ramjets and rockets.

Mechanical engineering has its foundation in the basic sciences and requires an understanding of such areas of applied science as solid and fluid mechanics, thermodynamics, heat transfer, structures, vibrations, mechanical design, manufacturing processes and instrumentation in order to resolve the complex engineering problems of the real world.

In the mechanical engineering curriculum, the student may by the advice of an advisor must select a senior year program of mechanical engineering and technical electives. The following areas of concentration are available.

Energy. A study of energy conversion systems and the laws governing energy transformations. This option includes the design and analysis of conventional and future power generating systems utilizing various energy sources. The central courses are Mech. Engr. 4140-50-60.

Environment. A study of the systems which control the environment within enclosed spaces. The program includes the design and analysis of air conditioning, refrigeration, and heat pump devices encompassing heating, cooling, ventilation, humidifying, and noise control. The central courses are Mech. Engr. 4710-20-30.

Manufacturing. A study of manufacturing methods and production processes common to mass production industries. The program includes the selection of processes, design of tools and fixtures, numerical control, and analysis and design of the total manufacturing system. The central courses are Mech. Engr. 4821-23-24 with related courses in metallurgy.

Machine Design. The study and application of the principles of mechanics, materials, and manufacturing processes to the design and analysis of machine elements, machines, and structures. The central courses are Mech. Engr. 4860 and 4960.

Propulsion. The study of propulsion devices for ground vehicles, aircraft, and spacecraft. The program covers the analysis and design of internal combustion engines, gas turbines, jet and rocket engines using conventional and non-conventional fuels. The central courses are Mech. Engr. 4810, and Aero Engr. 4250-60.

Aerospace. The study of aircraft and spacecraft including the mechanics of flight and related systems and propulsion devices. The program includes the analysis and design of a variety of aerospace vehicles and systems. The central courses are Aero. Engr. 4240-50-60.

GRADUATE STUDY PROGRAMS

Graduate programs leading to the degrees of Master of Science, Master of Engineering, and the doctorate in philosophy with specialization in mechanical engineering or aerospace engineering are available to graduates of recognized undergraduate curricula in mechanical or aerospace engineering and to a limited extent others who satisfy the necessary prerequisite courses. The general requirements for advanced degrees are summarized in the Graduate School Catalog.

Mechanical Engineering (650)

2040 Introduction to Mechanical Engineering (1)
Presentation and discussion of topics related to mechanical engineering. Satisfactory-No Credit.

3000 Energy-An Overview (4) Introduction to available energy resources, recovery and utilization; power generation techniques including conservation schemes; emphasis on the resources-environment-man interaction associated with energy; primarily for non-engineering students.

3040 Seminar (1) Presentation and discussion of topics related to mechanical engineering. Prereq: Junior standing. Satisfactory-No Credit.


3321-30 Engineering Thermodynamics (2, 3) Properties of gases and gas mixtures; chemical reaction; equilibrium. Application to engineering problems. Prereq: 3311 and 3321 respectively.

3410 Fluid Flow (3) Development of continuity, momentum and energy principles for fluid systems: applications to mechanical and aerospace engineering problems. Prereq: Math 2850; Coreq: 3311.


3520-30-40 Thermical Sciences (3, 3, 3) Fundamental principles of thermodynamics and transport phenomena as applied to engineering design. For non-departmental majors. To be taken in sequence. Prereq: Math 2820 and Basic Engr. 1330.


3660 Manufacturing Processes (3) Selection of processes as related to the design of machine parts. Casting, hot and cold forming, metal removal and weldments. Manufacturing tolerances and surface finish. 2 hrs and 1 1/2 hr lab. Prereq: Met. Engr. 2110.

3681 Dynamics of Machines (3) Motion and forces in machines; vibrations and isolation of machinery; and balance of rotating machines. Vibration and damping machines. Prereq: Graphics 1320 and ES & M 2720 or 3700.

3682 Selection of Machine Elements (3) Designed stress conditions, material properties, and strength requirements for various machine elements. selection of shafts, bearing, gears, and bearings. Prereq: ES & M 3310 or 3311.


4010 Thesis (3) Problem investigation and report. Prereq: Senior standing.

4140 Energy Conversion Systems (3) Laws governing energy transformations and their application to power plants. Prereq: 3330; Coreq: 4420.

4150 Energy Conversion Systems (3) Operating and design characteristics of new technology energy conversion systems, selected direct conversion techniques. Prereq: 3330, 4420, 4510.

4160 Energy Conversion Systems (3) Economic and technical design parameters as applied to electrical plants for public utilities or industrial applications; selected design and layout problems. Prereq: 4150- 50.

4170 Turbo-Machinery (3) Basic principles of turbomachinery; systematic methods of analysis, design, performance evaluation. Prereq: 3530 or Aerodynamics 3515.

4180 Energy Production and Utilization (3) Thermodynamic constraints on energy production; comparison of new energy sources and concepts; energy conservation schemes. Prereq: Senior standing in engineering.

4220 Environmental Noise (3) Basic principles of acoustics—measurement and control of noise in industrial and community environments. Prereq: Senior standing in engineering or consent of instructor.

4310 Seminar (1) Discussion of topics related to engineering; includes inspection trips to industrial plants. Prereq: Senior standing. Satisfactory-No Credit.

4320 Seminar (1) Presentation and discussion of topics related to engineering. Prereq: Senior standing.


4471-01 Experimental Mechanical Engineering (3, 3) Experimental methods and measurements of force, length, time, temperature, transport rates, and physical properties. Planning, conducting, analyzing, and reporting experimental tests run according to stated objectives and criteria. Prereq: 3321, 3410, 3440, Engr. Sci. & Mech. 3320 for 4471; 4471 for 4491. Coreq: 4420 or 4491.

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. Prereq: 3630 or Aerospace Engineering 3630.

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

4621 Manufacturing Processes (3) Comparison of machining methods; plastic production; metrology. Prereq: 3650 and 3660 or consent of instructor.

4622 Tool Design (3) Principles underlying tool and die design, design of high-volume production tools and molds, work holding fixtures. Prereq: 3650-60 or consent of instructor.


4625 Manufacturing Process Engineering I (3) Product Specification: dimensional analysis of size and form; true position tolerance theory; tolerance analysis; and workpiece control for production to tolerance. Prereq: 3660 or IE 4040.


4633 Matrix Analysis (3) Application of matrices to solution of complex structures and lumped parameter vibrating systems. Prereq: 4632.

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. Prereq: 3650, 3660.


4690 Machine Design (3) Innovative design of complete machine; documentation including specifications, design calculations, working drawings and cost analysis. Written and oral report. Prereq: 4670, 4690.

4710 Thermal Environmental Systems (3) Vapor compression and absorption cycles, heat pump systems; moist air properties; psychrometric processes. Prereq: 3330, 3440.

4720 Thermal Environmental Systems (3) Design analysis of air washers, cooling towers and extended surface coils; solar radiation; building heat transmission; physiological effects. Prereq: 4420, 4710.


4740 Solar Energy Utilization (3) Nature and availability of solar radiation; review of selected heat transfer topics pertinent to solar energy collection and use; design analysis of solar energy collectors and methods of storage; selected applications. Prereq: 3521, 3440, or consent of instructor.

4810 Internal Combustion Engines (3) Thermodynamic phenomena in internal combustion and propulsion engines. Combustion; detonation; equilibrium; dissociation. Analysis of internal combustion engines using ideal and real fluids. Prereq: 3330, 3440.


4910-20-30 Selected Topics in Mechanical Engineering (3, 3, 3) Problems related to developments and practice in mechanical engineering. Prereq: Consent of instructor.

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5110 Conduction Heat Transfer (3)

5120 Convection Heat Transfer (3)

5130 Radiation Heat Transfer (3)

5140 Phase Change Heat Transfer (3)

5210 Classical Thermodynamics (3)

5220 Microscopic Thermodynamics (3)

5230 Special Topics in Thermodynamics (3)

5310 Intermediate Fluid Mechanics (3)

5410-20-30 Research in Mechanical Engineering (3, 3, 3)

5510-20-30 Mechanical Engineering Design (3, 3, 3)

5540-50-60 Advanced Strength of Materials (3, 3, 3)

5610-20-30 Experimental Stress Analysis (3, 3, 3)

5640-50-60 Advanced Machine Design (3, 3, 3)

5670-80-90 Dynamics of Machinery (3, 3, 3)

5710 Metal Machining (3)

5810-20-30 Rocket Propulsion Systems (3, 3, 3)

5840-50-60 Turbo-Machinery Systems (3, 3, 3)

5870 Dynamic Modelling and Simulation (3)
Nuclear Engineering (716)

Professors: P.F. Pasqua (Head), Ph.D. Northwestern, P.E.; W.H. Jordan, Ph.D. California Institute of Technology; T.W. Kerlin, Jr., Ph.D. Tennessee; H.G. Mahan; Ph.D. California (Berkeley); J.E. Mott, Ph.D. Minnesota; J.C. Robinson, Ph.D. Tennessee; P.N. Stevens, Ph.D. Northwestern, P.E.

Associate Professors: H.L. Dodds, Ph.D. Pennsylvania, P.E.; J.B. Fussell, Ph.D. Georgia Institute of Technology; T.J. Mitaliczo, Ph.D. Pennsylvania; H.C. Roland, Ph.D. Tennessee; O.L. Smith, Ph.D. Missouri.

Assistant Professor: L.F. Miller, Ph.D. Texas A & M.

BACHELOR OF SCIENCE PROGRAM

The curriculum in nuclear engineering is designed to provide basic training in many of the fields encountered in the applications of nuclear and radioactive materials. The first two years are concerned with the fundamental courses in engineering, physics, mathematics, chemistry, and English. The last two years encompass scientific and engineering courses equipping the student for entry into a variety of work in industry, research, or graduate studies.

MASTER OF SCIENCE and MASTER OF ENGINEERING PROGRAMS

A graduate program leading to a degree of Master of Science and Master of Engineering is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary prerequisite courses before entering the program.

The general requirements for the Masters' degrees are summarized in the Graduate School Catalog.

DOCTORAL PROGRAM

A program leading to the Ph.D. degree is available in nuclear engineering. For details, see the Graduate School Catalog.
4140 Thermocatalytic Systems (3) Fusion reactions; properties of plasmas; plasma containment; plasma diagnostics; thermocatalytic devices. Prereq: Physics 3730, Math 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: 4110 (or registration therein), or equivalent.

4530 Reactor Simulation Laboratory (3) Simulation of reactor design and operation with analog computer; reactor kinetics, single and multigroup theory, reactivity coefficients, poisoning, control rod calibration; power reactor; subcritical assembly. Prereq: 4120.

4610-20-30 Reactor Power Systems (3, 3, 3) Nuclear structure, decay laws, neutron diffusion, time behavior of reactors, heat removal, analysis of reactor power plants; economic, safety, and environmental aspects of nuclear power. Prereq: Math 4610; non-nuclear engineering students only.

4710 Energy Transport (3) Development of differential and integral energy conservation equations; conduction, convection, and radiation heat transfer; application of nuclear reactor fuel elements and heat exchangers. Prereq: 3730.

4720 Reactor Thermal Design (3) Hydrodynamics and heat transfer in boiling systems; boiling crises; fuel element thermal design, steam generator design. Prereq: 4710.

4730 Nuclear Reactor Design (3) First order reactor design; integration with nonnuclear heat transfer and power conversion system, economic evaluation; optimization procedures, description of typical systems. Coreq: 4130.


4820 Reactor Kinetics and Controls (3) Derivation of kinetic equations; basic kinetics parameters; transient response with feedback; control and protective systems. Prereq: 4110.

4840 Nuclear Reactor Safety (3) Presentation of reactor safety concepts and criteria; credible accidents; fission product release and transport; containment systems; accident analysis; engineered safeguards. Prereq: 4120.

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

GRADUATE

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

5110-20-30 Transport Processes in Nuclear Engineering (3, 3, 3)

5210 System Dynamics (3)

5220 Reactor System Dynamics (3)

5230 Experimental Methods in Reactor Dynamics (3)

5240 Reactor Instrumentation (3)

5310-20-30 Nuclear Systems Reliability (3, 3, 3)

5710-20-30 Nuclear Reactor Theory (3, 3, 3)

5740 Reactor Shielding (3)

5790 Monte Carlo Shield Design Shielding (3)

5840-50 Fast Breeder Reactors (3, 3)

5910-20 Advanced Nuclear Reactor Design (3, 3)

5970 Special Topics in Nuclear Engineering (3)
Home economics is an integral part of The University of Tennessee’s academic program in its three major functions of teaching, research, and extended services. The College ranks among the top three colleges of home economics in the nation in enrollment and second in the number of Master’s degrees granted. Much of the qualitative and quantitative growth of the College is due to its highly qualified faculty and staff who, being aware of the current community problems and needs, have made its programs relevant to the goals and aspirations of today’s students.

Today’s students are seeking professional positions in which they can better serve people—individuals, families, consumers—to help them predict and solve problems arising from the increasingly rapid changes occurring in the society in which we live. The basis of the College’s professional programs is to prepare young men and women to serve the needs of people in their many varied environments and different stages of life.

The philosophy of the College might best be stated as follows: Home economics, while it does seek knowledge which describes and analyzes, is not content with only studying “what is,” but also is concerned with promoting “what can and should be” in order to enhance the quality of life and well-being of people and societies.

The College’s mission is twofold: its graduate programs are geared toward research producing alternative solutions to technical and social problems which are and will be encountered by the people who are to be served; its undergraduate programs prepare students to work with people in a professional capacity and to direct them to the needed information so that they may make use of what has been learned in serving as professional agents of change.

The University of Tennessee pioneered as one of the first institutions of higher education in the South to offer home economics and has continued to hold a position of leadership. The first class was taught in 1897.

The faculty of the College numbers 60 full-time teaching and research staff. There are five departments with curricula leading to the Bachelor of Science degree: Child and Family Studies; Crafts, Interior Design, and Housing; Food Science, Nutrition, and Food Systems Administration; Home Economics Education; and Textiles and Clothing. The undergraduate program in Home Economics Education is offered in cooperation with the College of Education and the Home Economics Extension Education program is offered in cooperation with The Institute of Agriculture. Approximately 350 courses are offered in these departments. The graduate programs leading to the Master of Science degree were begun in the summer of 1925. Programs for the Doctor of Philosophy degree were initiated in 1960. The Doctor of Philosophy degree program in home economics now includes three options: Interdisciplinary, Food Science, Nutrition. Food Systems Administration may be taken as a concentration in the Food Science doctoral option.

Special Resources

Several special programs enrich the offerings of the College:

Selected Students have the opportunity to study for one year at the Merrill-Palmer Institute for Human Development and Family Life in Detroit, Michigan or at the Child Development Center of the Center for Health Sciences in Memphis. Credits earned may be applied toward a Bachelor of Science degree in most curricula of the College.

Model Research Programs for infant care and preschool day care and nursery school provide home economics students the opportunity to train as directors of, and teachers in child day care facilities. The need for appropriate child day care facilities staffed with well-trained, competent staff is recognized as one of the most urgent problems of today’s urban society.

Opportunities for home economics graduates with special interest in preschool programs are numerous and continue to increase. The Nursery School through Grade Three program offered jointly with the College of Education provides certification for teachers in early childhood education.

Each Summer the craft workshops in Gatlinburg, Tennessee, are made possible through cooperative efforts between the Department of Crafts, Interior Design, and Housing and the Pi Beta Phi Arrowmont School of Crafts. The Pi Beta Phi Sorority provides the funds, the facilities and the management for Arrowmont. The University of Tennessee, Knoxville, College of Home Economics, Department of Crafts, Interior Design, and Housing appoints the instructors, and provides for the administration of craft classes with appropriate accreditation. In addition to providing advanced instruction in designer-created crafts through classes taught by nationally known craftpersons, the craft workshops have expanded to a full-fledged program serving as a training center for artists and craftpersons from throughout the United States. Also, cooperation with national and local craft organizations has so stimulated the work of craftpersons
throughout the area that their work has gained national recognition.

The U.S. Department of Agriculture Textiles and Clothing Research Laboratory is a part of the Southern Region Mid-Atlantic Area and was located at The University of Tennessee in 1967. Textiles and clothing researchers collaborate with the U.S.D.A. staff to conduct investigations that will (1) determine consumer needs for textiles and clothing and the adequacy of products available to meet these needs, (2) develop basic principles to guide consumers in selecting and caring for textiles and clothing, and (3) solve other economic and technical problems pertaining to the field. Graduate students in this area may be trained at the laboratory.

International Study Tours in several areas of home economics are offered when a demand is indicated. The course “Home Economics 4910 International Study Tour” is offered for 6 credit hours at the undergraduate level. At the graduate level, Home Economics 5700 International Studies is available, depending on demand and resources, for up to 15 graduate credit hours. The length of the tours may vary from 6 to 8 weeks, and the programs will be under the direction of a member of the faculty.

The Department of Food Science, Nutrition, and Food Systems Administration has a cooperative arrangement in which food service systems, such as those of the University, hospitals, schools, hotels, and restaurants are available for laboratory experience for food systems administration students and in food industries for those in the food science curriculum.

The Food Systems Administration program includes a four-year Coordinated Undergraduate Program in Dietetics for those students interested in health care facilities, and a Food and Lodging Administration program to meet the need for administrators in the restaurant, resort, and tourist industry. Students in the Coordinated program receive clinical experience integrated with courses during the senior year in hospitals and other health care facilities. The Food and Lodging Administration program offers coordination of theory and experience with industry during all four years. Graduates of the Coordinated program will be eligible for membership in the American Dietetics Association (ADA) and for consideration for ADA registration. The Nutrition program is affiliated with the Child Development Center, UT Center for Health Sciences, Memphis, for special study in mental retardation and developmental disorders. A liaison is maintained with the Knox County Health Department to provide concurrent field experience for students in the Community Nutrition option.

All Departments of the College conduct basic and applied research which may be supported in part by the College, by special grants and contracts, and by the Agricultural Experiment Station. The University of Tennessee Atomic Energy Commission program at Oak Ridge also provides opportunity for training and research.

Workshops on special topics of current importance are offered by the different departments in home economics. These will be of special interest to those desiring to work for advanced degrees. Announcements are sent upon request.

The Continuing Education Program provides advanced courses in all areas of home economics at centers across the state for updating and re-training as faculty resources permit. The program includes short courses, workshops, evening courses, and special video-tape and tele-lecture courses. Individually planned graduate programs should be arranged with the appropriate department heads.

Facilities

The Jesse W. Harris Home Economics Building was dedicated in 1926. Since that time two wings have been added, one in 1937 and another in 1959. All departments have well-equipped modern laboratories for both graduate and undergraduate work.

The Child Development Center is a separate building especially planned as a laboratory for teaching and research with preschool children. It houses an infant day care center, nursery school classrooms for two-, three-, four-, and five-year-old children, a preschool curriculum laboratory, and rooms for observation and research.

A separate Child Day Care Center housed in the UT Golf Range Apartments is staffed by the College and provides a laboratory for study as well as a day care center for group care of children 2 to 6 years of age. The Family Life Center provides office and classroom space.

Food Science, Nutrition, and Food Systems Administration facilities include well-equipped laboratories for basic food science, experimental food science, experimental nutrition (animal), and chemistry for graduate and undergraduate students. A reading room and audio-tutorial laboratory provide opportunity for independent study. Laboratories include instruments for the evaluation of the chemical, physical, histological, and sensory properties of food, in addition to facilities for metabolic and survey studies of human nutrition.

Home Economics Education offices and laboratories are located in the Home Economics Building.

The Department of Crafts, Interior Design, and Housing facilities include provisions for study, regular classroom laboratory and studio experiences. Laboratories for crafts and interior design and housing studies are especially equipped for this purpose.

Textile research facilities are available to undergraduate and graduate students and to research personnel interested in textile studies that benefit fiber producers, fabric and clothing manufacturers, and consumers.

Certification in Vocational Home Economics Education

Certification to teach vocational home economics requires either a Bachelor's or Master's degree in home economics from an institution offering a curriculum for teacher training approved by the State Board for Vocational Education and by the United States Office of Education. The University of Tennessee, Knoxville is approved for the training of teachers in home economics.

A description of the home economics education curriculum leading to recommendation for certification will be furnished upon request. Graduate students interested in meeting certification requirements should consult the head of the Department of Home Economics Education. Transfer and graduate students who desire to qualify for vocational certification in home economics should state this when applying for admission so that their credits may be evaluated in terms of this goal.

Certification in Early Childhood Education

A joint program in Early Childhood Education—Nursery School through Grade Three—was recently approved for the Department of Child and Family Studies (College of Home Economics) and the Department of Curriculum and Instruction (College of Education). In addition to preschool education, graduates are certified to teach Kindergarten through Third Grade.

Educational Programs For Home Economics Extension Education

Students interested in careers as home economics extension agents have many opportunities for employment in service to urban and rural families. Special programs of study can be arranged for such students in cooperation with the Institute of Agriculture. The student selects a major in one of the curricula offered by the College of Home Economics. Elective courses may be selected by the student from those recommended by a joint advisory committee of the College of Home Economics, the College of Agriculture, and the home economics unit of the Agricultural Extension Service.

Summer field work experience, coordinated by the Department of Agricultural Extension Education, is available to selected students with a minimum 2.5 grade point average. The student must enroll in Agricultural Extension Education 3110 during the fall or spring quarter of the junior year prior to enrolling in Agricultural Extension Education 4110-20 Field Studies in the summer quarter (see page 58 for course descriptions). Six hours credit are awarded for summer Field Studies during which the student works ten weeks as a Junior Assistant County Agent of the Tennessee Agricultural Extension Service.

Students interested in this program should contact their adviser and the Administrative Assistant in the Office of the Dean of the College of Home Economics for detailed information.

Undergraduate Study In Home Economics

Curricula in the following areas lead to the degree of Bachelor of Science in home economics:

Child and Family Studies (CFS)

Option 1 — Early Childhood Development

Option 2 — Human Development and Family Studies

Option 3 — Nursery School-Grade 3
Crafts, Interior Design, and Housing (CIDH)
Option 1 — General Professional
Option 2 — Professional Interior Design
Option 3 — General Crafts
Option 4 — Crafts Specialization

Food Science, Nutrition, and Food Systems Administration (FSNFSFA)
Option 1 — Food Science
Option 2 — Nutrition Science
Option 3 — Community Nutrition
Option 4 — Coordinated Undergraduate Program in Dietetics (ADA)
Option 5 — Food and Lodging Administration

Home Economics Education (HEED)

Textiles and Clothing (T & C)
Option 1 — Merchandising
Option 2 — Textile Technology

NOTE: Students are advised to consult the University requirements as stated in the front section of this catalog as well as the requirements for their particular college or school.

For the degree of Bachelor of Science in home economics, students generally plan to complete the last forty-five quarter hours of work (three quarters) at The University of Tennessee, Knoxville. Seventy-two hours must be earned in courses numbered above 3000 at The University of Tennessee, Knoxville. The prospective transfer student is advised to preplan the total college program before starting any college level work. Careful planning prior to transferring to the College of Home Economics is essential to maintaining a program of study with maximum utilization of credit and sequence of course work. All new freshman and transfer students whose majors require chemistry must enroll in the freshman chemistry course sequence until requirements are completed. It is recommended that transfer students complete the freshman chemistry requirements before transferring to the College of Home Economics.

Students wishing to transfer 36 or more credit hours of the College must have an average of 2.0 for admission. Students with an average of less than 2.0 are not eligible for enrollment in junior or senior courses.

During the first quarter of residence, each student takes courses basic to all curricula and is assigned a faculty advisor for program planning.

A normal student load per quarter is 15-16 hours. The maximum load is 21 credit hours per quarter (18 hours maximum for the Coordinated Undergraduate Program in Dietetics) unless otherwise approved by the Dean.

When a student has completed one quarter in residence at The University of Tennessee, Knoxville (with at least a 2.0 average in course work), the student will be eligible to participate in self-registration. Students participating in the voluntary academic registration program bear full responsibility for meeting degree requirements in the proper sequence.

A College of Home Economics student may choose to take for elective credit only, a course (outside the specific requirements of the College of Home Economics and outside the major department) in which the student will receive a satisfactory or no-credit grade. The purpose of the satisfactory/no credit grading system is to encourage the student to explore subject matter areas outside of the requirements and other courses of the major by minimizing the pressure for the student’s concern that performance may be somewhat less outstanding than that in preferred subject areas. These courses will count as hours for graduation but not for calculating the student’s grade point average. A final grade of C or better will be recorded as satisfactory. The maximum satisfactory or no credit hours which could be counted toward a degree is 30 hours. When the student wishes to take a satisfactory or no credit course, the student must so indicate at the time of registration.

Proficiency examinations are offered for numerous courses of the College. Information on courses for which proficiency examinations are offered may be obtained from departments of the College of Home Economics.

Field training provides the opportunity for practical pre-professional experience and constitutes an integral part of many of the college’s programs. Students enrolled in certain College of Home Economics courses who are involved in field experiences are required to participate in the group liability insurance plan offered through the College of Home Economics. The annual cost to the student for this insurance coverage is $4.00 (subject to change).

The first digit in course numbers indicates the student group for whom the course is primarily offered: 1000 indicates courses for freshmen, 2000 for sophomores, 3000 for juniors, 4000 for seniors, 5000 and 6000 for graduate students.

Education 3810 should be elected in the sophomore year by those students majoring in the vocational home economics education curriculum. This course is a prerequisite for other required courses in education. Psychology 2500 is a prerequisite for Education 3810.

For majors in the food science, nutrition or textiles curricula, Nutrition 3310 should be taken preferably in the sophomore year and not later than the first quarter of the junior year.

The following four courses are fundamental to home economics and are required in all curricula:

<table>
<thead>
<tr>
<th>Hours</th>
<th>Credit</th>
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<tbody>
<tr>
<td>Home Economics 1510 Family Systems: Human Development 4</td>
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<tr>
<td>Home Economics 1520 Family Systems: Aesthetic Environment 4</td>
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</tr>
<tr>
<td>Home Economics 2510 Family Systems: Physiological Well-being 4</td>
<td></td>
</tr>
<tr>
<td>Home Economics 3510 Family Systems: Consumer Resources 4</td>
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Professional Curriculum in Child and Family Studies

The Department of Child and Family Studies is located in the College of Home Economics. A focus is on the development of children, human development and family interaction throughout the life span, and with resource management and consumer studies.

Departmental goals and objectives are designed to contribute to the interpersonal and professional competence of men and women students, and to provide preparation for careers in the helping professions related to children, adolescents, adults, and families, depending on the option the student selects.

The curriculum is appropriate for persons oriented toward teaching and/or administrative positions in child care centers and nursery schools, public schools, positions in family services, child welfare agencies, extension, banks and consumer agencies. Other opportunities exist that require study beyond the bachelor’s level (for example: administration, research and clinical services). All options provide necessary background for graduate study in child development, family relationships, early childhood education, and social work. A total of 191 credits is required for the bachelor of science degree.

OPTION 1. EARLY CHILDHOOD DEVELOPMENT

This option is appropriate for persons interested in the following types of positions: day care teacher, nursery school teacher, worker in child welfare, worker for socially disadvantaged and/or handicapped children, entry level positions in social work, or preparation for graduate school.

<table>
<thead>
<tr>
<th>Hours</th>
<th>Credit</th>
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<tbody>
<tr>
<td>Freshman Child and Family Studies 2110 3</td>
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</tr>
<tr>
<td>Home Economics 1510 4</td>
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</tr>
<tr>
<td>Home Economics 1520 4</td>
<td></td>
</tr>
<tr>
<td>Natural Science 12</td>
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</tr>
<tr>
<td>English 1510-20 8</td>
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</tr>
<tr>
<td>Mathematics 1540 4</td>
<td></td>
</tr>
<tr>
<td>Philosophy 1510 or 2510 or 2520 or 2310 or upper division foreign language 4</td>
<td></td>
</tr>
<tr>
<td>Music 1210 or Art 1815 or 1825 4</td>
<td></td>
</tr>
<tr>
<td>Electives 6</td>
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<table>
<thead>
<tr>
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<tbody>
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<tr>
<td>Nutrition 1230 3</td>
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<tr>
<td>Physical Education Elective 2</td>
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<tr>
<td>Speech 1221 or 2021 or 2351 4</td>
<td></td>
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<tr>
<td>Physical or Biological Science Elective 4</td>
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<tr>
<td>Social Sciences 16</td>
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<tr>
<td>History or Political Science Elective 4</td>
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<td>Electives 10</td>
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<table>
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<tr>
<td>CFS 3120 or Library Science 3510 3</td>
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<tr>
<td>CFS 3210-20 6</td>
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</tr>
<tr>
<td>CFS 3420 or 4830 3</td>
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<tr>
<td>Economics 2110 3</td>
<td></td>
</tr>
<tr>
<td>Philosophy or Religious Studies Elective 4</td>
<td></td>
</tr>
<tr>
<td>Special Education 3333 3</td>
<td></td>
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<tr>
<td>Physical Education 3560 or 3570 3-6</td>
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</tr>
<tr>
<td>Public Health 3210 4</td>
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<tr>
<td>Electives 7-6</td>
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<td>Senior</td>
<td>Hours Credit</td>
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<td>CFS 4110</td>
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<tr>
<td>CFS 4230</td>
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<td>CFS 4260 or 4430 or 4810</td>
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<td>CFS 4350</td>
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<tr>
<td>CFS 4610</td>
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<td>CFS 4620</td>
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<tr>
<td>CFS 4810 or 4820</td>
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<tr>
<td>Home Economics 3510</td>
<td>3</td>
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<td>Electives</td>
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<tr>
<td><strong>TOTAL: 191 Hours</strong></td>
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</table>

Twelve hours selected from the following:
- Biology 1210-20-30
- Chemistry 1510-20-30
- Physics 1410-20-30
- Zoology 2461-17-81

Thirty hours may be selected to count toward home economics degree requirements.

**OPTION 2. HUMAN DEVELOPMENT AND FAMILY STUDIES**

This option is for undergraduate CFS majors who want a general background in individual and family studies. This option does not prepare a career in preschool education. Students interested in Cooperative Extension Service, community agencies, general family counseling, social work, and graduate work should choose this undergraduate option.

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Hours Credit</th>
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<tbody>
<tr>
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<td>English 1510-20</td>
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<tr>
<td>Mathematics 1540</td>
<td>4</td>
</tr>
<tr>
<td>Philosophy 1510 or 2510 or 2520 or 2311 or upper division foreign language</td>
<td>4</td>
</tr>
<tr>
<td>Music 1210 or Art 1815 or 1825</td>
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<td>Electives</td>
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**Sophomore**

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Hours Credit</th>
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<tbody>
<tr>
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<td>Nutrition 1230</td>
<td>3</td>
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<td>Home Economics 2510</td>
<td>3</td>
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<td>Speech 1221 or 2021 or 2349</td>
<td>4</td>
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<tr>
<td>Physical or Biological Science Elective</td>
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<tr>
<td>Social Sciences</td>
<td>16</td>
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<tr>
<td>History or Political Science Elective</td>
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<tr>
<td>Elective</td>
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<table>
<thead>
<tr>
<th>Junior</th>
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<tbody>
<tr>
<td>CFS 2410 or Sociology 3150</td>
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<tr>
<td>CFS 3210</td>
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<tr>
<td>CFS 3220</td>
<td>3</td>
</tr>
<tr>
<td>CFS 3510</td>
<td>3</td>
</tr>
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<td>CFS 3515</td>
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<td>Home Economics 3510</td>
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<td>Economics 3110</td>
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<tr>
<td>Philosophy or Religious Studies Elective</td>
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<tr>
<td>Electives</td>
<td>15</td>
</tr>
<tr>
<td><strong>TOTAL: 191 Hours</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Courses should be from:** Biology 1210 or 1220 or Botany 1110 or 1120 or Zoology 2820 or 2930.

**Courses should be from:** Philosophy 1510 or 1520 or 2510 or 2520 or Religious Studies 2610 or 2620.

Nutrition 1230 recommended.

Selected courses to be counted are:
- Chemistry 1110, 1510, 1610 (choose one) or 1120, 1520, 1620 (choose one), or
- Geology 1510 or 1520 or 2110, or Astronomy 2110 or 2120, or Physics 1210 or 1220 or 2210 or 2220.

**OPTION 3. NURSERY SCHOOL-GRAGE THREE (Dual Program)**

This option is appropriate for persons interested in working with children ages 0-3 in various settings. Certification for teaching grades K-3 is built into the program.

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Hours Credit</th>
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</thead>
<tbody>
<tr>
<td>HE 1510</td>
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<td>HE 1520</td>
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<td>CFS 1500</td>
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<tr>
<td>English 1510-20</td>
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<tr>
<td>Speech 2211 or 2311</td>
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<tr>
<td>Music 1210 or 1220 or Art 1815 or 1825</td>
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<tr>
<td>Biological Science</td>
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<tr>
<td>Math 2110-20-30</td>
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<tr>
<td>Philosophy or Religious Studies</td>
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**Sophomore**

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Hours Credit</th>
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<tbody>
<tr>
<td>HE 2510</td>
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<td>CFS 3210</td>
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<tr>
<td>Health Elective</td>
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<td>Music Ed. 2100</td>
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<td>P.E. 3450</td>
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<td>Physical Science</td>
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<td>Literature Elective</td>
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<td>Culture and Society Electives</td>
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<td>History Elective</td>
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<td>Social Science Elective</td>
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<td>Economics 2110</td>
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**Junior**

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<td>Educ. C &amp; I 3720</td>
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<td>Educ. C &amp; I 4303</td>
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<tr>
<td>Educ. C &amp; I 3010-20-30</td>
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<tr>
<td>Music Ed. 3110</td>
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<tr>
<td>Public Health 3210</td>
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<td>P.E. 3660</td>
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<td>Elective</td>
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**Senior**

<table>
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<td>Spec. 3</td>
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<tr>
<td>Electives</td>
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</table>

**Crafts, Interior Design, and Housing**

Acquisition and Exhibition

The department reserves the right of acquisition and exhibition of work completed in its studios under the guidance of the faculty.

**OPTION 1. GENERAL PROFESSIONAL**

This general curriculum is designed for students preparing for positions in business, educational and public service programs and provides background for advanced study in crafts, interior design and housing.

<table>
<thead>
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<tbody>
<tr>
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<td>English 1510-20</td>
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<td>Food Science 1010</td>
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<td>Home Economics 1510</td>
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<tr>
<td>Home Economics 1520</td>
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<tr>
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<tr>
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**Sophomore**

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<td>Psychology 2500 and 2520 or 2540</td>
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<td>CIDH 2210</td>
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<tr>
<td>Speech 2311</td>
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**Junior**

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<td>Microbiology 2010</td>
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<tr>
<td>CIDH 3110</td>
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<tr>
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</tr>
<tr>
<td>Textiles and Clothing 3420</td>
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**Senior**

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<td>CIDH 4320</td>
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<td>Humanities and Social Science Electives</td>
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*Selected from anthropology, political science, history.