Student Calendar For 1979-80

Winter Quarter, 1979

January 3-4 (Wednesday-Thursday) Registration
January 5 (Friday) Classes Begin
February 8 (Thursday) Change of Registration Deadline
March 15 (Thursday) Classes End
March 19 (Monday) Commencement

Spring Quarter, 1979

March 26-27 (Monday-Tuesday) Registration
March 28 (Wednesday) Classes Begin
April 13-14 (Friday-Saturday) Easter (No Classes)
May 1 (Tuesday) Change of Registration Deadline
June 7 (Thursday) Classes End
June 12 (Tuesday) Commencement

Summer Quarter, 1979

June 18-19 (Monday-Tuesday) Registration, First or Both Terms
June 20 (Wednesday) Classes Begin
July 4 (Wednesday) Independence Day (No Classes)
July 9 (Monday) Change of Registration Deadline, First Term
July 20 (Friday) Classes End, First Term
July 23 (Monday) Registration, Second Term
July 24 (Tuesday) Classes Begin, Second Term
July 24 (Tuesday) Change of Registration Deadline, Full Term
August 10 (Friday) Change of Registration Deadline, Second Term
August 22 (Wednesday) Classes End
August 25 (Saturday) Commencement

Fall Quarter, 1979

September 17-19 (Monday-Wednesday) Registration
September 20 (Thursday) Classes Begin
October 24 (Wednesday) Change of Registration Deadline
October 26 (Friday) East Tenn. Educ. Assoc. (No Classes)
November 3 (Saturday) Homecoming (No Classes)
November 22-24 (Thursday-Saturday) Thanksgiving (No Classes)
November 29 (Thursday) Classes End
December 4 (Friday) Alternative Period
December 6 (Thursday) Commencement

Winter Quarter, 1980

January 3-4 (Thursday-Friday) Registration
January 7 (Monday) Classes Begin
February 11 (Monday) Change of Registration Deadline
March 11 (Tuesday) Classes End
March 12-15 (Wednesday-Saturday) Alternative Period
March 18 (Tuesday) Commencement
Correspondence Directory

Graduate Study
L. Evans Roth, Vice Chancellor for Graduate Studies and Research
Margaret N. Perry, Dean for Graduate Studies
Diana C. Lopez, Director of Graduate Admissions
Clea J. Greenawalt, Assistant Director of Graduate Admissions

Assistantships
Head of department in which you plan to major

Loans
Work Study
Part-time Employment
Student Loans

Clea J. Greenawalt, Assistant Director of Graduate Admissions

Graduate Management
Admission Test or Graduate Record Examinations
Educational Testing Service, Princeton, New Jersey, or Berkeley, California

Housing
Married students—Office of Rental Properties, Stadium
Single students—Office of Residence Halls, 405 Student Services Building

International Student Advisor
Dixon Johnson, Alumni Hall

Scholarships and Fellowships
Clea J. Greenawalt, The Graduate School

Thesis Consultant
Georgia Bunn, The Graduate School

Timetable of Classes
Supervisor of Registration, Registrar's Office

Transcripts
Bob L. Cochran, Registrar

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The University of Tennessee, Knoxville

Main Campus

A — Ayres Hall (Liberal Arts)
AA — Art & Architecture Bldg. (under construction)
AC — Art Center
ACH — Art Center House (Laurel House)
AD — Admissions Office
AH — Alumni Hall (Alumni, Placement Offices)
AH — Andy Holt Tower
AP — Austin Peay Memorial Bldg. (Psych.)
APQ — Administration Parking Garage
AOC — Aquatic Center
AUX — Art Annex
B — Berry Hall
BCC — Black Cultural Center
BL — Blount Hall
BT — Tom Black Track and Recreation Area
BU — Buescher Hall
C — Clairson Education Building
CAH — Carrick Hall (Residence)
CBT — Clarence Brown Theatre
CD — Communications Design Building
CEP — Ceramic Building
CLH — Clement Hall (Residence)
CN — College of Nursing
CM — Communications and University Extension Bldg.
CR — Craft House
CT — Carousel Theatre
CU — Credit Union
DAB — Dabney Hall
DES — Design House
DO — Dougherty Engineering Bldg.
DLH — Dunford Hall (Residence)
ECO — Ecology
ESH — Estabrook Hall (Architecture)
EMP — UT Employment Office
F — Fraternity House
FH — Ferris Hall
FLC — Family Life Center
G — Glocker Business Administration Bldg.
G&G — Geology and Geography Bldg.
GIB — Gibbs Hall (Residence)
GRH — Greve Hall (Residence)
GSP — Graduate School of Planning
GYM — Alumni Memorial Auditorium-Gymnasium
H — Hasler Biology Bldg.
H&H — Hearing & Speech Center
HE — Harris Home Economics Bldg.

Agricultural Campus

AE — Agricultural Engineering Bldgs.
AEL — Agricultural Engineering Lab
ASB — C.E. Brehm Animal Sciences Bldg.
CC — Cotton-Corn Bldg.
CVM — College of Veterinary Medicine
DP — Dairy Products Bldg.
FL — Fiber Research Laboratory
FOR — Tennessee Division of Forestry
FT — J.H. McLeod Food Technology Bldg.
GH — Greenhouses
MC — McCord Hall
MH — Morgan Hall
PB — Plot Barn
PO — Poultry Diagnostic Laboratory
PPL — Plant Pathology
PS — Plant Sciences Annex
SL — Spinning Lab.
Graduate School Office Hours
Monday - Friday 8:00 A.M.-5:00 P.M. (All Year) 115 Student Services and Administration Building
Telephone - (615) 974-3251

The Graduate School Administration
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<tr>
<td>Child and Family Studies</td>
<td>M.S.</td>
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<td>X</td>
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<tr>
<td>Consumer Studies and Housing</td>
<td>M.S.</td>
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<td>X</td>
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<td>Public Policy</td>
<td>M.S.</td>
<td></td>
<td>X</td>
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<tr>
<td>Crafts, Interior Design, and Housing</td>
<td>M.S.</td>
<td></td>
<td>X</td>
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<tr>
<td>4-Food Science</td>
<td>M.S.</td>
<td></td>
<td>X*</td>
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<tr>
<td>Food Systems Administration</td>
<td>M.S.</td>
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<td>X*</td>
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<tr>
<td>4-Home Economics</td>
<td>PH.D.</td>
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<td>X*</td>
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<tr>
<td>4-Nutrition</td>
<td>M.S.</td>
<td></td>
<td>X*</td>
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<tr>
<td>Textiles and Clothing</td>
<td>M.S.</td>
<td></td>
<td>X*</td>
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<tr>
<td>All M.S. and PH.D. applicants obtain special application form from Associate Dean, College of Home Economics.</td>
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<tr>
<td>Intercollegiate Area</td>
<td>Degree(s)</td>
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<tr>
<td>Intercollegiate (Aviation Systems, Ecology, Management Science, Organizational Psychology, Water Resources Development)</td>
<td>M.S., M.S., M.S.</td>
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<thead>
<tr>
<th>College of Liberal Arts</th>
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<tr>
<td>Anthropology</td>
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<tr>
<td>Art</td>
<td>M.A., M.A.</td>
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<tr>
<td>Audiology</td>
<td>M.A., M.A.</td>
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<tr>
<td>Biochemistry</td>
<td>M.S., M.S.</td>
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<tr>
<td>Biology</td>
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<tr>
<td>Botany</td>
<td>M.S., M.S.</td>
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<tr>
<td>Chemistry</td>
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<tr>
<td>Computer Science</td>
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<tr>
<td>English</td>
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<tr>
<td>French</td>
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<td>Geography</td>
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<td>German Language and Literature</td>
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<td>History</td>
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<td>Mathematics</td>
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<td>Philosophy</td>
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<td>Physics</td>
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<tr>
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<td>Psychology</td>
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<td>Radiation Biology</td>
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<td>Romance Languages</td>
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<td>Sociology</td>
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<tr>
<td>Spanish</td>
<td>M.A., M.A.</td>
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<tr>
<td>Speech and Hearing Science</td>
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<tr>
<td>Speech Pathology</td>
<td>M.A., M.A.</td>
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<tr>
<td>Speech and Theatre</td>
<td>M.A., M.A.</td>
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<tr>
<td>Zoology</td>
<td>M.A., M.A.</td>
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<tr>
<th>College of Nursing</th>
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<tbody>
<tr>
<td>Nursing</td>
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<tr>
<th>School of Biomedical Sciences</th>
<th>Degree(s)</th>
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<tbody>
<tr>
<td>Biomedical Sciences</td>
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<tr>
<th>School of Library and Information Science</th>
<th>Degree(s)</th>
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<tr>
<td>Library Science</td>
<td>M.S.L.S.</td>
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<tr>
<td>School of Planning</td>
<td>M.S.P.</td>
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<thead>
<tr>
<th>School of Social Work</th>
<th>Degree(s)</th>
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<tr>
<td>Social Work (Memphis, Nashville and Knoxville)</td>
<td>M.S.S.W.</td>
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Notes:
- *Offered only at UT Space Institute.
- *Offered also at off-campus locations.
- *Department doctoral option offered under the major of home economics.
- *Interdisciplinary option offered in each department.
- *Ph.D. applicants only.
- *American applicants only.
- *Ed.D. applicants only.
- *Ed.S. applicants only.
- *International applicants only.
- *Interdisciplinary Ph.D. applicants only.
The Graduate School

The mission of The University of Tennessee, Knoxville is to offer instruction on all levels of higher education, engage in and train for research, and provide extended services of great variety. The obligations of this mission are reinforced by the fact that The University of Tennessee is both the State University and the official Land-Grant Institution of Tennessee.

Advanced Graduate Work and Research

The University of Tennessee has some obligations not shared in the same degree by other public colleges and universities of the state, although these specialized functions are common to most major state universities and land-grant institutions. For instance, the University must develop and maintain advanced instruction and research in the basic arts and sciences and in professional and occupational areas dependent upon the fundamental fields of learning, especially (but not exclusively) those of substantial importance to the state. It is the business of such a state university to advance the frontiers of knowledge in all areas of human concern, to discover facts previously unknown, to present new theories, and to test hypotheses and theories not previously established. The augmentation of the intellectual heritage of the human race, particularly in basic research, is a major function of this and all other universities. So far as publicly-supported higher education is concerned, The University of Tennessee, Knoxville is the center of advanced graduate training and research in Tennessee. As of 1978 the University provides Master's level work in 120 fields of knowledge and doctoral work in 47, enrolling more than 7,000 graduate students.

The search for new knowledge and its application to the changing needs of society is a major aim of The University of Tennessee. In graduate instruction, through research programs, and by public service, the University and its faculty constitute a major resource for contributions to state, national, and international problems. In addition to typical departmental units of administration, numerous interdisciplinary programs, institutes, and centers have been developed in the locations and the scholarly areas needed. Beyond those described below, numerous other organizations exist and are described within the appropriate department or college descriptions.

Environment Center

J. H. Gibbons, Director, Ph.D. Duke
R. A. Bohm, Associate Director, Ph.D. Washington (Missouri)

The Environment Center was created to encourage and support UT faculty and students to become involved in interdisciplinary studies to provide alternative solutions to problems related to energy and the environment. The Center provides assistance to faculty interested in developing research and public service projects, manages research and development projects that involve several disciplines, and assists Tennessee government and industry in specific problems related to energy and environment. It also participates in the Statewide Consumer Education Program, especially in developing material.

Current research includes environmental and human costs of coal production, solar energy utilization in buildings, energy conservation in buildings and industry, and regional solid waste management and resource recovery.

The Center is operated through the Office of the Vice Chancellor for Graduate Studies and Research.

Transportation Center

Knoxville: K. W. Heathington, P.E., Director, Ph.D. Northwestern
R. A. Mundy, Ph.D. Pennsylvania State
M. S. Bronzini, P.E., Ph.D. Pennsylvania State, Associate Directors
R. L. Perry, Assistant Director, M.S. Tennessee
Nashville: D. H. Jones, P.E., M.S. Tennessee; P. R. Tut, P.E., M.S. Texas, Assistant Directors

The Transportation Center performs four main functions: (1) managing interdisciplinary transportation projects for the University, (2) managing transportation projects for the Tennessee Department of Transportation, (3) managing highway safety projects for the Governor's Highway Safety Program, and (4) providing public service activities in transportation throughout the state. In performing these functions, the Transportation Center works extensively with various colleges and departments, organizations, and campuses of The University of Tennessee.

The Center conducts research in all modes of transportation. Current research includes transportation management, railroad and waterways, urban goods movement, airport ground transportation, transportation brokerage, social service transportation, ridesharing, transit, legislation, diagnostic vehicle inspection, highway safety, tunnel construction and ventilation, archaeological exploration, highway construction, and environmental impacts.

The Center is operated through the Office for Graduate Studies and Research. The Center's main office is at UT, Knoxville with a satellite office in Nashville.

The University of Tennessee Space Institute

C. H. Weaver, Dean, Ph.D. Wisconsin
R. L. Young, Associate Dean, Ph.D. Northwestern
A. A. Mason, Assistant Dean, Ph.D. Tennessee

The Space Institute was originated to interface University faculty research with the Arnold Engineering Development Center of the United States Air Force. Located at Tullahoma, Tennessee, the Space Institute offers graduate degree
programs with majors in Aerospace Engineering, Aviation Systems, Computer Science, Electrical Engineering, Industrial Engineering, Administrative Engineering, Administration, Engineering Science, Mathematics, Mechanical Engineering, Metallurgical Engineering, and Physics. In addition to the fundamental academic work characteristic of each discipline, research opportunities and supporting interdisciplinary course work are available to permit specialization in many avenues of space flight such as subsonic to hypersonic aerodynamics, aerospace vehicle design, control and guidance, modern materials and structures, propulsion systems, aircraft noise and sonic boom, flight simulation, avionics, plasma dynamics, and spectroscopic and electrooptic means, and systems management. Work is also in progress in remote sensing and magnetohydrodynamic power generation of coal utilization.

Course and research work in related areas of environmental pollution control, earth resources, energy conversion, materials and systems and simulation are also available. The research personnel and facilities of the Institute and those available at the Arnold Center through appropriate contractual arrangements provide an outstanding opportunity for meaningful research in these and other areas. Students who enroll at UT must be admitted to the Graduate School, University of Tennessee, Knoxville. Further information concerning the Institute may be obtained from the Director, The University of Tennessee at Nashville, Knoxville, Tullahoma, Tennessee 37388.

The institute is operated by The University of Tennessee in close cooperation with numerous departments at The University of Tennessee, Knoxville, and the office of the Vice Chancellor for Graduate Studies and Research.

Water Resources Research Center
W. F. Brandes, Director, M.S. Illinois

The Water Resources Research Center is a federally-designated institute for the conduct of water research for the state. The purposes of the Center are: (1) to assist and support all the academic institutions of the state, public and private, in pursuing water resources research programs addressing problem areas of concern to the state; (2) to provide information dissemination and technology transfer services to state and local government bodies, academic institutions, professional groups, environmental organizations, and others, including the general public, who have an interest in water resources matters; (3) to promote education in fields relating to water resources and to encourage the entry of promising students into careers in these fields.

The Center also has a mission in graduate education through the M.S. degree program in Water Resources Engineering.

The Center is operated through the office of the Vice Chancellor for Graduate Studies and Research.

Off-campus Graduate Centers
Kingsport University Center: The University of Tennessee offers at Kingsport resident graduate programs in science and engineering, and business at both the Master's and doctoral levels. The program is operated within the policies set by the Graduate Council of The University of Tennessee and is administered by the Vice Chancellor for Graduate Studies and Research. It is coordinated with the graduate and undergraduate offerings of East Tennessee State University.

Students who enroll in this program must be admitted to the Graduate School of The University of Tennessee, Knoxville. Information and appropriate application forms may be obtained from Marvin K. Goodman, Director, Kingsport University Center, The University of Tennessee, University Boulevard, Kingsport, Tennessee 37660.

Oak Ridge Resident Graduate Program: The University of Tennessee offers graduate study programs at Oak Ridge, with work leading to Master's degrees in Business Administration with a concentration in management, Industrial Education, and the Master's and doctoral degrees are available in engineering, mathematics, and physical and biological sciences. Courses are given in the late afternoons, evenings, and Saturdays at facilities provided by and used in cooperation with the Oak Ridge Associated Universities and the Oak Carbine Corporation, Nuclear Division.

This program is supported under a subcontract with Oak Ridge Associated Universities with principal support coming from Oak Carbine Nuclear Division. The University of Tennessee is one of the forty-three colleges and universities which sponsor ORAU, a nonprofit education and research management corporation.

Information concerning the Graduate School may be obtained by writing the Director, UT-Oak Ridge Graduate School, Post Office Box 117, Oak Ridge, Tennessee 37830.

Chattanooga Graduate Engineering Program: The University of Tennessee offers a program of graduate work leading to the Master's degree in the areas of engineering. Courses are given at The University of Tennessee at Chattanooga in the late afternoons and evenings. Students who enroll in this program must be admitted to the Graduate School of The University of Tennessee, Knoxville. Information concerning this program may be obtained from Lynn D. Russell, Director, Chattanooga Graduate Engineering Program, The University of Tennessee, Chattanooga, Chattanooga, Tennessee 37401.

The University of Tennessee at Nashville: Opportunities for graduate study leading to the degree of Master of Science in Civil Engineering, Engineering Administration, and Industrial Engineering are offered by The University of Tennessee, Knoxville and are administered by the Vice Chancellor for Graduate Studies and Research.

Students who enroll in these programs must be admitted to The University of Tennessee, Knoxville Graduate School. Information and appropriate forms may be obtained from the Registrar, The University of Tennessee at Nashville, Tenth and Charlotte, Nashville, Tennessee 37203.

The University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences: The University provides programs leading to the M.S. and Ph.D. degrees in various areas of biomedical sciences. Graduate students have the opportunity to study and to do research in the Biology Division of the Oak Ridge National Laboratory.

For complete information concerning the program, see page 147.

School of Social Work: The University of Tennessee offers a fully accredited two-year program leading to the degree of Master of Science in Social Work through the School of Social Work, with programs in Nashville, Knoxville, and Memphis.

For complete information concerning the program, see page 154.

Admission and Registration

Admission to the Graduate School requires a Bachelor's degree with a satisfactory grade point average from an accredited college or university. (A minimum grade point average of 2.5 out of a possible 4.0, or 3.0 for the senior year, is considered a satisfactory grade point average. Meeting the minimum admission requirement does not insulate acceptance into a degree program since other factors may prevent admission in some areas.) An application cannot be processed without the $10 fee payable to The University of Tennessee.

If permission to enter The University of Tennessee Graduate School is given prior to graduation, this admission is automatically withdrawn if the Bachelor's degree is not awarded before the date of registration.

The file is destroyed after one year if an applicant does not enter the Graduate School the quarter in which admission is requested, unless permission is requested and granted to enter in a future quarter. To reapply after a file is destroyed, applicants must submit a new application and fee.

Admission to the Graduate School does not imply admission to candidacy for the degree desired; admission to candidacy must be obtained after entry but at least one full quarter prior to receipt of the Master's degree and three quarters prior to receipt of the doctorate.

Types of Admissions

Admission to a Graduate Degree Program: Master's degree-Admission to a degree program requires a minimum grade point average of 2.5 out of a possible 4.0 or 3.0 during the senior year. However, many departments require a higher average. (Refer to pages 8-9 for items required for admission.)
Doctoral degree—in addition to meeting the minimum requirements for admission to the Graduate School, applicants at the doctoral level must have demonstrated a potential for superior academic performance. To be considered are such criteria as performance in prior undergraduate and/or Master's level studies, achievement on aptitude tests for graduate studies, letters of recommendation from professors familiar with the applicant's work, and similar evidence of scholarly accomplishment. (Refer to description of doctoral programs for specific requirements for admission.)

Non-degree Graduate Students: No more than 15 hours of course work completed by a student while in the non-degree status may be included in a Master's degree program. The applicant must have a satisfactory grade average (2.5 out of a possible 4.0 or 3.0 during the senior year). Non-degree students may take courses for graduate credit, providing the department approves the registration, but cannot be admitted to candidacy for a degree without first gaining admission to a graduate degree program.

Some departments will not permit non-degree students to register for graduate credit. Please contact the head of the department in which a major is planned concerning registration for graduate credit. No international student may enroll as a non-degree graduate student.

Eligibility of Seniors: A senior in The University of Tennessee, Knoxville who has been admitted to a degree program may be admitted to the Graduate School through established procedures. However, the following persons may not receive doctoral degrees from The University of Tennessee, Knoxville: a. Any member of the instructional, research, library, or administrative staff holding the rank of assistant professor and above or equivalent status at The University of Tennessee, Knoxville; b. Staff in the Institute of Agriculture holding rank of associate professor and above or equivalent status and occupying full-time research and extension positions; c. Any member of The Knoxville Tennessee system administration holding the rank of assistant professor and above or equivalent status, except in the case of Institute of Agriculture personnel as specified in item "b" above.

Any exceptions to this policy shall be made by petition to the Graduate Council at The University of Tennessee, Knoxville. A faculty member may, however, do graduate work on a non-degree basis.

Admission of International Students: The Graduate School can accept only students who have outstanding records. A student from China must possess a Bachelor's degree with a grade average of 80.0 or above for the last two years of a four-year program. A student from the Indian Institute of Science must be First Class the last two years of a four-year Bachelor's degree program after completing the twelfth grade. All students with a Master's degree must be First Class. Applicants from other countries will be evaluated upon receipt of transcript.

An applicant must present: (1) a complete and accurate chronological outline of all previous university-level education; (2) authorized school or university certified translations if the records are in a language other than English; (3) evidence of financial resources sufficient to provide him/her with at least $6200 (U.S.) per calendar year during the period of registration as a student; and (4) certification of proficiency in English. Every international student whose native language is not English must either submit a score of at least 525 on the Test of English as a Foreign Language (TOEFL), taken within the last two years, or have received a Master's degree from an accredited institution in the United States in order to gain admission.

The complete file (application, official certificates, descriptive titles of courses studied, detailed transcripts including marks gained in final examinations and English proficiency certification) must be submitted to the Graduate Office. Acceptance is conditional on the quarter in which the applicant hopes to gain admission. An applicant who is accepted will receive the necessary forms to enable him/her to obtain a student visa. The University of Tennessee will not consider for admission any student who has entered the United States on an I-20 issued by another institution. No international student will be admitted as a post-baccalaureate or non-degree student.

All students whose native language is not English must pass an English proficiency examination after arrival at the University. Students who cannot satisfy this requirement must enroll for English 1221 Written and Oral English for Foreign Students (or a course assigned by the English Department) for undergraduate credit and pass with a grade of C or better. (No student can audit this course.) A student may not take more than 6 additional hours while enrolled for English. (Any student not passing this examination at a specified level will be sent to an intensive English program until English proficiency is gained.)

Post-baccalaureate: When an applicant who has a Bachelor's degree from an accredited institution is ineligible for regular admission to the Graduate School, but believes that eligibility can be shown if given the opportunity, the student may request admission as a post-baccalaureate student. A student and the proposed major department must outline a course of study, and the student must register for 12 to 15 quarter hours during the undergraduate courses (3000-4000 level). If the student completes these with a B average, the student automatically becomes a non-degree student.

If the student does not earn a B average at the end of 15 hours, admission to the Graduate School will be denied and further registration prohibited.

A post-baccalaureate student cannot receive graduate credit for any course work when taken or at a later date. No international applicant may enroll as a post-baccalaureate student.

Admission Procedures

Procedures for admission are as follows:
(1) complete the "Application for Admission" form (first page of the catalog); select a major from those listed on pages 8-9; (2) return the completed application form along with a $10 application fee as soon as possible; (3) request the registrar of all colleges and universities attended to send two official transcripts to the Graduate School (all documents, including transcripts, submitted for admission become the property of the University and will not be returned); (4) if required, submit scores from the Graduate Record Examination or Graduate Management Admission Test; and (5) request that any reference or rating forms required as part of the application file be sent to the Graduate Office or where indicated.
Examinations
Applicants for admission to many of the degree programs are required to submit scores from the Graduate Record Examination or the Graduate Management Admission Test. (Refer to pages 9-9 for majors requiring these examinations.) All students whose native language is not English must submit scores from the Test of English as a Foreign Language (TOEFL) unless graduated from an accredited institution in the United States.

Each applicant is individually responsible for arrangements for the examination for transmission of these scores directly from Educational Testing Service to the Vice Chancellor for Graduate Studies and Research. Application forms may be obtained from Educational Testing Service, Princeton, New Jersey 08540, or from the UTK Graduate School Office.

The completed application form and examination results must reach the proper office at the Educational Testing Service approximately one month in advance of the test date (tests are given four to five times each year). Approximately six weeks should be allowed for the examination results to reach the University.

The University of Tennessee is an approved testing center for all examinations.

Readmission
A student who has not attended the Graduate School at The University of Tennessee, Knoxville for more than five quarters must apply for readmission. Since readmission is not automatic, a readmissions application should be submitted at least two weeks prior to desired reentry date. A student who has attended another accredited institution since enrollment at the University must submit two official transcripts showing all course work and any degrees earned at that institution. The student will be notified when the application is received and when action has been taken by the department and the Graduate School. If readmission is denied, the student may receive graduate credit for the work taken during the initial quarter; however, future registration will not be permitted until the student is fully reaccredited to the Graduate School.

Students are urged to reapply well in advance of planned registration.

Registration Procedures
Dates of registration are listed in the University Calendar (front of catalog). Students should report to the Graduate School to obtain registration materials (scan form and timetable of classes giving details concerning registration procedures) and then should see a department advisor to plan a program and obtain a signature.

Registration requires two days. The University holds advanced registration at approximately the middle of a given quarter for the subsequent quarter. Information may be obtained from the Graduate Office. If a student participates in advanced registration, the student should obtain the class schedule and pay fees on the first day of registration.

All graduate students, including graduate and teaching assistants, research assistants, and scholarship or fellowship holders, should complete the registering procedure at registration (in Stokely Athletics Center) or afterwards at the Treasurer's Office, where the assessment of their tuition and fees will be determined. Those who do not report to the Treasurer's Office before the established deadline for paying fees will be charged the late registration fee. Retroactive registration is not permitted.

Fees, Fee Classification, and Financial Aid

University Fees
University fees are determined by the Board of Trustees and are subject to change without notice. The general fees in effect for graduate and post-baccalaureate students are as follows:

APPLICATION FEE: $10

Each graduate application for admission must be accompanied by a fee of $10 before it will be processed. (Fee not required if: (1) former UTK graduate student; or (2) graduate application fee previously paid at another UT campus.)

If a student applied but does not enter graduate school within twelve months after date of requested admission it will be necessary for him or her to resubmit the $10 application fee and application. This fee is not refundable.

MAINTENANCE FEE (all students):

PER QUARTER $160

TUITION (additional for out-of-state students):

PER QUARTER $312

NOTE: In lieu of the above charge for tuition and/or maintenance fee, part-time students may elect to pay fees computed by the quarter hour credit (or audit) as follows:

In-State $23 per quarter hour or fraction thereof; minimum charge $69.
Out-of-State $54 per quarter hour or fraction thereof; minimum charge $162.

All fees collected at registration are subject to audit for correctness. Adjustments, if needed, will be made after final audit.

UNIVERSITY PROGRAMS AND SERVICES FEE:

PER QUARTER $20

All graduate students taking in excess of 8 quarter hours per quarter will be assessed a University programs and services fee of $20 per quarter. Part-time students taking 8 quarter hours or less will be assessed at the rate of $1 per quarter hour or fraction thereof; minimum charge $3.

The fee for the summer quarter will be $15. Part-time students taking 8 quarter hours or less will be assessed at the rate of $1 per quarter hour or fraction thereof; minimum charge $3.

Graduate and teaching assistants, as well as fellowship students who may have waiver of fees (tuition and/or maintenance), must complete their registration at the Treasurer's Office and pay the appropriate part of the fee.

Students enrolled exclusively in Evening School or at off-campus centers will be exempt from the programs and services fee.

Students taking a course load of 6-8 hours may elect to pay the full programs and services fee. This fee is not refundable.

LATE REGISTRATION FEE:
All students are required to have a validated fee receipt to complete the registration procedure. This includes students whose fees are billed, prepaid, or waived. Students who do not complete registration on the regular dates scheduled for this purpose will be charged a late registration fee of $2 up to $43. See the University General Catalog for application of this fee. The payment of fees with a check which is not honored by the bank will incur a service charge of $10 to $43, depending on the date the check is redeemed.

MUSIC FEE:
One-half-hour lesson per week, per quarter ............. $20
One-hour lesson per week, per quarter .................. $40
Payable by students receiving individual instruction in music.

GRADUATION FEE:
Master's degree candidates ....................... $16
Doctoral degree candidates ....................... $41

There is no additional charge for diploma, binding, or microfilming. The graduation fee is non-refundable and is valid for three quarters after the quarter in which it is paid.

DEFERRED PAYMENT SERVICE FEE: $3

This fee is applicable when the payment of any part of a student's account is deferred, including accounts which must be billed to outside agencies, organizations, and institutions. This fee is also applicable when any additional charge (out-of-state tuition, music fee, room and board adjustments) is not paid within five regular business days after the date it was incurred.

If the student's responsibility to take the initiative to pay all University obligations promptly.

AUDITORS FEE:
Fees for courses being audited are the
same as courses taken for credit. For fee purposes, non-credit seminars are considered as one-hour courses.

REFUND OF FEES FOR WITHDRAWAL:
Withdrawal from school for the quarter after receiving a schedule must be by official notification to the Withdrawal Office, Student Counseling and Services Center, 900 Volunteer Boulevard, whether or not fees have been paid, classes have been attended, or the schedule is incomplete. Failure to attend class does not automatically allow a student to withdraw. A student who is not officially notified as having dropped a course will have to do so in person at the Deans Office.

The effective date of withdrawal is the date the Withdrawal Office is notified by completion of the official withdrawal request form. The appropriate percentage of fees will be charged unless this action is initiated by the student before the first official day of classes for the quarter. Failure to notify the Withdrawal Office promptly when withdrawing could result in a larger fee assessment. Withdrawal does not cancel fees or charges incurred. A student who withholds notification of withdrawal to the Withdrawal Office will be held liable for fees and charges already incurred.

The drop/add procedure must not be used to withdraw from school for the quarter.

For a regular academic quarter, withdrawal within 7 calendar days beginning with the first day following regular registration permits an 80 percent fee refund. Withdrawal between 8 and 14 calendar days following regular registration permits a 60 percent fee refund. Withdrawal between 15 and 21 calendar days following regular registration permits a 40 percent fee refund. Withdrawal between 22 and 28 calendar days following regular registration permits a 20 percent fee refund. The above refund policy does not apply to the off-campus Graduate Centers. At the Centers, no refund is made after the first 14 days. Refunds, in accordance with the withdrawal refund policy, will be made after the Center's deadline.

Part-time students may pay fees computed at the appropriate quarter-hour rate as indicated above. No charge is made for courses dropped after 21 days. Students who drop courses are eligible for a refund only if the sum of the charges for the course(s) dropped and the regular registration day for the course(s) involved is computed at the appropriate quarter-hour rate as indicated above. No charge is made for courses dropped after 21 days. Students who drop courses are eligible for a refund only if the sum of the charges for the course(s) dropped and the regular registration day for the course(s) involved is computed at the appropriate quarter-hour rate for the quarter. No charge is made for courses dropped after 21 days. Students who drop courses are eligible for a refund only if the sum of the charges for the course(s) dropped and the regular registration day for the course(s) involved is computed at the appropriate quarter-hour rate for the quarter.

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WAIVER OF FEES:
Graduate assistants, teaching assistants, and others whose fees are billed, prepaid, or waived must complete their registration with the Bursar's Office, where they should have their fee receipts validated and supply necessary details concerning fee payment waiver.

NOTE: All fees are subject to change.

Fee Classification for the Purpose of Paying University Fees
Shortly after a student applies to the Graduate School, the receipt of the application, application fee, and residency classification for fee purposes is sent.

If a student has any questions concerning the residency status, he/she should contact the Residential Clerk at the Graduate School Office.

Rules for Determination of Status:
(1) Every person having his or her domicile in this state shall be entitled to classification as an in-state student for fee and tuition purposes. No person having domicile elsewhere than in this state shall be entitled to classification as an in-state student for fee and tuition purposes.
at the beginning of the quarter or semester in which application for reclassification was submitted.

**Student Financial Aid**

The University of Tennessee offers a comprehensive program of financial aid for full-time students who otherwise would not be able to attend the University. Through this financial aid program an eligible student may receive one or more types of assistance to help pay college expenses.

Financial need is defined as the difference between a family's resources and the total expenses of attending the University. If there is a deficit, the student is considered to be in need of financial assistance. To assist in determining the need for financial aid, the University of Tennessee utilizes the need analysis system of the College Scholarship Service (CSS). Through the use of the CSS form and the Free Application for Federal Student Aid (FAF), the Financial Aid Office determines the amount the parents and students could generally be expected to contribute toward meeting educational expenses. For more detailed information on the determination of need, please refer to the brochure entitled, "Financial Assistance for Students."

The University of Tennessee has two basic types of financial aid for graduate students—loans and part-time employment. These may be awarded individually or in combination according to the needs of the student.

**Fellowships and Assistantships**

The Hilton A. Smith Graduate Fellowships for full-time studies at The University of Tennessee, Knoxville are awarded on the basis of ability and without regard to the field of study of the candidate. Monthly stipends are provided, and tuition and maintenance fee are paid by the University. Applicants need better than an overall 3.0 grade point average. A loan of up to $250 per quarter to an annual maximum of $750 is available, subject to change by federal legislative action.

**Nursing Student Loans.** The Nursing Student Loan Program is operated for a period of nine months after graduation or as long as the individual remains in at least half-time attendance at an accredited institution of higher education in the United States. Repayment may also be deferred for a period of three years while the borrower is serving in the Armed Forces, Peace Corps, or Vista. Interest is 3.5 percent per year on the unpaid balance. The maximum repayment period is 10 years with the current minimum annual repayment of $360 or 10 percent of the accumulated loan, whichever is greater. If upon graduation the student becomes a full-time teacher in a public or non-profit school which is designated by the Commissioner as having a high enrollment of low-income families or becomes a teacher of the handicapped, 15 percent of the total principal plus interest is cancelled for the first and second years of teaching, 20 percent for the third and fourth years, and 30 percent for the fifth year. If after graduation the student becomes a staff member in a preschool program which is operated for a period comparable to one year, 15 percent of principal plus interest will be cancelled for each year of service. Cancellation for up to 50 percent of the loan will also be granted for each year of Armed Forces service in an area of hostility. Graduate level students may be extended annual loans of $2,500 to a maximum accumulated (undergraduate and graduate) loan total of $10,000. The above regulations and provisions of the National Direct Student Loan Program are subject to change by federal legislative action.

The University of Tennessee Student Loans. Student loans from University sources are available to currently enrolled students with a 2.0 or above cumulative grade point average. A loan of up to $250 per quarter to an annual maximum of $750 can be extended. One surety or cosigner is required for each promissory note and a new promissory note must be completed for each loan installment. The interest is 3 percent per annum payable annually on the anniversary date of the note. The loan is made for a specific time period and is due at the beginning of each year from the date of the note. Extensions may be obtained if academic studies are continued at the graduate level. The borrower may, without penalty, pay all or part of the loan at any time before the maturity date.

**Nursing Student Loans.** The Nursing Student Loan Program is offered to students who are enrolled or admitted as students in a course of study leading to a baccalaureate or graduate degree in nursing and who show need of assistance in order to pursue their course of study. The program provides a long-term, low-interest loan with repayment beginning nine months following termination of half-time study at an accredited school of nursing. Repayment may also be deferred for a period up to three years while the borrower is serving in the Armed Forces or Peace Corps or up to five years for a full-time course of study leading to advanced professional training. If upon graduation the student becomes employed full-time as a registered nurse in a public or non-profit private agency or institution, up to 10 percent of the principal may be cancelled at the rate of 15 percent of the loan that was unpaid on the first day of employment plus interest for the first 3 years of employment and 20 percent for the fourth and fifth years of employment.

A Nursing Student Loan or any other educational loan will be repaid by the U.S. Department of Health, Education and Welfare if the nursing graduate enters into an agreement to serve as a full-time registered nurse for a continuous period of at least 2 years in an area designated as having a shortage of nurses. Thirty percent of principal plus interest will be cancelled for the first 3 years of employment and 25 percent for the fifth year. The above regulations and provisions of the Nursing Loan Program are subject to change by legislative action.

**Student Employment**

Two employment programs are administered in the Financial Aid Office to help students find part-time employment. The College Work-Study Program is a federal work program which provides jobs for students who have financial need and who must earn a part of their educational expenses. Eligible students are placed in jobs on- or off-campus where they work approximately 15 hours per week. The Student Employment Service operates as a central referral agency. It coordinates lists of part-time employment from both University and private employers with the requests of students seeking part-time employment. Referrals are made in accordance with the student's skills and qualifications. Part-time jobs average from 15 to 20 hours per week.

**Other Assistance**

**Guaranteed Student Loans** to help meet educational expenses may be available through the federal government or a state guaranteeing agency. In addition, banks and credit unions can determine participation in the program. To receive the loan, one must be admitted to or in regular full-time attendance in good standing at the University. Interest on such loans is paid by the federal government while the student is in school if the student is eligible for interest benefits. During the repayment period, all loans made to active duty military personnel who must earn a part of their educational expenses may be cancelled at the rate of 15 percent of the loan that was unpaid on the first day of employment plus interest for the first 3 years of employment and 20 percent for the fourth and fifth years of employment. If the student enters into an agreement to serve as a full-time registered nurse for a continuous period of at least 2 years in an area designated as having a shortage of nurses, thirty percent of principal plus interest will be cancelled for the first 3 years of employment and 25 percent for the fifth year. The above regulations and provisions of the Nursing Loan Program are subject to change by legislative action.

**Application Procedures**

Because a student's resources can...
Summer employment may be possible.

Aspects of the operation of the hall to coordinating and supervising assigned and assists the Head Resident in the Assistant Head Resident is responsible to the Office of the Registrar for University authentication and processing.

Further information can be obtained from the Office of Residence Halls, 405 Student Services Building, The University of Tennessee, Knoxville, Tennessee 37916.

Veterans' Benefits

The Office of the Registrar administers the University's participation for programs of the Veterans Administration. Each veteran or eligible dependent should apply to the nearest Veterans Administration office for a certificate of eligibility. The application should be made before registration if possible. Certificates of eligibility are sent directly to students who then bring them to the Office of the Registrar for University authentication and processing.

Applications for financial aid can be obtained by writing to The Financial Aid Office, 301 Student Services Building, The University of Tennessee, Knoxville, Tennessee 37916.

General Information

Housing

Single Men and Women: Single graduate students are provided excellent accommodations in both traditional and modern facilities which are conducive to academic achievement and personal development. Single graduate students have the same priority as other single students and may be assigned to any residence hall. Some units of the residence halls and of the student apartment building have been designed specifically for single graduate students.

In Melrose Hall the graduate section offers community living units for groups of up to ten students with personal responsibility emphasized. The Holt Avenue Apartment Residence Hall accommodates, on a graduate floor, students in groups of four. It is the responsibility of each resident to maintain the apartment by University standards. Further information can be obtained from the Office of Residence Halls, 405 Student Services Building.

Assistant Head Resident positions are available for single graduate students. The Assistant Head Resident is responsible to and assists the Head Resident in coordinating and supervising assigned aspects of the operation of the hall to which the assignment is made. The position is a part-time live-in position, with appointment on a 9½-month basis. Summer employment may be possible.

Services to the Physically Disabled

Services relating to academic programs for students with physical disabilities, whether permanent or temporary, are coordinated by the Office of the Dean of Admissions and Records, 305 Student Services Building. In conjunction with the Physical Plant Office, the UT Bookstore, the Student Activities Office, and the academic departments, efforts are made to insure that attendance at the University of Tennessee, Knoxville is as convenient as possible for students with physical disabilities.

These services include assistance during registration (preregistration, collection of class schedules, payment of fees, drop and add); the securing of special parking permits, elevator keys, tickets for special events; and similar efforts to relieve the special mobility problems of the students. The Physical Plant Office coordinates efforts to eliminate physical barriers to the degree possible, with priority being given to access and facilities for academic buildings.

The Office of the Dean of Admissions and Records assists students in the scheduling of special class sections in order to respond to the particular needs of the physically handicapped.

Vehicle Operation and Parking

The University of Tennessee endeavors to provide adequate facilities for the increasing number of vehicles being operated by students. However, the areas available for parking are necessarily limited. In an effort to provide parking facilities and to reduce the traffic congestion within the campus area, large student parking areas are located on the perimeter of the campus. The University provides an intracampus bus system connecting these parking areas with the main campus and provides transportation to the campus and staff parking areas are located throughout the campus.

Each person who operates a motor vehicle in connection with attendance or employment at the University must register that vehicle with the Traffic section of the Security Department. A University Traffic and Parking Authority determines the parking policy, traffic regulations, and fees, and this information is published each year in the "University Traffic and Parking Regulations." Consequently, a system of fees for violations of these regulations is established by the University Traffic and Parking Authority. The importance of compliance with these parking and traffic regulations is indicated by the following policy of the UTK Traffic and Parking Authority.

Any staff member or student who has failed to pay traffic citations is subject to disciplinary action up to and including termination or dismissal from the University.

Students with unpaid traffic citations will not be permitted to register at the beginning of the quarter until indebtedness is cleared.

A staff member with unpaid traffic citations will not be allowed to register the vehicle or purchase a parking permit. If a traffic citation is not paid or appealed within 10 working days after issuance, a penalty of 50 percent of the fee will be assessed. This penalty does not apply to fire lane violations.

Computing Center

The University of Tennessee Computing Center (UTCC) provides computing facilities and services for the needs of the University's teaching, research, public service, and administrative activities. In particular, UTCC maintains close contact with the UTK academic community by supporting research and instructional users with professional computer staff.

UTCC is principally located in the Stokely Management Center in and Andy Holt Tower. From the Stokely location, UTCC supplies computing services to all UT campuses through job entry facilities located on each campus. At UTK, UTCC maintains five job entry stations for batch work and eight sites for interactive computer work.

UTCC's equipment consists of an IBM 370/148, an IBM 360/65 and a DECsystem-10 which are used for research, instruction and administrative computing work. UTCC also maintains an IBM 360/65 which is used exclusively for administrative work. The IBM 370/148 has two million bytes of memory, and the IBM 360/65 has 2.75 million bytes of memory. The DECsystem-10 is a 1080 configuration with 256K words of memory.

UTCC supports remote job entry stations (card reader/line printer) with the IBM 370/148-IBM 360/65 DECsystem-10 combination and a CalComp plotter. The IBM 370/148 and 360/65 run under OS/360 MVT with HASP II. The DECsystem-10 runs under the TOPS-10 Monitor. The time sharing system supported by the two machines includes ATS/360, FORTRAN, BASIC, COBOL, Assembler language, and other special purpose application packages.

UTCC publishes a User's Guide which describes the use of the IBM 370/148 and 360/65 and policies and procedures and the DECsystem-10 Programmer's Guide, which is a general handbook for the use of the DECsystem-10. The two guides are available at the UT Book and Supply Store. UTCC also publishes a monthly Newsletter which announces systems, equipment and procedural changes and contains other...
items of interest to the user community. Program writeups and special user's guides are also published.

UTCC periodically offers intensive training seminars of several days duration in computer utilization on the IBM 370/148 and 360/65 and the DECSYSTEM-10. These seminars are planned primarily for faculty, staff and graduate students who use or plan to use UTCC facilities. UTCC offers non-credit short courses each quarter in topics such as programming languages and special purpose programs. These courses are announced in the Newsletter and in the UT Daily Beacon.

Computing services can be requested via the Request for Services form available from the business office in the Stokely Management Center. All users of UTCC facilities are assigned a consultant to provide user assistance.

Office of International Student Affairs

This office, located at 201 Alumni Hall, assists students from other countries with the many matters that are of particular concern to them during their stay in the United States. International Student Affairs serves as the official University representative in all matters involving immigration authorities, international educational organizations, and foreign governments.

The office maintains the student's official immigration records and handles questions regarding immigration regulations. It coordinates such projects as a community volunteer program for international students and activities for student spouses. To aid the international student's understanding of American life, the Center's staff serve as advisors on personal and related problems.

Orientation programs are held at the beginning of each term, and international students are urged to attend them.

International students applying for admission should write to: The Vice Chancellor for Graduate Studies and Research, The University of Tennessee, Knoxville, Tennessee 37916.

University International House

The International House is located approximately two blocks from the heart of the campus, at 1601 West Clinch Avenue. Provided by The University of Tennessee and operated by the staff of the Office of International Student Affairs, the House provides an activity center where domestic and international students may meet to relax and discuss matters of mutual interest. The small library at "I" House contains books and periodicals from all over the world.

The University Library

The University of Tennessee, Knoxville Library owns approximately 1,390,000 volumes, 1,970,000 manuscripts, 50,000 microfilm reels and 1,100,000 items of other microtext, plus recordings, tapes, United States and United Nations documents, and more than 20,000 periodicals and other serial titles, which are received annually. The library's membership in the Association of Research Libraries indicates the University's emphasis on research and graduate instruction at the doctoral level and the support of large, comprehensive collections of library materials on a permanent basis.

Interlibrary loan service augments the UTK Library research holdings for faculty and graduate students and includes borrowing monographs, obtaining copies of needed materials, and providing access to bibliographic services offered by other institutions, such as computer-based data searches and information retrieval.

Library holdings in Knoxville are housed in the James D. Hoskins (Main) Library and its five branches: Agriculture, Law, Music, Science-Engineering, and the John C. Hodges Undergraduate Library. The Special Collections section, located in the Main Library, is a repository of regional and local materials, Tennessee, and other specialties, including the legislative records and memorabilia of many Tennessee political figures, and the Radiation Biology Archives which houses the files of a group of internationally renowned scientists. Its materials are of particular interest to scholars in the fields of history, political science, social sciences, biological sciences, and the arts.

The libraries located on the statewide campuses in Chattanooga, Martin, Memphis, Nashville, and Tullahoma are individually administered; all libraries of The University of Tennessee are accessible to all students and faculty in the system.

General Regulations of the Graduate School

Responsibility

A graduate student must assume full responsibility for knowledge of rules and regulations of the Graduate School and departmental requirements concerning the individual degree program. A statement on Graduate School and Responsibility is printed on the back of the student's Admission Status Form. Additional copies are available at the Graduate Office.

Requirements

The Graduate School requirements are minimal and, in many cases, are exceeded by those of the individual departments. In some cases, departments have brochures describing in detail their programs and requirements.

Academic Termination

Continuous registration is not automatic. Graduate credit (particularly at the doctoral level) requires continuous evaluation of the student. This evaluation includes not only periodic objective evaluations such as satisfactory cumulative grade point average, satisfactory completion of the preliminary examination and approval of the dissertation or thesis but also the overall appraisal by the faculty of the student's progress and potential. The determination to dismiss a student for academic reasons requires a report written both objective and subjective; a student may be terminated from a program regardless of his or her grade point average. Although a B average is required for graduation, the determination of whether a student is making satisfactory progress toward the degree does not depend solely on his or her grade point average but reflects the appraisal of the student's total record and potential.

Departments (programs) may develop requirements for graduation or continuation in addition to the minimum requirements set forth in this Catalog. Such additional requirements must be in writing and on file in the Office of the Dean for Graduate Studies. It is the student's responsibility to become familiar with any additional requirements of his/her department (program).

Appeals Procedure

Normally grievances should be handled at the departmental level through the student's advisor, the department head, or program head. Further appeal may be made to the Vice Chancellor for Graduate Studies and Research, then to the Chancellor and, if such appeal is not satisfied, to the By-Laws of the University (Article V, Section 7) provide that any individual may ultimately appeal to the Board of Trustees, through the President. A copy of the detailed procedure is available in the Graduate Office and in each department.

Correspondence Study

No graduate credit is allowed for work done by correspondence study with this or any other university.

Graduate Credit

No student may receive graduate credit for a course unless properly admitted to the Graduate School. The student is expected that students will be so admitted prior to registration for courses carrying graduate credit. In some instances, however, students who appear to meet the criteria for admission as graduate students will be so admitted prior to registration for graduate credit after filing an application for admission to the Graduate School and paying the application fee. Transcripts (two official copies) and additional materials required must then be filed with the Graduate Office at once. If the student is admitted within seven weeks from the last day of registration, the student may receive graduate credit for the courses. Should the student not be so admitted, whether because of lack of qualifications or because of failure to furnish the necessary materials in ample time for a decision concerning admission, the courses being taken will be changed to undergraduate credit, and no future registration will be permitted until the student is properly admitted as a graduate student.

Change of Registration

A student's permanent record card will show all courses for which registration has been completed, except those from which the student withdraws during the first 5
calendar days after the beginning of classes.

Students who fail to attend the first class meeting without prior arrangement with the department may be dropped from the course. The department or college office may require students to make their spaces available to other students. Students must respond to these requirements in a reasonable time.

The deadline for change of registration (from credit to audit, audit to credit, graduate to undergraduate, undergraduate to graduate, withdrawal, etc.) is set at midquarter, approximately 35 calendar days after the first day of classes each quarter. A student may change registration from a course at any time up to and including this date by executing a change of registration slip and submitting this to the Graduate Office. The advisor’s signature is not required. The instructor’s signature is required to add a course two weeks after classes begin and/or to add a course that is closed. If withdrawal from a course or from the University occurs after the first 5 days of classes and before the withdrawal deadline, the grade of W will automatically be entered on the student’s record by the Registrar’s Office on the student’s class roll sent to the instructor in the course.

A student withdrawing from a course, or from the University, after the withdrawal deadline will receive a grade of F unless the student can clearly demonstrate that the request for withdrawal is based on circumstances beyond the student’s control.

Examples of circumstances beyond the student’s control are:

a. Illness or injury of the student (verified by the Student Health Service or private physician).

b. Necessary change in work schedule occurring after the drop deadline (verified by the student’s employer).

c. Examples of causes which are within the student’s control and which would not be acceptable to grant withdrawal permission are:

a. Improper registration on the part of the student.

b. Failure to achieve academically.

c. A student wishing to withdraw from a course, or from the University, after the withdrawal deadline, or change his or her registration shall present the request, together with evidence of extenuating circumstances to the Graduate Office. If the request is approved, the Graduate Office will notify the Office of Admissions and Records, which will enter the grade(s) of W on the student’s permanent record.

### Maximum Load

The maximum load for a graduate student is 12 hours; however, a student may register for more than 12 hours if the student has not been completed in the Graduate Office at the end of the second quarter, the I will be converted to an F. The incomplete will not be counted in the cumulative average until a grade is assigned. No student may graduate with an I on the record.

S/NC—(carries credit hours, but no quality point value); S is equivalent to B or better, and NC means no credit earned. NC grades may be repeated for an S.

S/NC grading is allowed only where indicated in the Graduate Catalog. The number of S/NC courses to be allowed in a student’s program of study shall be limited to one-fourth of the course work hours required (excluding thesis or dissertation) in a program. (This would be 9 hours in a 45-hour Master’s thesis program or 12 hours in a 45-hour non-thesis program or 18 hours in a doctoral program of 72 hours excluding dissertation hours.)

S/N is used for courses which culminate in a thesis, dissertation, or preliminary examination. The N grades take on the value of the S when the thesis or dissertation is accepted by the Graduate School.

Graduate students are required to make an overall minimum grade average of B in courses taken for graduate credit. No graduate student will be allowed to repeat a course for the purpose of raising a grade already received. The grade will not be counted in computing the grade average on courses completed in the Graduate School.

### Course Numbers

All 5000- and 6000-level courses are graduate courses. Some 3000- and 4000-level courses, if listed in the Graduate Catalog, are available for graduate credit; however, a "G" must be indicated on the registration material at the time of registration. (A "G" will also be placed on the permanent record beside the hours credit.)

### Prerequisites

Graduate work in any department must be preceded by sufficient undergraduate work in the major area and related ones to satisfy the department that the student can successfully do graduate work in the chosen field. All prerequisites are not listed in the Graduate Catalog since undergraduate records are examined and evaluated by the appropriate department before admission to a degree program.

### Residence Requirements

There is no residence requirement for any Master’s program.

The Specialist in Education Degree requires one quarter of full-time study if the student has a Master’s degree. A student without a Master’s degree is required to have two consecutive quarters of full-time residence.

*If a student receives an I after finishing the course work for the Master’s degree but has not received the degree, he/she may graduate with an I with the approval of the Vice Chancellor for Graduate Studies and Research.
The minimum residence for any doctoral degree is one academic year of three consecutive quarters of full-time study (minimum of 9 hours) in the resident graduate program. A student in residence is devoting essentially all energies to graduate study on campus. Part-time enrollment does not count toward this requirement. Consecutive quarters include the summer quarter.

Revision of Program
A student who wishes to revise a major program of study must complete a “Request for Revision of Graduate Program” form which can be obtained from the Graduate Office. It is necessary to obtain the signature of the head of the department in which admission was previously granted. No signature is needed if a student is requesting a change from one degree to another in the same department.

Time Limit
The time limit for the use of graduate credit toward a Master’s degree is six years from the beginning date of the earliest course applied toward the degree. The last 45 hours of credit for an Specialist in Education degree must also be earned within a period of six years prior to the award. Normally, these time limits may not be extended. However, in exceptional cases, courses taken beyond these periods may be recognized after special examination or other means recommended by the department and given prior approval of the Vice Chancellor for Graduate Studies and Research.

The doctoral program must be completed within a period of five years after passage of preliminary examinations.

Graduate School News
The Graduate School News is published quarterly and is available to all graduate students. Calendars, schedules, and new requirements for degrees are published in order for students to have access to the latest information, some of which may supersede this catalog.

Proficiency Examination
A proficiency examination may be given in any academic course offered for graduate credit. To be eligible, a student must be regularly admitted to the Graduate School, and the examination must be recommended by the head of the department offering the course. Students applying for this privilege must present evidence that they have developed the knowledge and abilities expected of graduate students who have taken the same courses. Upon passing such an examination with a minimum grade of B, the student will receive regular graduate credit. A maximum of three graduate course credits may be completed by this method. A fee must be paid before administration of each examination. Proficiency examinations may not be used to raise the grade or change the credit in a course previously completed, nor may such an examination be repeated.

English Proficiency
Any student whose native language is not English must present a TOEFL score of at least 525 unless he/she has received a Bachelor’s or Master’s degree from an accredited institution in the United States. The student must also pass an English proficiency examination prior to initial registration. The regulations concerning this examination are described under Admission of International Students.

Law Courses
A graduate student may be allowed to take up to 9 quarter hours of law courses and receive credit toward a degree upon approval of the College of Law and department committee chairman. MBA students may take a maximum of 12 hours.

Transfer Credits
A maximum of 9 quarter hours (6 semester hours) may be transferred into a student’s Master’s program from work taken at accredited institutions. (Extension courses at other universities are not applicable.) One-half of a student’s program must be transferred from within The University of Tennessee System. Such work must have been taken for graduate credit and passed with a grade of B or better, be part of an otherwise satisfactory graduate program (B average) but not used toward another degree, and be listed on the Admission to Candidacy Form approved by the committee members and the Vice Chancellor for Graduate Studies and Research. Ordinarily, course work from foreign institutions is not transferred since these institutions have not been accredited. This course work must be completed within the six-year period prior to the receipt of the degree. The same rule applies also to the Specialist in Education degree. Courses transferred into a student’s Master’s program from a combination of University of Tennessee System courses and courses from other institutions so long as the total accepted does not exceed one-half the total program, and courses accepted from outside The University of Tennessee System do not exceed 9 quarter hours. Transfer credits will be placed on The University of Tennessee transcript record only after the student has been admitted to candidacy. Courses taken for graduate credit at another institution and passed with a grade of B or better from a satisfactory graduate program (B average) may be accepted in a student’s doctoral program. The number of hours a student may include will be determined by the doctoral committee. They must be listed on the Admission to Candidacy form and approved by the committee members. Although the hours may be used as part of the requirements for the degree, the courses will not appear on The University of Tennessee transcript record. Official transcripts must be received by the Vice Chancellor for Graduate Studies and Research directly from appropriate institutions. If any transfer or credit will be approved.

Requirements for Advanced Degrees

Master’s Degrees
Master’s degree programs offered in the Graduate School may be found under “Majors and Degrees Available” on pages 9-9. See also chart, page 22 for a summary of procedures for these degrees.

Non-Thesis Programs: Some departments offer optional non-thesis programs for the Master’s degree. Departmental announcements indicate whether this option is available.

Course Requirements: A candidate for a Master’s degree must present a total minimum credit of 45 quarter hours of approved graduate courses. These hours may be entirely in one major subject or may include one or two minors, if approved by the student’s faculty advisory committee and the Vice Chancellor for Graduate Studies and Research. The major subject must include at least 18 quarter hours of course work except in the MBA degree program. A minor shall consist ofnot less than 9 or more than 18 quarter hours of course work. All courses for which a student registers must be completed (even officially dropped) before graduation. At least one-half of these total hours in the graduate program must be at or above the 5000-level, of which no more than 9 may be
which the thesis is accepted by the register for a minimum of 3 hours of 5000, the candidate shall continue to work each quarter in the Graduate School. Similar rules apply when problems are used in lieu of the thesis.

The examination is not merely a reexamination of course work but is a test of the candidate's ability to integrate material in the major and related fields. It must be scheduled through the Graduate Office in accordance with the Graduate School News deadlines and will be conducted by a committee of not fewer than three faculty members, with the student's major professor as the chairperson. (Members of the University faculty may attend the examination.) In case of failure of the final examination, the candidate may not appear for reexamination until the following quarter. The result of the second examination is final.

Final Examination for None-Thesis Students: A none-thesis student must pass a final written examination on all work offered for the degree. The examination may or may not follow this examination with an oral examination.

The examination is not merely a reexamination of course work but is a test of the candidate's ability to integrate material in the major and related fields. It must be scheduled through the Graduate Office in accordance with the Graduate School News deadlines and will be conducted by a committee of not fewer than three faculty members, with the student's major professor as the chairperson. In case of failure of the final examination, the candidate may not appear for reexamination until the following quarter. The result of the second examination is final.

Final Examination for Thesis Students: A candidate presenting a thesis must pass a final oral (or oral and written) examination on all work offered for the degree. The examination is not merely a reexamination of course work, but it is a test of the candidate's ability to integrate material in the major and related fields, including the work presented in the thesis. This examination, which must be scheduled through the Graduate Office shall be held at least 10 days before the final date for submission of theses to the Graduate School. The complete thesis, in a form approved by the major professor, shall be distributed to committee members at least one week before the date of the final oral examination. This examination will be conducted by a committee of not fewer than three faculty members, with the student's major professor as the chairperson. (Members of the University faculty may attend the examination.) In case of failure of the final examination, the candidate may not appear for reexamination until the following quarter. The result of the second examination is final.

Final Examination for Non-Thesis Students: A non-thesis student must pass a final written examination on all work offered for the degree. The examination may or may not follow this examination with an oral examination.

The examination is not merely a reexamination of course work but is a test of the candidate's ability to integrate material in the major and related fields. It must be scheduled through the Graduate Office in accordance with the Graduate School News deadlines and will be conducted by a committee of not fewer than three faculty members, with the student's major professor as the chairperson. In case of failure of the final examination, the candidate may not appear for reexamination until the following quarter. The result of the second examination is final.

Thesis: The thesis represents a culmination of original research project completed by the student. The organization, method of presentation, and subject matter of the thesis are important in conveying to others the results of research. Two copies of the thesis must be submitted to and approved by the Graduate School. The dates specified by the Graduate School. Each copy of the thesis must include an approval sheet, signed by the members of the committee, which certifies to the Vice Chancellor for Graduate Studies and Research that the committee has examined the final copy of the thesis and found its contents to be satisfactory. The student should check with the department head concerning additions required copies of the thesis. The thesis must be prepared according to the Graduate School Thesis and Dissertation Manual.

Specialist in Education Degree

The Specialist in Education (Ed.S.) degree is offered in Curriculum and Instruction, Educational Administration and Supervision, Educational Psychology and Guidance, Safety Education and Service, and Vocational-Technical Education. Students in the Graduate School who become candidates for the Ed.S. must have a minimum of one year of teaching experience or its equivalent. Admission to the Specialist in Education program requires formal application for admission to Graduate School, followed by processing and recommendation by the department or the student is majoring, and is dependent upon final approval by the Vice Chancellor for Graduate Studies and Research.

The formulation of the student’s program, supervision of program development, recommendation for admission to degree candidacy, direction of research, and qualifying and terminal examinations are executed by a committee of not fewer than three faculty members. This committee is appointed upon request from the department head by the Vice Chancellor for Graduate Studies and Research and will include a minimum of two members from the department or area of specialization. See chart, page 23 for summary of procedures.

Course Requirements: Each student's program involves a minimum of six quarters of study totaling not less than 90 quarter hours. A student with a Master's degree is required to have at least one quarter of full-time residence. A student without a Master's degree is required to have two consecutive quarters of full-time residence. A minimum of 12 quarter hours from collateral fields in professional education (outside the major department or area) and 12 quarter hours from fields outside of the College of Education is required for each individual program.

Credits earned in a Master's degree may meet course requirements in the student's Specialist in Education program to which they are specifically comparable. Nine hours of work beyond the Master's degree may be transferred from approved institutions and may be used to meet the student's course requirements. (See Transfer Credits, page 19.)

For a student admitted to the program with a Master's degree or appropriate work beyond the Master's degree, program requirements may be modified upon recommendation of the student's committee and approval of the Vice Chancellor for Graduate Studies and Research, except that no modifications shall be permitted to the following: (1) examination requirements, research requirements, and the minimum of 24 quarter hours of course credit.
outside the department or area in which the student is doing the work are met; and (2) all graduate course work completed prior to admission accepted as part of the student's program must be appropriately related to the student's objectives.

Undergraduate courses required for certification at The University of Tennessee in the student's field of specialization may not be taken for graduate credit as part of the program. At least 22% of the last 45 hours of course work, exclusive of the thesis or problems, must be in 5000- or 6000-level courses.

**Admission to Candidacy:** Admission to candidacy is established by formal application to the Vice Chancellor for Graduate Studies and Research, normally during or immediately following the quarter in which the student's course credit totals or exceeds 45 hours and upon the recommendation of the student's committee. Approval of the Vice Chancellor for Graduate Studies and Research is required. The student must submit the Admission to Candidacy form, with appropriate signatures, to the Graduate Office no later than commencement day of the quarter preceding the quarter in which the student plans to graduate. A qualifying examination is required if the student's Master's degree was earned six or more years prior to admission to the program. The qualifying examination may be written, oral, or both written and oral.

**Thesis:** The thesis represents a culmination of an original research project completed by the student. The organization, method of presentation, and subject matter of the thesis are important in conveying to others the results of such research. A minimum of 9 hours of research credit (5180, 5190, and 5200) is required. If the student does not complete the research during the first quarter registered for 5200, the student must continue to register for the course each quarter as long as active work on the thesis continues or until the thesis is accepted by the Graduate School. The thesis is to be prepared according to the instructions in the Graduate School Thesis and Dissertation Manual. It should be approved by the committee prior to submission and must be submitted by the appropriate date the quarter the student wishes to graduate.

**Final Examination:** The final step in the program is an oral examination covering the student's research and course of study. This examination must be scheduled through the Graduate Office in accordance with the regulations in the Graduate School News. In case of failure, the student may not appear for reexamination until the following quarter.

**Doctoral Degrees**

Three doctoral degree programs are available: Doctor of Philosophy, Doctor of Education, and Doctor of Business Administration. Doctoral programs are listed under " Majors and Degrees Available" (see pages 8-9). The doctoral degree, the highest in-course degree, is awarded in recognition of distinctive scholarship and the completion of a research project which is a significant contribution to knowledge.

Doctoral programs include a field of specialization and often study in one or more collateral fields. Collateral study is defined as a minimum of 9 quarter hours of graduate courses in a given area outside of the department of the student's major field. The selection of specific courses will be determined by each student's faculty committee, subject to regulations of the Graduate School and approval by the Vice Chancellor for Graduate Studies and Research. See chart, page 24, for summary of procedures for this degree.

**Doctoral Committee:** The student's committee is nominated by the student's major professor who serves as the chairperson of the committee, and department head and approved by the Vice Chancellor for Graduate Studies and Research, preferably before beginning the second year of graduate study. The committee shall consist of at least one member from outside the major department. Three of the four members, including the chairperson, must be approved by the Graduate Council to direct doctoral research.

This committee has the primary responsibility, subject to Graduate Council policies and special requirements adopted by the faculties of individual areas of study, for the degree work of the student. The committee should plan and must approve all course work, certify the student's mastery of the subject matter of the field of study, direct the research, and recommend the dissertation for approval.

**Continuous Registration:** Registration for course 6000 is necessary whenever a student is working on the dissertation. A minimum registration of 36 quarter hours of course 6000 is required of all doctoral candidates before the dissertation will be accepted. The student will continuously register for course 6000 (minimum of 3 hours) from the time that the doctoral research proposal is approved, admission to candidacy is accepted, or registration for course 6000 is begun, whichever comes first, including the quarter in which the dissertation is accepted by the Graduate School and Doctor of Business Administration committee. The continuous registration is interpreted to include the summer quarter.) If a student must be away from the University during the doctoral study the student may, upon recommendation of the department head and approval of the Vice Chancellor for Graduate Studies and Research, be granted a leave of absence from the requirement for periods not exceeding eight quarters.

**Preliminary Examination:** A comprehensive preliminary examination which is an indication of the student's fitness for completing the program is required of each person working toward the doctorate. This examination may be written but may also include an oral examination by the student's committee. The nature and time of the examination will be determined by the student's major department or faculty committee. The preliminary examination must be passed prior to admission to candidacy and at least three quarters in advance of conferral of the degree.

**Language Requirements:** Usually candidates for the Ph.D. degree must possess a reading knowledge of at least one foreign language in which there exists a significant body of literature relevant to their major field of study. Some programs require two languages and some none. Language requirements must be met at The University of Tennessee and cannot be transferred from another institution. Refer to the departmental descriptions of each Ph.D. program. The student's faculty committee will determine, with the approval of the Vice Chancellor for Graduate Studies and Research, the specific language (or languages) required. When the student feels adequately prepared to take a language examination, he or she should notify the language representative in the department. The appropriate forms to schedule the examination may be obtained from the Graduate Office. The dates and times of the examinations are printed in the Graduate School News.

Satisfactory completion (B grade or better) of an appropriate 3030 course in a language department may be substituted for the actual language examinations. (The student cannot repeat this course if a grade of C or below is received when used in lieu of language examination.)

**Admission to Candidacy:** A student may be admitted to candidacy after successful completion of the preliminary examinations, fulfillment of the language requirements (for Ph.D.), and maintenance of at least a B average in the courses. (Each doctoral student must plan to take an appropriate number of 6000-level courses, usually a minimum of 9 quarter hours, which are designed expressly for doctoral students at The University of Tennessee, during the program of study. These courses cannot be transferred from another institution.) Admission to candidacy must be secured at least three quarters prior to the date the degree is to be conferred. Each student is responsible for filing the application for admission to candidacy, which must be signed by the committee members and approved by the Vice Chancellor for Graduate Studies and Research. The student will be notified when admission to candidacy has been approved.

**Research Requirements:** Research is an essential part of the program of every candidate for the doctoral degree. For the Doctor of Philosophy and Doctor of Business Administration degrees, original research forms the basis of the dissertation.
The program for the Doctor of Education degree requires demonstration of proficiency in at least two types of research techniques. These techniques may include foreign languages, historical research methods, statistics, experimental design, sociological research methods, survey design and analysis, philosophical research methods, or machine data processing. The candidate's faculty committee shall determine the research techniques to be included in the candidate's program.

Final Examination: A final examination (oral, or oral and written) on the student's dissertation, special field, and such other fields as the student's faculty committee may specify, will be administered by the full, approved committee after completion of the dissertation and all course requirements. This examination must be passed at least ten days before the date for submission of the dissertation to the Graduate Office. The examination must be scheduled through the Graduate Office and oral examinations not properly scheduled must be repeated. The dissertation, in the form approved by the major professor, must be distributed to the committee at least two weeks before the examination. The date of the examination is announced publicly and the examination is open to all faculty members.

Dissertation: The dissertation represents a culmination of an original major research project completed by the student. The organization, method of presentation, and subject matter of the dissertation are important in conveying to others the results of such major research. A student should be registered for the number of dissertation hours representing the appropriate fraction of effort devoted to this phase of the candidate's program. A minimum registration of 36 quarter hours of course 6000 is required of all doctoral candidates before the dissertation will be accepted. The student shall continue to register for course 6000 (minimum of 3 hours) for the entire period during which the person is actually working on research and dissertation, including the quarter in which the dissertation is accepted by the Graduate School. The number of hours registered each quarter should be at full-time levels (12 hours) if the facilities and faculty are being utilized at full-time levels. Two copies of the dissertation (prepared according to the regulations given in the Graduate School Thesis and Dissertation Manual) must be submitted to and approved by the Graduate School. These copies must include an approval sheet, signed by all members of the faculty committee, which certifies to the Vice Chancellor for Graduate Studies and Research that they have examined the final copy and found that its contents demonstrate scholarly achievement. Doctoral forms and a thesis card are also submitted at this time. The student should check with the department head concerning additional required copies of the dissertation.

Summary of Procedures for Master's Degrees

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>UNDER DIRECTION OF</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission as a potential candidate (if previously admitted non-degree)</td>
<td>Major departmental advisor and Vice Chancellor for Graduate Studies and Research</td>
<td>Prior to completing 18 hours of course work</td>
</tr>
<tr>
<td>Formation of faculty committee</td>
<td>Major departmental advisor</td>
<td>Prior to application for admission to candidacy</td>
</tr>
<tr>
<td>Submission of application for admission to candidacy (forms at Graduate Office)</td>
<td>Major professor and student's committee</td>
<td>B average, completed prerequisites, at least one quarter prior to graduation*</td>
</tr>
<tr>
<td>Approval of admission to candidacy</td>
<td>Vice Chancellor for Graduate Studies and Research</td>
<td>Prior to Commencement</td>
</tr>
</tbody>
</table>

GRADUATION REQUIREMENTS

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>UNDER DIRECTION OF</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placement of name on graduation list</td>
<td>Student</td>
<td>Indicate on registration material</td>
</tr>
<tr>
<td>Application for diploma</td>
<td>Vice Chancellor for Graduate Studies and Research</td>
<td>See deadline notice available at registration*</td>
</tr>
<tr>
<td>Scheduling of oral or written examination</td>
<td>Major professor, student, and Vice Chancellor for Graduate Studies and Research</td>
<td>Not later than one week prior to oral or written examination</td>
</tr>
<tr>
<td>Submission of thesis to faculty committee</td>
<td>Faculty committee</td>
<td>At least one week prior to oral or written examination</td>
</tr>
<tr>
<td>Oral examination</td>
<td>Major professor and committee</td>
<td>Not later than ten days before thesis deadline*</td>
</tr>
<tr>
<td>Removal of incompletes</td>
<td>Instructor of course</td>
<td>Not later than one week before Commencement*</td>
</tr>
<tr>
<td>Submission of final copy of thesis and thesis card</td>
<td>Major professor, candidate's committee, and Vice Chancellor for Graduate Studies and Research</td>
<td>After oral examination and no later than two weeks before Commencement*</td>
</tr>
</tbody>
</table>

* Dates are printed in Graduate School News quarterly.
## Summary of Procedures for Specialist in Education Degrees

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>UNDER DIRECTION OF</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission as a potential candidate (if previously admitted non-degree)</td>
<td>Major departmental advisor and Vice Chancellor for Graduate Studies and Research</td>
<td>After submission of Revision Form</td>
</tr>
<tr>
<td>Formation of faculty committee</td>
<td>Major departmental advisor</td>
<td>Prior to application for admission to candidacy</td>
</tr>
<tr>
<td>Submission of application for admission to candidacy (obtain forms from the Graduate Office)</td>
<td>Major professor and Vice Chancellor for Graduate Studies and Research</td>
<td>At least one quarter prior to graduation*</td>
</tr>
<tr>
<td>Approval of admission to candidacy</td>
<td>Vice Chancellor for Graduate Studies and Research</td>
<td>Prior to Commencement</td>
</tr>
</tbody>
</table>

### GRADUATION REQUIREMENTS

| Placement of name on graduation list | Student | Indicate on registration material |
| Application for diploma | Vice Chancellor for Graduate Studies and Research | See deadline notice available at registration* |
| Scheduling of oral or written examination | Major professor, Vice Chancellor for Graduate Studies and Research, student | Not later than one week prior to oral or written examination* |
| Submission of thesis or problems to faculty committee | Faculty committee | At least one week prior to oral examination |
| Oral examination | Major professor and committee | Not later than ten days prior to thesis/problems deadline* |
| Removal of incompletes | Instructor of course | Not later than one week before Commencement* |
| Submission of final copy of thesis and thesis card | Major professor, candidate's committee, and Vice Chancellor for Graduate Studies and Research | After oral examination and no later than two weeks before Commencement* |

* Dates are printed in Graduate School News quarterly.
## Summary of Procedures for Doctoral Degrees

<table>
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<tr>
<th>PROCEDURE</th>
<th>UNDER DIRECTION OF</th>
<th>DATE</th>
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</thead>
<tbody>
<tr>
<td>*Appointment of faculty committee</td>
<td>Vice Chancellor for Graduate Studies and Research on recommendation of major department</td>
<td>Preferably before the second year of graduate study, but at the latest, prior to admission to candidacy</td>
</tr>
<tr>
<td>* Preliminary examination</td>
<td>Major department</td>
<td>Prior to admission to candidacy</td>
</tr>
<tr>
<td>* Foreign language examination(s)**</td>
<td>Major department and language department jointly</td>
<td>Prior to admission to candidacy</td>
</tr>
<tr>
<td>Approval of admission to candidacy (obtain blanks from Graduate Office)</td>
<td>Faculty committee and Vice Chancellor for Graduate Studies and Research</td>
<td>At least three quarters prior to graduation</td>
</tr>
</tbody>
</table>

### GRADUATION REQUIREMENTS

| Placement of name on graduation list                                      | Student                                    | Indicate on registration material                                   |
| Application for diploma                                                  | Vice Chancellor for Graduate Studies and Research | See deadline notice available at registration**                    |
| Scheduling of oral examination                                           | Faculty committee and Vice Chancellor for Graduate Studies and Research | When approved by faculty committee and at least one week prior to oral examination** |
| Submission of dissertation to faculty committee                          | Faculty committee                           | At least two weeks prior to oral examination                         |
| Oral examination                                                          | Faculty committee                           | Not later than ten days before dissertation deadline**              |
| Removal of incompletes                                                    | Instructor of course                        | Not later than one week before Commencement**                       |
| Submission of final copy of dissertation, doctoral forms, and thesis card | Faculty committee and Vice Chancellor for Graduate Studies and Research | After oral examination and at least two weeks before Commencement** |

* The order of these items varies with individual programs.
** Dates are printed in *Graduate School News* quarterly.
*** Not required in some programs.
The Institute of Agriculture traces its history to 1869 when the University was designated as Tennessee's Federal Land-Grant Institution. Under terms of the Federal Land-Grant Act, the University was enabled to offer instruction in agriculture and the mechanic arts for the first time. Since 1869, agricultural programs at the University have been expanded to include research for the development of new knowledge and extension for dissemination of such knowledge to rural people. Thus the Institute of Agriculture has come to include the work of three main divisions: Agricultural Experiment Station, Agricultural Extension Service, and College of Agriculture.

In March 1974 the College of Veterinary Medicine was established within the Institute. The college is developing research and graduate programs in veterinary medical sciences in addition to the professional curriculum leading to the degree, Doctor of Veterinary Medicine. The first students were admitted in the fall of 1976.

### Agricultural Experiment Station

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

The Agricultural Experiment Station was established by the University's Board of Trustees on June 8, 1882, five years before the passage of the Hatch Experiment Station Act by the U.S. Congress. The University was one of the first five institutions in the U.S. to establish an Agricultural Experiment Station. Since its beginning the Station has given first attention to investigations of concern to the agriculture of Tennessee. The investigations of the Station follow a systematic method of gaining and applying knowledge efficiently to the biological, physical, and economic phases of producing, processing, and distributing farm and forest products; to the social and economic aspects of rural living; and to consumer health and nutrition. Both farm and urban populations gain from the accomplishments of the Agricultural Experiment Station. Examples of some of these accomplishments are new and improved varieties of crops, new and better methods of controlling crop and livestock pests, more efficient production of crops and pasture through improved fertilization and mechanization, and more efficient feeding and management of livestock.

The program is designed and administered through sixteen subject matter departments located at Knoxville. A number of the staff have teaching responsibilities in addition to their research. To assist in the research program the Station supports a large number of graduate students. To serve Tennessee's diverse agriculture, branch stations are operated at Jackson, Spring Hill, Springfield, Lewisburg, Crossville, Greeneville, and Martin. In addition, field stations are operated at Grand Junction, Milan, Wartburg, Tullahoma, and near Chattanooga. Professional and technical staff are in residence at these locations. The UT-DOE Comparative Animal Research Laboratory is located about twenty miles west of Knoxville near Oak Ridge, where a program of radiobiological research in the field of agriculture is carried out by the Agricultural Experiment Station under contract to the Department of Energy. The program includes research with farm and laboratory animals, with soils, and in applied radiobotany and plant breeding.

### Agricultural Extension Service

M. L. Downen, Dean
T. W. Hinton, Associate Dean
B. G. Hicks, Assistant to the Dean
M. F. Clarke, Assistant Dean

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

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

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

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

### College of Agriculture

O. Glen Hall, Dean

Graduate programs of the College of
Agriculture are designed to prepare men and women for positions of leadership in industry, state and federal government, teaching, research, and extension. The graduate student is expected to demonstrate a thorough knowledge of the subject matter in his/her specialized field of study and its relationship to the sociological, economic, and environmental impact on society. The student must demonstrate the ability to plan, conduct, analyze, and report original research. More importantly, emphasis is given to intellectual growth and to the development of scholarly habits of study, reasoning and analysis to the end that the graduate will continue to grow and develop professionally throughout his/her career.

MASTER OF SCIENCE PROGRAMS

Programs of graduate study leading to the Master of Science degree are offered through all departments in the College of Agriculture. The general rules of the Graduate School apply to all graduate work in this college. The graduate program may be entirely in one major subject or may include one or two minors in any of the subject matter areas related to the major.

Both majors and minors are available in Agricultural Biology, Agricultural Economics, Agricultural Engineering, Agricultural Extension, Agricultural Mechanization, Animal Science, Food Technology and Science, Ornamental Horticulture and Landscape Design, and Plant and Soil Science. Majors only are available in Forestry and Wildlife and Fisheries Science, and minors are available in General Agriculture and Rural Sociology. The minor in General Agriculture requires 18 hours of course work. A complete listing of majors is shown on pages 8-9.

For admission to a graduate degree program, the student must have a satisfactory academic average and have completed substantial requirements for an undergraduate major in his/her field of study or have completed sufficient undergraduate work in related areas to satisfy the department that he/she can successfully pursue graduate study in the chosen field. Prerequisite courses may be required when the student's preparation is deemed to be inadequate.

Each program of course work and thesis research is planned by the major professor and Master's committee in consultation with the student and with departmental faculty. For example, a student majoring in Agricultural Biology may pursue work with an emphasis either in the area of plant pathology, or economic entomology.

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

DOCTORAL PROGRAMS

Graduate study programs leading to the Doctor of Philosophy degree in Animal Science, Agricultural Economics, Agricultural Engineering, Plant and Soil Science are offered in the College. General Graduate School requirements relative to admission, faculty advisory committees, residence, grades, research, and admittance for degree are applied to all doctoral programs. Special departmental requirements are listed in the following paragraphs.

Agricultural Economics and Rural Sociology

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

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

Course Requirements: A minimum of 108 quarter hours credit beyond the Bachelor’s degree, exclusive of credit for Master’s research, is required in the doctoral program. Of this total, 36 hours in doctoral research and dissertation are required. At least 30 hours of course work shall be in agricultural economics and 15 hours in economics. Excluding the dissertation, a minimum of 21 hours in agricultural economics and 36 hours in agricultural economics and economics combined must be in courses numbered 5000 and above.

Agricultural Engineering

Candidates pursuing the Doctor of Philosophy degree in Agricultural Engineering may specialize in one of the following areas:
1. Agricultural power and machinery
2. Soil and water conservation engineering
3. Agricultural structures
4. Electric power and processing
Supporting studies are required in related biological, physical, and engineering sciences and mathematics fundamental to the training of the candidate.

Additional course requirements for the degree of Doctor of Philosophy in Agricultural Engineering include:
1. Agricultural power and machinery
2. Soil and water conservation engineering
3. Agricultural structures
4. Electric power and processing
Supporting studies are required in related biological, physical, and engineering sciences and mathematics fundamental to the training of the candidate.

Plant and Soil Science

The Department of Plant and Soil Science offers programs leading to the Doctor of Philosophy degree in the following areas of specialization:
1. Soils
2. Plant breeding and genetics
3. Crop physiology and ecology
Supporting studies are required in related sciences fundamental to the training of the candidate.

Animal Science

The Department of Animal Science, with support from the Department of Food, Technology and Science, offers programs leading to the Doctor of Philosophy degree in the following areas of specialization:
1. Animal nutrition
2. Animal breeding
3. Animal physiology
4. Animal products
Supporting studies are required in related biological and physical sciences fundamental to the training of the candidate.

Additional specific course requirements for the degree of Doctor of Philosophy in Animal Science include:
1. Minimum of 108 quarter hours credit in courses beyond the Bachelor’s degree, exclusive of credit for the Master’s thesis. Of this number, students are required to complete a minimum of 36 quarter hours in 6000 Doctoral Research and Dissertation.
2. At least 36 quarter hours credit in courses numbered 5000 and 6000, exclusive of Doctoral Research and Dissertation.
3. A minimum of 24 quarter hours credit may not be completed in related fields outside of animal science.

The specific program of a candidate for the degree of Doctor of Philosophy in Animal Science depends upon the interest and previous training of the candidate. Actual course content of the program is planned with each student in consultation with a faculty advisory committee to meet requirements in the various areas of concentration.

Dissertation.

3. The program of each candidate shall consist of a major and supporting studies in one or more additional areas. The major shall consist of a minimum of 24 quarter hours exclusive of research and dissertation. A minimum of 24 quarter hours shall be taken in departments outside of the Department of Agricultural Engineering.

The specific program of a candidate for the degree of Doctor of Philosophy in Agricultural Engineering will depend upon the interest and previous training of the candidate. Each candidate will be under the immediate supervision of a faculty advisory committee in planning his/her program. The major professor will serve as chairperson of the faculty advisory committee and will direct the research and preparation of the dissertation.
of Master's. This number, students are required to complete a minimum of 36 quarter hours in Doctoral Research and Dissertation.

2. Minimum of 30 quarter hours credit in courses numbered 5000 and 6000 exclusive of Doctoral Research and Dissertation.

In the specific program of a candidate for the degree of Doctor of Philosophy in Plant and Soil Science will depend upon the interest and previous training of the candidate. The program of courses and research will be planned with the student in consultation with a faculty advisory committee. The major professor will serve as chairperson of the faculty advisory committee and will direct the research and the preparation of the dissertation.

Departments of Instruction

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

Agricultural Biology

MAJOR Agricultural Biology DEGREE M.S.

Professors:
- C. J. Southard (Head), Ph.D. North Carolina State; J. W. Hilty, Ph.D. Ohio State; L. F. Jordan, Ph.D. Louisiana State.

Associate Professors:

Assistant Professor:
- E. C. Bernard, Ph.D. Georgia.

3130 Introductory Plant Pathology (4) Principles of plant pathology illustrated by diseases of common agricultural crop plants. Prereq: Introductory botany or zoology. Graduate credit for non-majors only. (Same as Botany 3130.) 3 hrs and 1 lab.

3210 Economic Entomology (4) Structure, life histories, habits and principles of control of important insect pests of farm, garden, orchard, and household. 3 hrs and 1 lab.

3220 Apiculture (3) Biology of the honey bee, with emphasis on beekeeping equipment and apiary management practices relative to pollination of crops and production of honey and beeswax. 2 hrs and 1 lab.

4010 Biology of Soil Microorganisms (4) Morphology and physiology of soil organisms, decomposition of organic matter, chemical transformations, and interactions between soil organisms and higher plants. Prereq: Introductory microbiology or 3130. 3 hrs and 1 lab.

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

5000 Thesis

5010 Research Methods and Instrumentation in Plant Pathology and Entomology (3) Techniques for laboratory, field, and greenhouse research in plant pathology and entomology. 1 hr and 2 labs.

5210 Plant Parasitic Nematodes (4) Morphology, physiology, taxonomy, and ecology of plant parasitic nematodes with emphasis on host-parasite relationships. Prereq: 6 hrs biological science or consent of instructor. (Same as Zoology 5210.) 2 hrs and 2 labs.

5220 Plant Disease Control (3) Basic problems and principles involved in controlling plant diseases. Prereq: 130.

5230 Field Crop and Vegetable Insects (3) Taxonomy, biology, and control of insects affecting field and vegetable crops. Prereq: 3210 or equivalent course in applied entomology. 2 hrs and 1 lab.

5250 Medical and Veterinary Entomology (4) Morphology, taxonomy, biology and control of arthropod parasites and vectors of pathogens of humans and domestic vectors in relation to pathogen transmission and control. Prereq: 3210, general entomology, or consent of instructor. 3 hrs and 1 lab.

5260 Insect Pest Management (4) Principles and applications of biological, cultural, genetic, behavioral, and chemical methods of control to maintain pest populations below economic threshold levels. Prereq: 3210, Zoology 3110, or consent of instructor. 3 hrs and 1 lab.

5310 Special Problems in Plant Pathology or Economic Entomology (1-4) Comprehensive individual study of current problems in economic entomology or plant pathology. May be repeated. Maximum 9 hrs.

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

Agricultural Economics and Rural Sociology

MAJOR Agricultural Economics DEGREES M.S., Ph.D.

Professors:
- J. A. Martin (Head), Ph.D. Minnesota; M. B. Badenhop, Ph.D. Purdue; D. W. Brown, Ph.D. Iowa State; C. L. Cleland, Ph.D. Wisconsin; J. Dubov, Ph.D. California (Berkeley); L. A. Koller, Ph.D. Kentucky; F. D. Leuthold, Ph.D. Wisconsin; B. R. McManus, Ph.D. Purdue; D. H. Penrose, J. D. Tennessee; C. B. Sappington, Ph.D. Illinois.

Assistant Professors:

Assistant Professor:
- R. H. Orr, Ph.D. Illinois.

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

Agricultural Economics

4120 Farm Management (3) Principles of farm organization and operation; allocating land, labor, and capital to meet changing technologies; tenure arrangements and use of credit; risks; measures of success. Use and analysis of records; exercises in planning farms. Field trips arranged. Prereq: Agriculture 1110 and Economics 2120. 2 hrs and 1 lab.

4140 Introduction to Agricultural Production Economics (3) Resource allocation, product selection, scale of operation of agricultural firms; aggregate effects of decisions made by individual agricultural firms. Prereq: Agriculture 1110 and Economics 2120.

4240 World Agriculture and Trade (3) Economic bases of world agricultural production and trade; resource location, land tenure systems, international trade and commercial policy. Prereq: Agriculture 1110 and Economics 2120, or consent of instructor.

4250 Agricultural and Rural Planning (3) Decision-making concepts applied to design and implementation of land use and land management programs. Case examples from the U.S. and other countries.

5410 Seminar: Agricultural Policies (3) Prereq: Agriculture 1110 and Economics 2120, or consent of instructor.

5430 Agricultural Finance (3) Nature and source of capital; credit problems of farmers; kinds and sources of farm credit. Agricultural insurance and taxation. Prereq: Agriculture 1110 and Economics 2120.

5432 Agricultural Policies (3) Meaning of agricultural policy in democratic society; relationship of farm groups to public policy; problems giving rise to policy; agricultural policy and appraisal of research. Prereq: Agriculture 1110 and Economics 2120.

5433 Land Economics (3) Problems and policies of land use, conservation, development, taxation, and tenure; population growth and demand for land; principles and theories of rent, property, value, and income. Prereq: Agriculture 1110 and Economics 2120.

5460 Management of Farm Supply and Marketing Firms (3) Operation of firms selling farm supplies and merchandising agricultural products. Emphasis on accounting data and economic theories for decision making. Prereq: Agriculture 1110 and Economics 2120.


7410 Agricultural Law (4) Survey of law and application to the farmer, his family and agricultural industry. Property, contracts, torts, drainage and water rights, landlord-tenant relationships, taxation and insurance, forms of business organization, estate planning, regulatory laws, and other selected topics.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. 5/SIC only.

5011 Special Problems in lieu of Thesis (3)

5120 Agricultural Price Analysis (3) Analysis and interpretation of factors affecting agricultural prices; price distortions and cycles; agricultural price and statistical techniques to agricultural price research. Prereq: 3120 and Statistics 4310 or equivalent.

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

5210 Seminar: Agricultural Policies (3)

5220 Seminar: Methodology of Research (3)

5230 Seminar: Adjustments to Industrialization (3)

5310 Research (3) Special research projects in agricultural economics and rural sociology. Gathering, tabulating and interpreting data and reporting. May be repeated. Maximum 9 hrs. 5/SIC only.

5410 Agricultural Marketing Analysis (3) Application of tools of economic analysis to problems at all levels of marketing system for agricultural commodities. Prereq: 4500 or equivalent.

5420 Advanced Land Economics (3) Problems in land tenure, land use, and conservation in United States and selected foreign countries. Prereq: 4320 or equivalent.

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

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

5710 Quantitative Methods in Agricultural Economics (3) Linear programming technique with emphasis on its application to problems of maximizing profit, minimizing cost, firm growth, transportation, and location. Input-output analysis. Deterministic and probabilistic game theory and nonlinear programming. Prereq: Economics 4180 or consent of instructor.

6000 Doctoral Research and Dissertation

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

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

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

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

Rural Sociology

3420 Rural Sociology (3) Nature of rural society; social systems concept; rural-urban differences; nature of social relations; population characteristics and movement; problems of rural people; tenure and farm services; social scientists. Analysis of current issues in U. S. and world population changes and determinants; urban-rural conflict and evaluation of emphasis upon changes in rural sector. Prereq: Sociology 4110 or equivalent.

Agricultural Engineering

MAJORS

DEGREES

Agricultural Engineering

M.S., Ph.D.

Agricultural Mechanization

M.S.

Professors:

D. H. Lufttrell (Head), Ph.D. Iowa State;

H. O. Vaage (Assoc. Head), Ph.D. Iowa State;

G. L. Bledsoe, Ph.D. Washington State;

J. J. McDow, Ph.D. Michigan State, P.E.

J. L. Sewell, Ph.D. North Carolina State, P.E.

Associate Professors:

Z. A. Henny, Ph.D. North Carolina State, P.E.;

C. H. Shellon, M.S. Virginia Polytechnic Institute;

R. L. Wilhem, Ph.D. Tennessee, P.E.

Assistant Professors:

D. K. Gomulya, Ph.D.; L. M. Salely, Jr., Ph.D.;

D. P. Tompkins, Ph.D. Tennessee.

Agricultural Engineering

4230 Selected Topics in Agricultural Engineering (3) Develop new topics as required by current trends and problems in agricultural engineering.

4610 Design of Water Control and Waste Utilization Systems (3) Lecture, group discussion, and individual study on the design of water control and waste utilization systems including earth dams, irrigation, drainage, land grading, hydraulic transport systems, and waste disposal other than on agricultural land. Prereq: 3610 or consent of instructor. 1 hr and 2 labs.

4620 Design of Structures for Production, Processing, and Environmental Control (3) Fundamental planning and structural design of agricultural buildings; emphasis placed on complete design of structure or system; design to include functional, structural and environmental aspects. Prereq: 3620 or consent of instructor. 2 hrs and 2 labs.

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

4640 Design of Agricultural Machinery (3) Functional requirements of agricultural machinery. Elements of design of agricultural machinery; synthesis of mechanisms, mechanical and hydraulic drives. Team effort in completing machine design project. Prereq: 3640 or consent of instructor. 1 hr and 2 labs.

5000 Thesis

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

5340 Hydrology of Agricultural and Forest Lands (3) Analytical approach to problems involving water surplus, deficiency and time distribution. Prereq: 3610, Introductory hydrology; Forestry 4030, or consent of instructor. 2 hrs and 1 lab.

5340 Instrumentation in Agricultural Systems (3) Analysis of specific instrumentation needs in agricultural systems. May be repeated. Maximum 9 hrs.

5410 Agricultural Waste Utilization and Disposal (3) Principles and design in utilization of specialized raw materials related to handling, processing, and disposal. Prereq: 5340. 1 hr and 2 labs.

5420 Electromechanical Systems in Agriculture (3) Integration of electric power, mechanical equipment, structures, and environmental systems to plant and animal production, crop processing, and materials handling. Prereq: 3620 and 3510. 2 hrs and 1 lab.

5430 Agricultural Machinery and Tractors (4) Major developments and current practices in agricultural mechanization. May be repeated. Maximum 9 hrs.

5500 Thesis

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

6000 Doctoral Research and Dissertation

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

6310 Engineering Systems Analysis in Agriculture (3) Systems approach to design of engineering structures, linear programming, computer applications, statistical evaluations, and feedback control in agricultural problems. Prereq: Mathematics 4500 or 4710. Coreq: 5710 or equivalent. 2 hrs and 1 lab.

6610 Selected Topics in Agricultural Engineering (3) Lecture, group discussion, and individual study on specialized developments in processing and machinery, soil and water, structures, and processing. May be repeated. Maximum 9 hrs.

Agricultural Mechanization

4150 Agricultural Waste Utilization and Disposal (3) Techniques, equipment, and structures for utilizing, treating, and disposing of agricultural wastes by land spreading, lagoning, and processing. Prereq: 4170. 2 hrs and 1 lab.

4170 Small Engines (3) Concepts and mechanics of small gasoline engines; selection, operation, adjustment, and repair of single cylinder engines. 2 hrs and 1 lab.

4180 Equipment and Techniques for Application of Agricultural Chemicals (3) Equipment for application of liquid, solid, and gaseous chemicals; system components; operational characteristics; safety considerations; calibration; selection and management; materials handling and disposal systems. 2 hrs and 1 lab.

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

5000 Thesis

5110 Research Problems in Agricultural Mechanization (3) Research problems related to recent developments and current practices in agricultural mechanization. May be repeated. Maximum 9 hrs.

5210 Electromechanical Systems in Agriculture (3) Integration of electric power, mechanical equipment, structures, and environmental systems for animal and plant production, crop processing, and materials handling. Prereq: 3220 and 3510. 2 hrs and 1 lab.

5410 Agricultural Machinery Systems Analysis (3) Analysis of current field machinery; adaptation planning for sequential operations; machinery for special and alternate developments in farming systems; operational management. Prereq: 4210. 2 hrs and 1 lab.

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

**MAJOR**  
Agricultural Extension  
DEGREE  
M.S., Ph.D., M.S.

**Professors:**  
R. J. Johnson (Head), Ph.D., Ohio State;  
M. C. Bell, Ph.D., Oklahoma State;  
C. L. Chamberlin, Ph.D., Iowa State;  
H. M. Jamison, Ph.D., Tennessee;  
D. W. Groves, D.V.M., University of Illinois;  
S. R. Shrode, Ph.D., Ohio State;  
E. L. Tugwell, Ph.D., Kansas State.

**Associate Professors:**  
W. R. Backus, Ph.D., Tennessee;  
K. M. Barth, Ph.D., Rutgers;  
G. Bradt, D.V.M., Ph.D., Texas A & M;  
W. T. Butts, Ph.D., Tennessee;  
F. J. Bazemore, Ph.D., Kansas State;  
H. M. Jamison, Ph.D., Tennessee;  
J. B. McLaren, Ph.D., Ohio State;  
R. R. Johnson (Head), Ph.D., Ohio State.

**Institute of Agriculture**

**课程**

**5000 Thesis**

5010 Special Problems in Agricultural Extension (1-6) May be repeated. Maximum 9 hrs.

5210 Long-range Extension Program Planning (3) Development of a county extension program based on effective interpretation of physical, social, economic characteristics of areas. Prereq: 3110 or consent of instructor.

5220 Seminar (3) Review of literature and development of volunteer leadership function. Prereq: 3110 or consent of instructor.

5230 Evaluation in Programs of Agricultural Extension (3) Principles, instruments, and techniques of identifying, gathering, analyzing, and using data to appraise planning and teaching to determine progress of clientele. Prereq: 5210 or consent of instructor.

5310 History, Philosophy and Objectives (3) Historical and philosophical foundation of informal adult education in American agriculture. Prereq: Ag. 1130. 3 hrs and 1 lab.

5320 Volunteer Leadership in Agricultural Extension Programs (3) Theory, principles, and procedures in development of volunteer leadership for small groups in rural communities through agricultural extension programs. Emphasis on analysis and evaluation of volunteer leadership function, techniques of effective leadership in small groups and methods of developing volunteer leadership in agricultural extension program. Prereq: 3110 or consent of instructor.

5330 Supervision of Agricultural Extension Programs and Personnel (3) Principles of successful supervision applied to various parts of district and other extension programs; and planning for effective office management. Prereq: 5210 or 5220 or consent of instructor.

**Animal Science**

**MAJOR**  
Animal Science  
DEGREES  
M.S., Ph.D.

**Professors:**  
R. E. Carson, Ph.D., Kansas State;  
J. A. Corrick, Ph.D., Tennessee;  
D. C. Doyle, D.V.M., Ph.D., Michigan State;  
J. J. Montgomery, Ph.D., Wisconsin;  
L. R. Murphy, Ph.D., Wisconsin;  
D. O. Richardson, Ph.D., Ohio State;  
H. S. Robinson, Ph.D., Illinois;  
R. R. Shrode, Ph.D., Iowa State;  
E. W. Swanson, Ph.D., Missouri;  
R. L. Tugwell, Ph.D., Kansas State.

**Associate Professors:**  
W. R. Backus, Ph.D., Tennessee;  
K. M. Barth, Ph.D., Rutgers;  
G. Bradt, D.V.M., Ph.D., Texas A & M;  
W. T. Butts, Ph.D., Tennessee;  
D. V. M., Ph.D., Illinois;  
J. W. Holloway, Ph.D., Kansas State;  
F. B. Maslin, Ph.D., Kansas State.

**Assistant Professors:**  
R. E. Carson, Ph.D., Kansas State;  
J. A. Corrick, Ph.D., Tennessee;  
D. C. Doyle, D.V.M., Ph.D., Michigan State;  
J. J. Montgomery, Ph.D., Wisconsin;  
J. Kinaid, D.V.M., Ph.D., Purdue;  
D. V. M., Ph.D., Purdue;  
R. Schaub, Ph.D., Washington State;  
J. D. Smalling, Ph.D., Texas A & M.

3210 Anatomy and Physiology of Farm Animals (4) Skeletal, joint, muscles, blood and blood vessels, nervous system, nerves, autonomic nervous system, central nervous system, respiratory, digestive, renal and endocrine systems; demonstrations of physiochemical phenomena. Prereq: Biology 1210 or Agriculture 1130. 3 hrs and 1 lab.

3220 Physiology of Reproduction (3) Comparative anatomy and physiology of reproductive systems of higher vertebrates. Prereq: Biology 1210 or Agriculture 1130. 3 hrs and 1 lab.

5000 Thesis  

5110 Special Problems in Animal Science (1-6) May be repeated. Maximum 9 hrs.

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

4220 Avian Physiology (3) Anatomy and physiology of domestic fowl; emphasis on poultry. Prereq: 3210.

4320 Feeding Applications for Farm Animals (3) A detailed application of feeding principles designed to allow the student to discover and explore the feeding situations related to produc- ders through problem solving. Prereq: 3330. 1 hr and 2 labs.

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

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

4810 Beef Cattle Production and Management (4) Principles of nutrition, physiology, and breeding in a complete beef cattle management program. Topics include structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4820 Dairy Cattle Production and Management (4) Principles of nutrition, physiology and breeding in a complete dairy cattle management program. Topics include structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4830 Pork Production and Management (4) Principles of nutrition, physiology and breeding in a complete pork production and management program. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4840 Poultry Production and Management (4) Principles of nutrition, physiology and breeding in a complete poultry production and management program. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4850 Light Horse Production and Management (3) Principles of nutrition, physiology and breeding in a complete horse production and management program. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab.

4860 Lamb and Wool Production and Management (3) Principles of nutrition, physiology and breeding in a complete sheep and wool production and management program. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab.

5000 Thesis  

5110 Special Problems in Animal Science (1-6) May be repeated. Maximum 9 hrs.

5210 Endocrine Relations in Animal Production (4) Endocrine glands and their effects on reproduction; hormone preparation for altering life function. 3 hrs and 1 lab.
growth and reproductive rate of farm animals. Prereq: 3261 or consent of instructor. 2 hrs and 1 lab.

5230 Advances in Mammalian Reproduction (3) Germ cell development, maturation, transport, metabolism, and preservation; fertilization and embryonic mortality. Prereq: 3260 or 4240, 2 hrs and 1 lab.

5240 Advanced Studies of the Secretion of Milk (3) Effect of endocrine and nutritional factors on mammary gland development, initiation and maintenance of lactation. Prereq: 4510. 2 hrs and 1 lab.

5311 Analytical Techniques in Animal Nutrition (3) Physical and chemical analyses of feeds, intermediary metabolism, and biological fluids associated with nutrition research. 1 hr and 2 labs.

5322 Advanced Experimental Animal Nutrition (3) Animal experimental techniques for digestion, absorption, nutrient balances and radiotracer techniques. Prereq: 5311. 1 hr and 2 labs.

5333 Nonruminant Animal Nutrition (4) Physiological development and changes in digestive systems during the life cycle. Concepts and methodology concerning nutrient requirements; interrelationships, availability, and utilization of nutrients. Nonruminant additives, toxins, poisons, and disease effects; nutritional effects on products. Prereq: 3260, 3330 or consent of instructor. 3 hrs and 1 lab.

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

5410 Genetics of Animal Populations (4) Population and individual, gene and zygotic frequencies; statistical descriptions of populations; forces influencing genetic changes; application to animal breeding. Prereq: 3420 or consent of instructor. 2 hrs and 1 lab.

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

5710 Methods of Evaluating Experimental Data in Animal Science (3) Review of principles of experimental design and application to research in animal science analyzing data from experiments with unequal and disproportionate subclass frequencies; situations and procedures for use of computers in statistical analyses. Prereq: 5710. 2 hrs and 1 lab.

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

6000 Doctoral Research and Dissertation

6150 Topics in Milk Constituents (3) Properties of milk constituents and relationship to milk and dairy products. Prereq: Food Technology and Science 4650.

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

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

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

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

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

6322 Advanced Animal Nutrition (3) Chemical forms, digestion, absorption, intermediary metabolism, deficiencies, excesses and interaction of nutrients. Energy—proteins; vitamins; and minerals. Prereq: 5333 or 5344; and Biochemistry 4120 or Nutrition 5110; or consent of instructor. May be repeated. Maximum 15 hrs.

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

6420 Animal Breeding Research Methods and Interpretation (3) Obtaining valid estimates of genetic parameters. Recent advances in techniques of least squares adjustment of data; partition of variance; phenotypic, genetic, and environmental correlations; repeatability; heritability; and selection indexes. Prereq: 5410 and 5710.

6811 Advanced Topics in Animal Products (1-6) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs.

6910 Seminar (1) Animal nutrition, breeding, physiology and products. May be repeated. Maximum 6 hrs.

Food Technology and Science

MAJOR DEGREE

Food Technology and Science M.S.

Professors: T. Miller (Head), Ph.D. Wisconsin; J. L. Collins, Ph.D. Maryland; W. W. Overcast, Ph.D. Iowa State.

Associate Professors: B. J. Delaney, Ph.D. Michigan State; H. O. Jaynes, Ph.D. Illinois; C. C. Melton, Ph.D. Kansas State; S. L. Melton, Ph.D. Tennessee.

Assistant Professors: G. W. Davis, Ph.D. Texas A. & M.

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

3210 Food Composition (3) Determination and study of major constituents of fresh and processed foods with attention to changes and interactions occurring during processing and storage. Prereq: Chemistry 1120 or 1520 or 1620. 2 hrs and 1 lab.

3220 Food Preservation (4) Survey of food industry and preservation methods for prevention of deterioration. Prereq: Microbiology 2610-19. 3 hrs and 1 lab.

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

4010 Food Technology and Science Seminar (1-3) Review of literature; oral and written reports. May be repeated. Maximum 3 hrs.

4030 Dairy Products II (4) Principles in the manufacture of butter, cheese and special dairy products. Prereq: 3260. 3 hrs and 1 lab.

4050 Advanced Food Composition (3) Intensive study of food constituents and changes affected by processing and storage. Prereq: 3210 and Nutrition 3320 or equivalent. 2 hrs and 1 lab.

4110 Food Plant Sanitation (3) Environment for manufacturing and preserving foods. 2 hrs and 1 lab.

4120 Food Quality Assurance (3) Systems for quality assurance in food industries. Various methods including statistics used by food industries to assure desired quality of food products. Prereq: 3 hrs statistics, 2 hrs and 1 lab.

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

4310 Food Packaging (3) Characteristics and manufacturing practices on containers and packaging requirements of food. Prereq: 3220. 2 hrs and 1 lab.

4410 Food Crop Products (2) Food products from crops with emphasis on types, manufacturing systems, quality attributes, and utilization.

4810 Microbiology in Food Manufacturing (3) Relatively new common food microorganisms in fermentative and enzymatic changes occurring during processing and manufacturing of foods. Prereq: Microbiology 2610-19 or equivalent. 1 hr and 2 labs.

4820 Fermented Foods (3) Role of microorganisms in preparation and manufacture of foods. Recent advances and concepts, research techniques, current problems. Maximum 6 hrs.

4910 Food Flavor, Aroma and Textures (3) Chemical aspects of flavor, aroma, texture, and keeping quality. Prereq: Microbiology 2610. 2 hrs and 1 lab.

4940 Meat Products Manufacturing (3) Prepared meat products with emphasis on sausage making and information relating to cost controls, inspection, and meat science. Prereq: 3840 or consent of instructor. 1 hr and 1 lab.

4990 Physical Phenomena of Foods (4) Physical states of food materials, foams, emulsions, colloidal soils, hydrates, crystals, gels. Effects of manufacturing processes on structure of food materials and their interaction with food processes for hermetically-sealed packages of foods. Prereq: Consent of instructor. 3 hrs and 1 lab.

5000 Thesis

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

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

5130 Food Enzymology (3) Commercial and native enzymes in manufacturing, processing, and spoilage of food. Prereq: Nutrition 3320.

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

5150 Fats and Oils (3) Application of scientific principles to commercial technology of fats and oils. Prereq: 3210. 2 hrs and 1 lab.

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

5310 Food Products Development (3) Fundamentals of art, science, and technology applied to research, development and marketing of new food processes and products. Prereq: 4210 or 4310. 2 hrs and 1 lab.

5320 Food Thermobiology (3) Fundamentals of heat transfer as related to rate of destruction of microorganisms and to rate of loss of food quality through calculation of minimum safe thermal process for heat-processed packages of foods. Prereq: 3220. 2 hrs and 1 lab.

30 Institute of Agriculture
### 5420 Advanced Food Quality Assurance (3)
Applications of current instrumental methods used to control food manufacturing processes. Prereq: 4120. 2 hrs and 1 lab.

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

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

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

### Forestry, Wildlife, and Fisheries

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<th>MAJORS</th>
<th>DEGREES</th>
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<tr>
<td>Forestry</td>
<td>M.S. Wildlife and Fisheries Science</td>
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</table>

**Professors:**
- G. Schneider (Head), Ph.D. Michigan State; J. W. Barrett, Ph.D. Syracuse; H. A. Core, Ph.D. Syracuse; C. A. C. Dake, Ph.D. North Carolina State; F. W. Woods, Ph.D. Tennessee.

**Associate Professors:**

**Assistant Professors:**
- W. E. Hammitt, Ph.D. Michigan; R. J. Strange, Ph.D. Oregon State.

### Forestry

**3020 Forest Environments and Ecology (3)** Environments and ecology of forests and associated lands; emphasis on the application of ecological principles to contemporary problems. Prereq: 8 hrs of biology, botany, or zoology.

**3040 Dendrology and Silvics of Woody Angiosperms (3)** Wood measurement and documentation, identification and silvical characteristics of the more common woody angiosperms native to North America; distribution patterns and habitat requirements; regeneration requirements and life history, place in succession; ecological significance and commercial importance. Weekly field trips during scheduled lab period plus one weekend field trip. Prereq: 8 hrs basic biology or botany. 2 hrs and 1 lab.

**3050 Dendrology and Silvics of Gymnosperms (3)** Classification, nomenclature, identification, and silvical characteristics of the major North American conifers. Distribution patterns, habitat, and community relationships including classification, life history, regeneration requirements, place in succession, and importance. Prereq: 8 hrs basic biology or botany. 2 hrs and 1 lab.

**3110 Forest Measurements and Biometry (4)** Measurements of individuals in animal and plant populations; linear regression; sampling of forest populations; growth and potential production. Prereq: Plant and Soil Science 3610 and Computer Science 1410 or equivalent. 3 hrs and 1 lab.

**3120 Wood Technology (4)** Wood properties; identification of commercial woods by macro and micro characteristics. Prereq: 3040, 3050. 3050 may be taken concurrently. 2 hrs and 2 labs.

**3210 Forest Resource Economics (4)** Allocation of forest resources via market and institutional systems. Application of economics to forest resource management; the forest as a private and public sector. Prereq: Economics 2120.

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

**3230 Wildlife Management (3)** Lives and ecological relationships of wild animals; biological, social, and economic aspects of their management. Prereq: 5110 and Wildlife and Fisheries Science 3320. 2 hrs and 1 lab.

**3320 Principles of Silviculture (3)** Influence of site factors on reproduction, growth, development, and character of forest vegetation; classification of forest structure; silvicultural laws. Prereq: 3020 or Biology 2130, 3040, Plant and Soil Science 2130.

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

**4002 Utilization (3)** Wood-using industries; processing forest products—tallowmills, tree-logs, lumber grading; pulpwod operations, flooring plants, treating plants; plant layout, flow diagrams. Prereq: 3120.

**3003 Field Methods of Timber Inventory (3)** Field measurement and sampling; fiber cruiser, determining appropriate sample design for specific purposes; tree and stand growth; site evaluation; field problems. Prereq: 3110 and Agricultural Mechanization 3140.

**4004 Forest Practice (3)** Management of forest lands by public and private organizations; "multiple-use" concept as it influences management decisions; impact of public pressure for outdoor recreation on management decisions; management of recreation and forest industry. Prereq: 3120 or 4030. 2 hrs and 1 lab.

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

**4020 Forest Watershed Management (3)** Water as a forest resource; role of forests in the hydrologic cycle, control of water quantity, quality, and regimen; watershed planning. Prereq: 3120 or consent of instructor. Two overnight field trips.

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

**4220 Forest-resource Management (4)** The forest as an integration of resource uses; review of traditional timber-management concepts; the multiple-use concept; valuation of forest resources for decision making and planning; taxation of forest firm. Prereq: 4210.

**4230 Forest-resource Management Plans (4)** Field problems and case studies in forest-resource management; the forest as a system; management of forest enterprises as a producer of timber, recreational services, transportation services, and wildlife; producing multiple services; preparation of a complete plan based on optimizing forest uses. Prereq: 4210.

**4240 Interpreting Forest Resources (3)** Principles and techniques of interpretation of the importance of environmental interpretation to management of forest resources; development and administration of interpretive services. Possible overnight field trips required. Prereq: 3240 or equivalent.

**4330 Forest Policy (3)** History of forestry in United States with emphasis on development of forest resource policies; current policies influencing development and management of forest resources; brief survey of policy implications of forest resource organizations in public and private sectors. Prereq: 4210.

**4340 Aerial Photography in Forest-Resource Management (3)** Use of conventional aerial photographs in forest-resource management; interpretation of detailed forest resource maps; vegetation classification, forest change analysis, production of cover-type maps, uses of other remotely sensed imagery. Prereq: Civil Engineering 4260 and Forest 3110 or equivalent. 1 hr and 2 labs.

**4420 Forest Tree Improvement (3)** Forest tree improvement related to silviculture; nature and purposes of tree improvement and forest genetics; principles of physiology and population genetics; importance of seed source selection, selection of superior phenotypes and development of seed orchards; hybridization; seed production and seed certification. Prereq: 4006, Botany 1120. 2 hrs and 1 lab.

**4430 Regional Silviculture of the United States (3)** Factors that influence silviculture management of important tree species in North America; importance of forests and forestry to a region; physiography, geology, soils, climate and weather, and silvicultural problems of protection, and silvicultural characteristics of the more important species. Prereq: 4006 and 4210.

**4440 Forest Recreation (3)** Forest lands as a recreation resource; planning, developing, and managing recreation and other management activities; development and management of forest recreation areas; socioeconomic and political determinants of recreation development and management. Prereq: 6 hrs sociology and/or economics. 2 hrs and 1 lab.

**5000 Thesis**

**5110 Special Problems in Forestry (1-6)** May be repeated. Maximum 12 hrs. Prereq: 3230. 3 hrs minimum. 2 hrs maximum. 240 credits maximum.

**5220 Seminar in Forest Tree Biology (3)** Growth, reproduction, and physiology of forest trees; forest ecology; variability and taxonomy of forest trees. Prereq: 3320 or Botany 4310.

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

**5240 Seminar in Forest Genetics (3)** Population genetics and speciation, variation patterns and heritability in forest trees; gains with different breeding methods; planning and conducting forest genetics research. Prereq: 4420, Biology 3110, and consent of instructor.

**5250 Recreation Planning for Forests and Associated Lands (3)** Planning process for recreation development and administration of interpretive services. Analysis and critique of specific contemporary plans: Overnight field trips may be required. 2 hrs and 1 lab.

**5280 Industrial Forestry (3)** Structure and analysis of wood-using firms and industries. Forest taxation, land tenure and wood procurement alternatives. Development and application of forestry planning models. Prereq: 4230 or consent of instructor.

**5270 Topics in Forest Industries Management (3)** Current problems in industrial forestry. Executives from public and private business sector (concerned with forest industry) conduct classes in selected topics. Prereq: 4230 or consent of instructor. Prereq: 4440.

**5310 Seminar (1)** Current developments in forestry. May be repeated. Maximum 3 hrs. S/NC only.

### Wildlife and Fisheries Science

**3230 Wildlife Management (3)** (Same as Forestry 3230.)

**4450 Game Mammals (4)** Classification, identification, distribution, natural history, and management of major North American game mammals. Prereq: 4006. 4 hrs credit for non-forestry majors only.

**Graduate credit for non-forestry and non-wildlife and fisheries science majors only."**

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1 **Emeritus**
ment principles of game mammals in North America. Prereq: 3230 or 1 yr of zoology. 2 hrs and 2 labs.

4460 Game Birds (4) Biology, classification, identification, distribution, and management of game birds in North America. Prereq: 3230 or 1 yr of zoology. 3 hrs and 1 lab plus one weekend field trip.

4510 Freshwater Fishery Biology (4) Principles and methods of lake and pond management for commercial and sport fisheries; design, renovation, and stocking procedures; biology and culture of managed species. Prereq: 4510 or consent of instructor. 3 hrs and 1 lab or field period.

4520 Management of Lakes and Ponds (4) Principles and methods of lake and pond management for commercial and sport fisheries; design, renovation, and stocking procedures; biology and culture of managed species. Prereq: 4510 or consent of instructor. 3 hrs and 1 lab or field period.

5000 Thesis

5110 Special Problems in Wildlife and Fisheries Science (1-6) May be repeated. Maximum 6 hrs.

5210 Seminar in Wildlife Conservation (3) Current studies, problems and issues in wildlife conservation; wildlife agencies and organizations and their programs. Prereq: 3230 or consent of instructor.

5310 Seminar (1) Current developments in wildlife and fisheries science. May be repeated. Maximum 3 hrs. S/NC only.

5400 Advanced Topics in Wildlife Science (3) Recent advances and concepts, research techniques, and analysis of current problems. Prereq: 4450 and 4460 or consent of instructor. May be repeated. Maximum 6 hrs.


5500 Advanced Topics in Fishery Science (3) Recent advances and concepts, research techniques, and analysis of current problems. Prereq: 4450 and 4460 or consent of instructor. May be repeated. Maximum 6 hrs.

5600 Wildlife Diseases (3) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in the field and lab. Investigative procedure concerning wildlife diseases. Prereq: 1 yr zoology, 1 qr microbiology, pathology or parasitology, 4450 or 4460, or consent of instructor. 2 hrs and 1 lab.


5500 Advanced Topics in Fishery Science (3) Recent advances and concepts, research techniques, and analysis of current problems. Prereq: 4450 and 4460 or consent of instructor. May be repeated. Maximum 6 hrs.

Ornamental Horticulture and Landscape Design

MAJOR

Ornamental Horticulture

DEGREE

M.S. and Landscape Design

Assistant Professor: J. W. Day, Ph.D., Mississippi State

5930 Plant Propagation (3) Physiology, methodology, and environmental requirements for propagation. Prereq: 8 hrs of biological science. 2 hrs and 1 lab.

3110 Greenhouse Management (3) Factors involved in greenhouse production of greenhouse vegetable plants, and in care and management of greenhouse plants. Prereq: Consent of instructor. 2 hrs and 1 lab.

4120 Landscape Design I (4) Design and development of properties; planning, organization, structure, selection and use of plant and structural materials, methods of presentation, specification. Prereq: Consent of instructor. 2 hrs and 2 labs.

4140 Landscape Design II (4) Advanced theory of design. Pictorial and abstract approach to landscape design. Emphasis on recreational design from analysis of contemporary trends and objectives, projected needs and development of plans. Prereq: Consent of instructor. 2 hrs and 2 labs.

4150 Wholesale Nursery Management (3) Production, labor and sales management; layout, culture, equipment and facilities. Prereq: 3030 or consent of instructor. 3 hrs and 1 lab.

4160 Retail Nursery Management (3) Essentials of good nursery management: location, layout and operation of landscape nurseries, garden centers and chains. Prereq: 3030 or consent of instructor. 3 hrs and 1 lab.

5000 Thesis

5110 Special Problems in Ornamental Horticulture and Landscape Design (3) May be repeated. Maximum 9 hrs.

5210 Golf Course Design, Development and Operation (3) Development, theory, finance, management and operation of golf courses. Prereq: 4520 and 4560 or equivalent and Zoology 4240.

5000 Thesis

5110 Special Problems in Ornamental Horticulture and Landscape Design (3) May be repeated. Maximum 9 hrs.

5210 Golf Course Design, Development and Operation (3) Development, theory, finance, management and operation of golf courses. Prereq: 4520 and 4560 or equivalent and Zoology 4240.

5410 Histological Microtechnique (4) Preparation of plant material for microscopic examination. Prereq: 1 yr of biology or botany; general and organic chemistry, and consent of instructor. 2 hrs and 2 labs.

5500 Seminar (1) Current literature and developments in ornamental horticulture and landscape design. May be repeated. Maximum 3 hrs.

Plant and Soil Science

MAJOR

Plant and Soil Science

DEGREES

M.S., Ph.D.

Professors:

L. F. Beaty (Head), Ph.D., North Carolina State; E. V. Conger, Ph.D., Washington State; H. A. Fribourg, Ph.D., Iowa State; L. M. Josephson, Ph.D., Wisconsin; W. Parks, Ph.D., Purdue University; J. J. Peterson, Ph.D., Wisconsin; L. N. Skoel, M.S., Kansas State; M. E. Springer, Ph.D., California; B. D. tripod, Ph.D., Louisiana State.

Associate Professors:

D. L. Coffey, Ph.D., Purdue; L. S. Jeffery, Ph.D., North Dakota State; W. A. Krupey, Ph.D., Illinois; G. M. Lessman, Ph.D., Michigan State; R. J. Lewis, Ph.D., North Carolina State; V. H. Reich, Ph.D., Iowa State; H. C. Smith, M.S., Tennessee.

Assistant Professor: F. L. Allen, Ph.D., Minnesota.

3020 Crop Ecology (3) Crops and environment; geographic location; site, heat, light, water and interplant relationships as a basis for judgment of crop growth and yield. Prereq: 8 hrs biological science. 2 hrs and 1 lab.

3040 Crop Physiology (3) Physiology of crop plants; growth phenomena related to crop production; use of general theories of physiology; effects of season, growth regulating substances, functions of environment and factors influencing plant growth. Prereq: 8 hrs biological science. 2 hrs and 1 lab.

3110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability and uptake; Methods of soil fertility exploration and principles of fertilizer use; manufacture and properties of fertilizers. Prereq: 2130. 3 hrs and 1 lab.

3120 Grain and Oil Crops (3) Distribution, impact, promotion, morphology, culture, harvesting, and utilization of corn, small grains, grain sorghum, soybeans and related crops. Prereq: 2130. 6 hrs biological science. 2 hrs and 1 lab.

3140 Forage Crops (4) Characteristics, adaptation, improvement, management, and utilization of grasses and legumes for pastures, hay, and silage. Prereq: 2130. 6 hrs biological science. 3 hrs and 1 lab.

3160 Cotton and Tobacco (4) Characteristics, adaptation, improvement, culture, harvesting, and marketing of cotton and tobacco. Prereq: 2130. 8 hrs biological science. 3 hrs and 1 lab.
processing markets; emphasis on sweet potatoes, beans, tomatoes, pepper, cucurbits, sweet corn, and okra. Need not have 3510 as prereq. Prereq: 8 hrs of biological science. 2 hrs and 1 lab.

5610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Mathematics 1550.

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

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

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

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

4230 Soil Formation, Morphology, and Classification (4) Soil formation; properties, distribution, and classification of soils; interpretation of morphology; use of soil surveys. Prereq: 2130. 3 hrs and 1 lab.

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

5000 Thesis

5100 Special Problems in Plant and Soil Science (1-6) May be repeated. Maximum 9 hrs.

5200 Soil Crop Relationships (3-6) May be repeated. Maximum 6 hrs.

5240 Soil Productivity and Management (3) Concepts of soil productivity and management, quantitative evaluation of factors and their interaction affecting soil management decisions, cropping systems, water control and management, tillage and fertility management. Planning and evaluation of specific soil management programs. Prereq: 3220 and 4110 or consent of instructor.

5250 Pedology (4) Factors and processes of formation as related to physical, chemical, and mineralogical properties of soils; soil in an ecosystem; classification of soils. Prereq: 4200 or consent of instructor. 3 hrs and 1 lab.

5310 Design and Interpretation of Experiments (3) Experimental design and procedures; effect of different variables on precision of experiments; problems dealing with the analysis of data. Prereq: 3600 or equivalent.

5340 Soil Physics (3) Chemical and physical relationships among solid, liquid, and gaseous phases of soil mass; relation to plant growth and soil management. Prereq: 4110. 2 hrs and 1 lab.

5370 Advanced Soil Fertility (3) Fundamental concepts and soil chemistry as they relate to nutrient absorption by plant roots; interrelation of these concepts in soil fertility and soil management. Prereq: 4110.

5390 Soil Physical Chemistry (3) Structural properties of soil minerals determining physicochemical reactions, ion exchange, Donnan equilibrium, double layer theory. Prereq: 4110; Chemistry 4110 or concurrent registration.

5600 Seminar (1) May be repeated. Maximum 3 hrs.
School of Architecture

Donald D. Hanson, Dean
William J. Lauer, Associate Dean

Professors:

Associate Professors:

Assistant Professors:

Lecturers:

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

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

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

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

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

4311 Historic Preservation Laboratory (8) Directed studies for buildings of historical significance. Techniques of preservation; research of historic methods of construction; and studies of viable uses. Rehabilitation, restoration, preservation, and adaptive uses.

4731-32 Earthquake Resistant Structure I, II (4, 4) Analysis and design of structures to resist earthquake effects. Earthquake phenomena. Vibration of a single degree structural systems. Resonance and damping. Introduction to dynamic analysis of structures, instrumentation and structural response. Frame and shear wall behavior. Ground-structure interaction. Prereq: Consent of instructor. (Same as Civil Engineering 4731-32.)

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

4735 Aesthetics of Engineering Structures (4) Architecture in engineering; theory and utilization of space, design, and materials in large structures. Bridges, exhibition halls, power plants.

4850 Elementary Structural Matrix Methods (4) Introduction to the generalized matrix methods of analysis of structures. Review of matrix algebra and vectors; development of member stiffness and flexibility matrices; assembly of structural stiffness and flexibility matrices. Prereq: Consent of instructor. (Same as Civil Engineering 4850 and Engineering Science and Mechanics 4851.)


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

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

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

Graduate programs of the College of Business Administration are designed to prepare men and women to assume executive, managerial and professional positions in the increasingly complex world of domestic and international business and industry, teaching and research, government and institutional management.

Viewing the business firm as operating in a dynamic social, political and economic environment which demands leaders capable of dealing with innovation and rapid change, the College places central importance on development of students' thought processes rather than on specialized subject matter and courses descriptive of past practices. Emphasis is focused on flexibility of mind, receptivity to new ideas, capacity to adapt one's reasoning powers and judgment to rapid changes, vigor and imagination in using the mind, ability to reason analytically and logically and, above all else, inculcation of an irrepressible desire to continue to learn and grow in knowledge throughout the student's life.

Graduate Programs

The College of Business Administration offers programs leading to seven advanced degrees: the Doctor of Business Administration, the Doctor of Philosophy with majors in Economics and in Management Science, the Master of Arts in College Teaching with a major in Economics, the Master of Science with majors in Economics and Statistics, the Master of Accountancy in Accounting, and the Master of Business Administration. The Department of Management participates with the Department of Psychology in the College of Liberal Arts in offering an Intercollegiate program in Industrial and Organizational Psychology leading to the Master of Science and Doctor of Philosophy degrees. (see page 97.) Also, the department of Management Science offers an intercollegiate program leading to the Master of Science degree. (See page 96.)

The two College-wide programs, the MBA and the DBA, are described below. Descriptions of other degree programs will be found under the appropriate departmental or program headings.

The MBA Program

The College-wide curriculum of the Master of Business Administration program is designed to prepare students for successful careers in business and institutional management and for imaginative and responsible citizenship and leadership roles in business and society. The program is designed to encompass the major functional areas of business and economics in order to provide the perspective necessary for those who aspire to positions of executive and professional leadership. The curriculum reflects the application of evolving knowledge in economics and the behavioral and quantitative sciences. This program is accredited by the American Assembly of Collegiate Schools of Business.

Completion of the MBA program requires from four to six quarters (51 to 78 quarter hours of course work) for a full-time student, depending upon the individual's undergraduate preparation in business and economics. The four-quarter sequence is designed for those who have completed a baccalaureate program in business administration. Those with undergraduate degrees in the humanities, engineering, social sciences or natural sciences will require up to six quarters, depending upon the extent of their preparation in business and economics.

The complete MBA program with a concentration in management is offered by the regular graduate faculty of the College as a part-time evening program on the Knoxville campus, at Oak Ridge, and at the Kingsport University Center.

Students may begin the program in any of the four quarters of the academic year; however, those entering the program in the winter or spring may find it difficult to complete the program in minimum time due to course scheduling and sequencing.

The MBA student may select an area of concentration from the following fields: accounting; economics; finance; forest industries management; governmental financial administration; management; management science; marketing; real estate and urban development; statistics; transportation and logistics.

All entering students must have completed college-level mathematics through at least one quarter (or semester) of calculus or remove the deficiency by taking appropriate courses in mathematics. Specific requirements of the MBA program are shown below. To qualify for the degree, a student must complete a minimum of 51 quarter hours of graduate course work in Groups B, C and D, at least 42 hours of which must be at or above the 5000 level. Further, at least half of the credit hours taken in Group C (concentration area) must be at or above the 5000 level.

There is no thesis requirement although ample opportunity is provided for research and writing in course work.

Group A—Foundation Courses. Required for students who lack adequate preparation in the areas listed. Any or all of these courses may be waived if the student has completed undergraduate course equivalents. Additional prerequisite courses may be required for certain concentration areas. These courses are available only to satisfy Group A requirements and as stated on page 68.
Group B—Core for all Candidates. Accounting 5810 Accounting for Management 6
Management 5050
Total, Group B 27

Group C—Concentration. At least 12 but not in excess of 18 quarter hours of graduate level courses are required in one area of concentration. At least half of the credits used to satisfy this requirement must be earned in courses at or above the 5000 level. Any exception must be approved by the student’s faculty committee. To the extent that the concentration area is decreased below 18 hours, Group D—Electives is increased. A student may elect two areas of concentration of 12 quarter hours each, in which case no courses are required in Group D—Core for the double concentration programs should be coordinated through the Graduate Programs Office of the College of Business Administration and the Assistant Dean for Graduate Programs of the College of Business Administration. Total, Group C 12-18

MBA CONCENTRATIONS: Typical course groupings are listed below. Area prerequisites may be taken in one’s undergraduate program or included in the MBA curriculum prior to undertaking courses in the concentration area.

Accounting. Graduates are eligible for the CPA examination in Tennessee. Area prerequisite: Introductory Financial Accounting (6); Marketing 5200 Cost Accounting (6); Intermediate Theory (9); and Federal Income Tax (3).

The following areas must be included in the concentration unless taken in undergraduate program: auditing, consolidations, advanced federal income tax, and computer concepts in accounting. Additionally, at least three of the following must be included: 5110, 5120, 5130, 5210, and 5420.

Economics. (See also Master’s and Ph.D. programs in this area.) Area prerequisite: Intermediate Macro- and Microeconomic Theory (6). Any combination of 12-18 quarter hours of economics courses listed in this catalog as approved by the faculty advisor.

Finance. Area prerequisite: Finance 5050 or equivalent (6). A minimum of three courses must be taken in one of the following areas: Financial Management 5120, 5130, 5410, 5620, 5800, 5990; Investments 5420, 5430, 5810; Monetary Policy and Financial Institutions 5800, 5810, 5820, 5830.

Forest Industries Management. Area prerequisite: B.S. degree in forestry or equivalent. Organization, planning, and control: Management 5100 Introduction to Management Science or Statistics 5312. Statistical Methods 5311 Probability Theory 5312 Quantitative Option (select one)

Management 5300 Introduction to Management Science or Statistics 5312 Statistical Methods 5311 Probability Theory 5312 Quantitative Option (select one)

Business Administration 5310 Business Policy 5310 Total, Group C 27

Group D—Elective courses shall be chosen from the concentration area as approved by the student’s faculty advisor.

Governmental Financial Administration. Area prerequisite: Economics 5707; Finance 5710, 5720, 5730, 5740; Accounting 5510; Political Science 5740.

Management. Area prerequisite: Management 5050 or equivalent (for 5410 only). Organization, Planning, and Control: Management 5110, 5120, 5130; Personnel Management: 5210, 5220, 5230 (core course), 5240; Production Management: 5410, 5420, 5430; Management of Industrial Research: 5230; Management of Foreign Operations: 5710; Management Science. (See also Master of Science and Ph.D. degree programs in this area.) Area prerequisite: Mathematics through second year of calculus, a course in application of digital computers in engineering and science, a course in statistics for engineering. Statistics 5110 and Management Science 5310 are substituted in Group D—Core for the double concentration programs of the College of Business Administration.

Management Science. Area prerequisite: Management 5050 or equivalent (for 5410 only). Organization, Planning, and Control: Management 5110, 5120, 5130; Personnel Management: 5210, 5220, 5230 (core course), 5240; Production Management: 5410, 5420, 5430; Management of Industrial Research: 5230; Management of Foreign Operations: 5710; Management Science. (See also Master of Science and Ph.D. degree programs in this area.) Area prerequisite: Mathematics through second year of calculus, including differential equations. Any combination of 12-18 quarter hours of statistics courses listed in this catalog as approved by the faculty advisor.

Transportation and Logistics. Area prerequisite: Transportation 5050 or equivalent. Any combination of 12-18 quarter hours of transportation and logistics course(s) included in the catalog as approved by the faculty advisor. Transportation 5210 normally is required.

Group D—Electives. Unless the student elects two areas of concentration, a minimum of 6 quarter hours must be taken in areas outside the area of concentration. The elective area is increased beyond 6 hours to the extent that the concentration area is less than 18 hours. With specific approval of the student’s advisor, an elective course may be taken outside the College of Business Administration.

Total, Group D 6-12

Total Program (except Group A) 51

Other Requirements. The application for Admission to Candidacy (see page 20) must be approved by two faculty members in the student’s area(s) of concentration and the Assistant Dean for Graduate Programs of the College of Business Administration before submission to the Vice Chancellor for Graduate Studies and Research.

To qualify for the degree, the student must achieve a B average (3.0) or above in courses taken in the Master of Business Administration as well as in the overall program and pass a written comprehensive examination during the final quarter of the program. If the results of the written examination are not clearly passing or failing, a supplementary written or oral examination may be given in the same quarter. The complete examination process may be repeated one time, but it may not be taken until the quarter following the first attempt.

Dual J.D.—MBA Program

The College of Business Administration and the College of Law offer a coordinated dual program leading to the conferral of both Doctor of Jurisprudence and the Master of Business Administration degrees. A student pursuing the dual program may save up to two academic quarters (24 hours) of course work which would be required if the two degrees were to be earned separately.

Admissions. Applicants for the J.D.—MBA program must make separate application to, and be competitively and independently accepted by, the College of Law for the J.D. degree and the Graduate School and College of Business Administration for the MBA degree, and by the Dual Degree Committee. Students who have been accepted by both colleges may apply anytime prior to, or after, matriculation in either college and may commence studies in the dual program at the beginning of any quarter subsequent to matriculation in both colleges, provided, however, that dual program studies be started prior to entry into the last 42 hours required for the J.D. degree and the last 24 hours required for the MBA degree.

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

The College of Law will award credit toward the J.D. degree for acceptable performance in a maximum of 12 quarter hours of approved graduate level courses offered by the College of Business Administration, provided the 12 quarter hours must be earned in Accounting 5510 or a more advanced accounting course. If College of Law credit is given for such an accounting course, the student may receive College of Law credit for Legal Accounting (Law College Course 5850).

The College of Business Administration will award credit toward the MBA degree for acceptable performance in a maximum of 12 quarter hours of approved courses offered by the College of Law.

Except while completing the first year courses in the College of Law, students are encouraged to maximize the integrative facets of the dual program by taking courses in both colleges each quarter.

Awarding of Grades. For grade recording purposes in the College of Law for graduate business courses and in the College of Business Administration for law school courses, grades awarded will be converted to an Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college where such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a Law School course in which the student has earned a 2.3 grade or higher and a No Credit for any lower grade. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The student must pass a final written comprehensive examination to receive the MBA degree.

The DBA Program

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

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

Foundation Requirements. Although the program is designed for students who have completed an accredited MBA (or equivalent) degree program, those with outstanding undergraduate records in any area may be admitted directly to the DBA program and may, if they desire, earn the MBA degree in a coordinated program of study. Program prerequisites include at least one year of mathematics to include college algebra, general mathematics and a course in single variable calculus; a course in statistics; knowledge of computer programming (FORTRAN IV); Intermediate economic theory (micro and macro); and introductory courses in financial accounting, business finance, marketing, operations, production, and the legal environment of business. Entering students deficient in any of these areas may enroll in courses designed to meet these requirements.

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

A. Basic Disciplines. One graduate level course in each of the following areas must be completed. Students who have earned an MBA degree at an accredited institution probably will have met these requirements without previous graduate work in one or more of these areas may fulfill the requirement by taking the courses listed:

Managerial Accounting (Accounting 5810); Financial Management (Finance 5110); Marketing Management (Marketing 5200); Organization Theory/Behavior (Business Administration 5310);

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

Microeconomics/Advanced Microeconomic Theory (Economics 5111); Advanced Macroeconomic Theory (Economics 5211); Behavioral Science\1 Organizational Behavior (Management 5230); Quantitative Science\2 12 quarter hours in one or a combination of two of the following areas: statistics, management science, econometrics, or computer science. Approval of student's committee is required.

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

Accounting
Finance
Management
Marketing
Transportation and logistics

D. Supporting Area. A minimum of 12 quarter hours of graduate course work is required in an area complementary to, the concentration area. The student may choose the supporting area from one of the following: one of the business functional areas, additional work in one of the basic disciplines or a related area in another school or college of the University. The program of study should be arranged with an advisor in the discipline chosen and must be approved by the student's committee.

Preliminary Examinations. Comprehensive written preliminary examinations consisting of two sessions of approximately four hours each in the concentration area and one four-hour session in the supporting area are required of each person working toward the DBA degree. The student's committee may, if they deem it advisable, supplement the written examinations with oral examinations, and may accept the results of an oral examination only for supporting areas outside the College of Business Administration. These examinations are scheduled twice a year, in early October and early May. The student may opt to sit for all sessions during a single examining period, or may sit for the concentration area and supporting area in two successive periods. A student who fails an area on the first attempt must, if he/she wishes to continue in the program, retake the examination at the next scheduled administration, the results of which shall be final.

Admission to Candidacy. A student may apply for admission to candidacy for the DBA degree after maintenance of at least a B average in course work, successful completion of preliminary examinations and acceptance of a research proposal for the dissertation by his/her faculty committee. Admission to candidacy must be approved at least three quarters prior to the date the degree is conferred. (Admission in the fall quarter permits graduation in the following spring quarter.) Prior to presenting the research proposal for formal approval, the student must form his/her faculty committee and request the concentration area department head to recommend their appointment by the Vice Chancellor for Graduate Studies and Research. There must be at least four members, one of whom must be from a
Minimum Academic Performance Standards

A graduate student in the College of Business Administration whose grade point average at any point after 12 hours is below 3.0 shall be placed on probation. A student on probation shall be dropped from the program if, in the judgment of his/her cumulative grade point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next 12 quarter hours of course work attempted which is specified in the student’s degree program. Exceptions to this policy may be made only with the approval of the Assistant Dean for Graduate Programs of The College of Business Administration upon recommendation of the student’s faculty committee.

Admission Requirements

General admission requirements for the Graduate School are stated on pages 11-12. MBA and DBA applicants are required to take the Graduate Management Admission Test (GMAT). Applicants for programs in economics, management science, and statistics may submit results of either the GMAT or the Graduate Record Examination (GRE) aptitude portion. Applicants for economics who submit GRE aptitude scores must also submit the Advanced GRE score for economics. Applicants for management science must meet the quantitative methods prerequisites stated in the program description. Applicants whose native language is other than English must submit results of the Test of English as a Foreign Language (TOEFL). Scheduled dates and locations for taking these examinations may be obtained from Educational Testing Service, P.O. Box 966, Princeton, New Jersey 08540, and from most colleges and universities.

In addition to procedures required for admission to the Graduate School (pages 11-12), MBA applicants must submit additional forms provided by the College of Business Administration. The application for all programs and supporting materials should be submitted at least three months prior to desired entry date. The College of Business Administration is associated with other leading graduate programs in business as a member of the Graduate Management Admission Council.

Fellowships and Assistantships

Fellowships. Information concerning nonservice fellowships administered by the Graduate School as well as application blanks may be obtained from the office of the Vice Chancellor for Graduate Studies and Research. Assistantships. A limited number of graduate assistantships are available in each of the academic departments and in the Center for Business and Economic Research. Assistantships which carry remission of tuition and/or fees range up to $4500 per year, while others funded through various research centers of the University range up to $5500 per year for half-time service. Awards are generally made on the basis of scholarship and performance on the admission test. Application forms may be obtained in any of the departments or from the office of the Assistant Dean for Graduate Programs. Applications must be received by March 15 for consideration of assistantships to be awarded for the following fall term.

Center for Business and Economic Research

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

Management Development Programs

The Management Development Programs Department offers a wide variety of programs ranging from two- to three-day public seminars and customized "in-plant" programs to the four-week Tennessee Executive Development Program.

The Tennessee Executive Development Program (TEDP) is designed to provide extensive continuing educational opportunities for executives from firms and organizations in Tennessee, the South, and the nation. The major objective of the program is to prepare and develop executives for progressively higher levels of management responsibility and to sharpen existing executive skills needed for comprehensive decision making and leadership. Other major aims of the TEDP are to teach the fundamentals of analytical thinking and the use of the decision tools, and to examine the economic, political, technological, and other environmental factors affecting the firm's operations.

The TEDP limits enrollment to thirty-six participants who live on campus for a total of four weeks spread over a three-month period. This arrangement provides executives with extensive opportunities to exchange ideas and operational concepts with contemporaries in other business areas and with TEDP faculty as well.

The faculty for the TEDP consists of senior professors who teach business-related subjects in the University's graduate programs and nationally recognized professors of other institutions. Each participating faculty member has extensive experience in either consultation with or actual operations in business and industry. The TEDP faculty is augmented by outstanding practitioners in their fields of business and industry.

Department of Instruction

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

Accounting and Business Law

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

Accounting

MAJOR

DEGREE

Accounting

MAJOR

DEGREE

M. Acc.

Accounting Professors:

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

Associate Professors:


Ph.D. Arkansas, C.P.A.

Ph.D. Arkansas, C.P.A.
course including audit of specific asset, liability, revenue and expense accounts, with emphasis on reporting, data processing, statistical sampling, and internal auditing. Prereq: 4110 with C or better.

4630 Analysis and Design of Information Systems (3) General systems concepts, flowcharting, planning of systems study, determination of systems objectives, development and evaluation of design alternatives, implementation and control. Prereq: Computer Science 3910.

4950 Individual Research in Accounting (3) Special projects undertaken by majors in accounting under the direction of faculty members of professional rank. C or Better. T/NC or credit/no credit.

4990 Accounting Theory (3) Theory and conceptual framework underlying measurement of income and financial position as related to the tested accounting reporting problems. Prereq: 3130 with C or Better.

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise on full time before degree is completed. May not be used toward major requirements. May be repeated. T/NC only.

5050-60 Introduction to Accounting (3, 3) User oriented survey of financial and managerial accounting concepts and practices. May not be taken by accounting majors.

5110 Seminar in Accounting Theory (3) Evolution of accounting theory, concepts underlying financial reporting models, and authoritative accounting literature as each receives periodic performance and financial position. Prereq: Consent of department head. May not be taken for credit if 6110 is taken by students whose undergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5810 or consent of instructor.

5120 Seminar in Advanced Auditing (3) Theory and concepts underlying the philosophy of auditing as related to current auditing issues. Prereq: 4120 or equivalent.

5130-40 Seminar in Current Accounting Topics (3, 3) Critical in-depth consideration of current issues in financial accounting literature. Prereq: 4990 or 5110. Must be taken in sequence.

5150 Research in Accounting (3) Directed problem oriented research during any quarter when a student uses university facilities and/or faculty time before degree is completed. May not be taken toward major requirements. May be repeated. T/NC only.

5160 Graduate Internship in Accounting (3) Full time professional employment for one academic quarter involving qualified job experience, written report of responsibilities, and evaluation of student performance. Prereq: Consent of instructor.

5210-20 Seminar in Advanced Managerial Cost Accounting (3, 3) Analysis of current issues and formulation of individual research projects. Topics include cost allocation problems, budgeting, human resource management, social cost factors, performance evaluation and responsibility accounting concepts, service industry, costing and analysis of non-profit ventures and programs. Prereq: 3230 or equivalent. Must be taken in sequence.

5310 Auditing Concepts (3) Concepts and theory of auditing, environment of internal and external auditing, nature of evidence, internal control evaluation and reporting. Not intended for persons who have credit for auditing course. Prereq: 3130. Prereq or coreq: Statistics 4415, 5830, or equivalent. (May be taken concurrently.)

5330 Advanced Income Tax (3) Federal income taxation with emphasis on tax planning and research. Not intended for persons who have credit for advanced tax course. Prereq: 3130, 3230 and 3430.

5340 Consolidations and Business Combinations (3) Theory and practice of accounting for interrelated business entities—domestic and foreign. Not intended for students who have credit for a course with similar content. Prereq: 3130.

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

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

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

5630 Accounting Systems and EDP Concepts and Control (3) Elements and operation of computer in business environment. Analysis, design, implementation, documentation and control of accounting systems. Prereq: 2130 and knowledge of a computer programming language.

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

5810 Accounting for Control (3) User-oriented survey of contemporary financial and managerial cost accounting topics. Prereq: 5060 or consent of instructor. Not available for account majors.

5820 Corporate Reporting Problems (3) User oriented analysis of current corporate financial reporting problems and issues. May not be taken for credit by students whose undergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5810 or consent of instructor.

5910-20-30 Doctoral Seminar in Accounting (1, 1, 1) Research and discussion of contemporary issues in practice of accounting. May be repeated. Admission by consent of department head. T/NC only.

6000 Doctoral Research and Dissertation

6110-20-30 Doctoral Seminar in Accounting (3, 3, 3) Analysis of issues reflected in accounting literature. Prereq: 9 hrs of graduate credit in accounting and consent of instructor.

Business Law

Professors:

5050 Legal Environment of Business (3) Surveys legal and quasi-legal institutions with emphasis on the administrative agencies which have particular significance to the businessman. (Available only as stated on page 36.)

Business Administration

MAJOR DEGREES

MBA, DBA

5310 Business Policy (3) Case studies covering policy formulation and administration; point of departure—top and middle management, where company-wide objectives are set and departmental policies and activities are coordinated; sizing up company’s situation, determining objectives, developing sound policies, organizing and administering personnel to reach company objectives, continuous administrative reappraisals. Enrollment limited to given MBA students in last quarter of their program. Prereq: All other Group B (core) courses of MBA program.

5410 Business and Its Societal Environment (3) Analysis of current societal changes in society and interrelation of plans and actions in business firms with environmental factors. Prereq: Consent of instructor.
5610 Seminar in Applied Business Analysis (3) Application of business concepts and analytical skills to problems of small businesses in community. Students work in teams under supervision of participating professor. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Business Education See College of Education

Economics

MAJOR DEGREES

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


Associate Professors: S. J. Breslow, Ph.D. Detroit; H. S. Chang, Ph.D. Vanderbilt; E. Gustoft, Ph.D. Stanford; H. L. Graubard, Ph.D. Washington; W. Hoerz; M. B. Macdonald; A. Myhow, Ph.D. Texas; K. E. Phillips, Ph.D. Washington (Seattle).

Assistant Professors: N. O. Alper, M.A. Pittsburgh; D. P. Clark, Ph.D. Michigan State; A. J. Dietsch, Ph.D. California (Los Angeles); T. L. Majors (visiting); B.A. Tennessee; C. N. Modestone, Ph.D. Florida; M. J. Morelock, M.A. Washington State; F. M. Murtaugh (visiting); M.A. Pennsylvania; P. G. S. Reid, Ph.D. State University of New York (Binghamton); A. M. Schloittmann, Ph.D. Florida;

Washington (St. Louis).

THE MASTER'S PROGRAM

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

1) Economics 5111-12 and Economics 5121-22.
2) 9 additional hours in economics in the 4000 level or above.
3) 3 hours, or an additional 9 hours in economics at the 5000 level or above to be concentrated in one field. Students electing the non-thesis option will be required to pass a written comprehensive examination.

The requirements for a graduate minor in Economics are as follows: Either 1) Economics 5111-12 and Economics 5121-22, or 2) Economics 5111 or 5112, Economics 5140, and one other 4000- or 5000-series economics course or (4) with the consent of the head of the economics department, an alternative sequence of 9 hours to meet unusual conditions.

MASTER OF ARTS IN COLLEGE TEACHING DEGREE

The requirements for the MACT degree are listed on page 20. A thesis is required.

THE DOCTORAL PROGRAM

Subject Area Requirements

1. Students will be required to demonstrate their competence in the core subject fields as indicated:
   a. Economic theory, by a preliminary examination.
   b. Economic history, by completing 6 hours in economics at the 5000 level or above with an average grade of B or better or by satisfying an examining committee.
   c. History of economic thought, by completing Economics 5150 and 3 additional hours in this area at the 6000 level with an average grade of B or better or by satisfying an examining committee.

2. Students will be required to demonstrate their competence by preliminary examination in three fields with the approval of the department, at least two of which must be selected from the following: economic development; mathematical and quantitative methods in economics by completing Economics 5180, 5190, and 5510 with an average grade of B or better or by satisfying an examining committee. (Note: The Economics 5510 requirement may be waived for those students completing Economics 6170, 6180, and 6190.)

3. Students will be required to demonstrate their competence by passing a final written examination.

4. Students required to pass a final written examination will be notified by the examining committee who will decide with the advice of an ad hoc committee of three tenured members of the faculty. This petition is to be submitted at least nine months before the student takes the preliminary exam in question.

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

4000 Special Topics (3) Student-generated course offered at convenience of department upon student initiative. Subject matter and content determined by students and instructor with approval of the department.

5000 Thesis

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

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

5110-20-30 Economics Seminar (1, 1, 1) Research and Dissertation

ECONOMIC THEORY

4110 Managerial Economics (3) Application of economic theory to business decision making; emphasis on profit objectives, measurement and forecasting demand and costs, and capital budgeting. Prereq: 2110-2210. (Same as Water Resources Development 4110)

4130 Business Cycles (3) Fluctuations in income, employment, prices, and output in the economic system; subjects discussed are the historical facts concerning booms and depressions, statistical methods for analyzing business fluctuations, theoretical explanations of cyclical phenomena, and policies that have been proposed to combat them. Prereq: 3120 or consent of instructor.

4150 History of Economic Thought (3) Development of mathematical and quantitative methods, and economics as a social science, together with an analysis of socioeconomic conditions which influenced this development. Period covered: 1776 through 1938. Prereq: 1 yr of principles of economics and consent of instructor.

4170-80 Introduction to Mathematical Economics (3, 3) Application of mathematical methods in theoretical study of micro- and macroeconomic phenomena. Designed for beginning graduate students who have limited training in analytic geometry and calculus. Prereq: 3110 and college algebra, calculus, and analytic geometry or the equivalent.

5011-22 Macroeconomic Theory (3, 3) Determination of levels of employment and prices for economy as whole, focusing on relationships between interest rates, price expectations, productivity, and quality of money, on one hand, and aggregate saving, investment, and liquidity preferences on the other. Prereq: Intermediate economic theory or equivalent.

5105 History of Economic Thought (3) Development of economic ideas from mercantilist and classical theories through to the neoclassical tradition given to modern theory. Prereq: 1 yr of calculus.

5150 Quantitative Methods in Economic Research (3) Methods of estimation and testing of economic relationships with use of time series and cross section data, with applications to current economic problems. Prereq: Introduction to statistics or Statistics 5210 or the equivalent.

5200 Introduction to Econometrics (3) Statistical analysis of demand, production and cost analysis, distribution of income and wealth, models of growth and cycles, macroeconomic applications. Prereq: 4170-80 and consent of instructor who will take the student's petition.

5210 Public Finance: Revenues (3) Same as Finance 5715.

5220 Public Finance: Expenditures (3) Same as Finance 5720.

5740 Seminar in Public Finance (3) Same as Finance 5740.
5810 Financial Markets and Intermediaries (3) (Same as Finance 5810.)
5820 Monetary Theory and Policy (3) (Same as Finance 5820.)
5830 Commercial Bank Management (3) (Same as Finance 5830.)
6110 Seminar in Advanced Macroeconomic Theory (3) Topics in macroeconomic theory. May be repeated with consent of department. Prereq: 5111, 5112 and consent of instructor.
6121 Seminar in Advanced Macroeconomic Theory (3) Topics in macroeconomic theory. May be repeated with consent of department. Prereq: 5121, 5122 and consent of instructor.
6150-60 History of Economic Doctrines (3, 3) Important ideas of economic thinkers from Middle Ages to present.
6710-20 Seminar: Fiscal Theory and Public Finance (3, 3) (Same as Finance 6710-20.)

INTERNATIONAL TRADE AND ECONOMIC DEVELOPMENT
4230 Problems in International Trade and Economic Development (3) Problems or problem areas of current importance in fields both of international economics and economic development. Prereq: 3210 or 3220.
4231 The Political Economy of Latin America (3) Description, analysis, and comparison of major economics problems and policies of various Latin American countries.
4232 The Political Economy of Asian Development (3) Description, analysis, and comparison of major economics problems and policies of India, China, and Southeast Asian countries.
4260 Economics of Resources and Environmental Policy (3) Economic analysis of environmental policy and allocation of resources. Benefits and costs of development of natural resources and impacts of growth on environment. Prereq: 5120, 5130.
5210 Seminar in International Trade Theory (3) Pure theory of international trade.
5220 Seminar in Economic Development (3) Economic problems of developing countries.
5250 Economic History of Europe (3) Nature and functioning of economic systems and policies in history of western civilization; examination of some major issues of method and interpretation.
5260 Economic History of the U.S. (3) Interrelation of American economic structure and policies from colonial times.
5280 Analysis of Development Economics (3) (Same as Finance 5280.)
5600 Doctoral Research and Dissertation
6000 Doctoral Research and Dissertation

FINANCE
5410 Investments (3) Investment decision, capital costs and financing decision, and dividend decision of firm. Prereq: 5120. Coreq: 5410.
5420-30 Investments (3, 3) Investment decision and security analysis; financial statement analysis; and security prices; financial statement analysis; and security analysis.
5430 Investment and Portfolio Management (3) Investments, capital structure, and capital investment decision. Prereq: 5130.
and stock-price valuation models. Must be taken in sequence.

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

5800 Executive-in-Residence Seminar for MBA (3) Practical aspects of financial management and investments. Leading industry, banking, and governmental personnel conduct class. Prereq: Consent of department.

5900 Research in Finance (3) Directed research on topic of mutual interest to the student and staff member. Prereq: 5110. May be repeated. Maximum 6 hrs.


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

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

MONETARY POLICY AND FINANCIAL INSTITUTIONS

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

5820 Monetary Theory and Policy (3) Relationships of money, credit and liquidity to income, interest rates, employment and prices as well as examination of effect of monetary policy on economic activity. Prereq: Economics 5080 or equivalent. (Same as Economics 5820.)

5830 Commercial Bank Management (3) Bank management decision-making analysis of changes in banking environment and structure; acquisition and management of funds; current banking problems. Prereq: Consent of instructor. (Same as Economics 5830.)

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

6810 Financial Institutions and Markets (3) Theory of financial markets, role of financial institutions, and analysis of market efficiency.

GOVERNMENTAL FINANCIAL ADMINISTRATION

5710 Public Finance: Revenues (3) Allocative, distributional, and stabilization effects of alternative revenue systems. Coreq: Economics 5080. (Same as Economics 5710.)

5720 Public Finance: Expenditures (3) Functions and growth of public sector, public goods, and benefit/cost analysis. Coreq: Economics 5080 or equivalent. (Same as Economics 5720.)

5730 Finance Administration of Government (3) Budgetary and financial management in public sector. Prereq: Economics 5080 or consent of instructor.

5740 Seminar in Public Finance (3) Selected topics: public choice, pricing government services, financial intermediaries and fiscal dynamics. Prereq: 5710. (Same as Economics 5740.)

6710-20 Seminar: Fiscal Theory and Public Finance (3, 3) Advanced topics in fiscal theory and policy. (Same as Economics 6710-20.)

INSURANCE

5110 Theory of Risk Management (3) For students with major background in risk and insurance. Risk management and manageable risks facing individual and firm. Analysis of risk management techniques with emphasis on insurance as a tool.

REAL ESTATE AND URBAN DEVELOPMENT

4900 Aspects of Urban Environment (4) Intersessional course in urban problems. Prereq: Consent of instructor. (Same as Architecture 4900 and Psychology 4900.) S/N only.


5120 Real Estate Analysis (3) Analysis of real property investment, real estate appraisal and appraisal theory. Prereq: Finance 5050 or equivalent.

5130 Housing and Urban Land Markets (3) Analysis of housing demand, supply and location. Segregation and housing discrimination. Impact of urban renewal and public policy on housing markets. Prereq: 5110 or consent of instructor.

5140 Real Estate Investment and Taxation Analysis (3) Analysis of economic factors and institutions which underlie real estate investment decisionmaking and method utilized. Prereq: 5120 or consent of instructor.

Management

Professors:
H. D. Dewhurst (Heidi), Ph.D. Texas

Associate Professors:
F. A. Chamblin, MBA Indiana; O. S. Fowler, Ph.D. Georgia; R. C. Maddox, Ph.D. Texas; C. W. Neel, Ph.D. Alabama.

Assistant Professors:
J. A. Bachmann, Ph.D. Virginia Polytechnic Institute; W. Henderson, Ph.D. Purdue; M. C. Rush, Ph.D. Akron; J. E. Thiel, Ph.D. Indiana; W. S. Williams, Ph.D. Purdue State.

5010-02-03 Readings and Research in Personnel Management (1, 2, 3) Prereq: 4460, Statistics 4310, and consent of instructor.

5000 Thesis

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

5950 Production Management (3) Analysis of production function with emphasis upon application of mathematical-statistical methods. (For MBA students only. Available only as stated on page 36.)

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

5120 Organization Theory II (3) Dynamics of organizational leadership, motivation, informal organization. Prereq: 5110.

5130 Managerial Planning and Control (3) Processes of management planning and controlling, with emphasis on long-range corporate planning.

5170-80-90 Proseminar in Industrial and Organizational Psychology (3, 3, 3) Advanced problems in industrial and organizational psychology. Must be taken in sequence during the student's first year. (Same as Psychology 5170-80-90.)

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

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

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

5250-60-70 Industrial and Organizational Psychology (1-3, 1-3, 1-3) Review and critique of research in industrial and organizational psychology. Prereq: Consent of instructor. S/N or letter grade.

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

5410-20-30 Production Management (3, 3, 3) Quantitative approach to solution of production management problems. Study of functioning of internal and external factors on managerial decisions. Readings and cases.

5610 Energy Management: Theory and Practice (3) Management of energy resources in operating systems: decision criteria, trade-offs, system analysis, energy audits, technical parameters, conservation methods, worldwide energy supply and demand, new energy technologies.

6000 Doctoral Research and Dissertation

6110 History of Management Thought (3) Significant historical ideas leading to present state of art of management.

6120 Advanced Organizational Theory (3) Analysis of operational environment of international business firms and impact of internal and external factors on managerial decisions. Readings and cases.

6250-60-70 Seminar in Industrial and Organizational Psychology (3, 3) Advanced problems in organizational psychology. Areas include performance evaluation, executive development, group process, and morale. (Same as Psychology 6250-60-70.)

6380 Seminar in Industrial and Organizational Psychology (3) (Same as Psychology 6380.)

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

Management Science

MAJOR

DEGREE

Management Science

Ph.D.

Associate Professors:
C. E. Bell (Chairperson), Ph.D. Yale; R. S. Gartinkel, Ph.D. Johns Hopkins.

Assistant Professor:
R. E. Rosenthal, Ph.D. Georgia Institute of Technology.

Management Science Committee:
Members of the Management Science faculty and in addition: R. W. Boling, Management; J. E. Thiel, Management; C. E. Bell, Civil Engineering; E. Glustoff, Economics; S. Selkow, Computer Science; R. E. Shrieves, Finance; C. W. Neel, Public Administration.

* William B. Stokely Professor of Management.

* Alumni Distinguished Service Professor.
There is no foreign language requirement. These requirements generally are completed by the end of the first year of the program.

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

Research and Dissertation. The student must complete 36 quarter hours of Management Science 6000, Doctoral Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate. This effort, which is beyond the 72 hours of course work, normally is completed in the third year of the program.

5000 Thesis

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

5100 Introduction to Management Science Techniques (3) Review of matrix algebra and an introduction to techniques such as mathematical programming, decision theory, and queuing theory. Prereq: Statistics 5311. May not be taken for credit by students who receive credit for 5310.


5355 Mathematical Programming Computational Systems (2) Practical aspects of using state-of-the-art mathematical programming systems. Students will write compatible matrix generation and report writing software for specific applications.

5340 Application of Management Science Methods (3) Application of methods from 5310-20-30 to large-scale management problems. 5330 may be taken concurrently.

5810 Special Topics in Management Science (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5910 Management Science Problems (1) Directed study on subject of mutual interest to student and staff member.

6000 Doctoral Research and Dissertation

6110-20-30 Models for Production Systems (3, 3, 3) Seminar in written preliminary examinations to enhance professional development of doctoral students. Investigation of existing mathematical models for production processes and opportunities for original research.
**Statistics**

**MAJOR**

<table>
<thead>
<tr>
<th>DEGREE</th>
<th>M.S.</th>
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</thead>
</table>

**Professors:**
- C. C. Thigpen (Head), Ph.D. Virginia Polytechnic Institute; D. S. Chambers, MBA Texas; R. A. McLean, Ph.D. Purdue.
- H. A. Lafler, Ph.D. Rutgers; J. W. Philpot, Ph.D. Virginia Polytechnic Institute; R. D. Sanders, Ph.D. Texas; D. J. Wheeler, Ph.D. Southern Methodist; M. S. Younger, Ph.D. Virginia Polytechnic Institute.

**Associate Professors:**

**THE MASTER'S PROGRAM**

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

<table>
<thead>
<tr>
<th>Statistics Major Area</th>
<th>Quarter Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability theory</td>
<td>3</td>
</tr>
<tr>
<td>Theory of statistical inference</td>
<td>6</td>
</tr>
<tr>
<td>Additional coursework in statistics as approved by the student's committee</td>
<td>9</td>
</tr>
<tr>
<td>Additional coursework as approved by the student's committee</td>
<td>9</td>
</tr>
</tbody>
</table>

**Minor Area**

Selected with the approval of both the Department of Statistics and the department in which the work is to be taken.

**Thesis**

Total minimum hours 45

Statistics courses numbered 4000 and above presuppose familiarity with the basic probability distributions in statistics and with the general concepts of statistical estimation and hypothesis testing. Students unfamiliar with these concepts should seek advice from a statistics advisor concerning prerequisite course work.

**Quarter Hours**

| 3450 Statistics for Engineering (3) Survey of statistical methods with special application for engineering students; frequency distributions, selected sampling distributions, some tests of significance. Cannot be taken for credit concurrently with 2100. Prereq: Mathematics 2840. |
| 4250 Nonparametric Methods (3) Measures of association, two-sample tests, analysis of variance with ranked data, paired and multiple comparisons in preference testing; questionnaire evaluation. |
| 4310 Regression Analysis (3) Linear regression and correlation, multiple regression, stepwise methods, polynomial regression, use of dummy variables. Use of standard regression computer programs. Elementary theory and applications. |
| 4410 Design of Experiments (3) Principles and procedures for efficient experimental design. Randomization, choice of size and number of experimental units, utilization of blocking arrangements. Interpretation of experimental data. |
| 4415 Sampling Techniques and Theory (3) Procedures used in probability sampling for a variety of arrangements of statistical universes and development of estimators and standard errors associated with the sampling schemes. Some properties of estimators. Determination of sample size. Not available for credit to students with credit for 3410. |
| 5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. |
| 5110 Introduction to Probability Theory (3) Classical probability and distribution theory. Prereq: Elementary linear algebra and calculus of several variables. |
| 5211 Elementary Statistics (3) Introductory statistics for graduate students. Probability, sampling distributions, estimation, and hypothesis testing. Emphasis on interpretation and decision making. Not available for credit in any College of Business Administration degree program. |
| 5311 Fundamental Concepts of Probability Theory (3) Probability axioms, discrete and continuous random variables, joint distributions, functions of random variables, expectation, and sampling distributions. Prereq: 1830 and 1860 or 2512 and one course in computer programming. May not be taken for credit by students who receive credit for 5110. |
| 5312 Statistical Methods (3) Significance testing, applications of Chi-square statistic, analysis of variance, least squares, and linear regression. Prereq: 5311. |
| 5610 Special Topics in Statistics (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. |
| 6060 Applied Multivariate Analysis (3) Canonical correlation; discriminant analysis for several groups, and for equal and unequal covariance matrices; principal component analysis; Hotelling's T2, multivariate analysis of variance and covariance. Prereq: 1 yr applied statistics including analysis of variance and multiple regression analysis. |
| 6070 Factor Analysis (3) Principal component analysis and principal factor analysis; estimates of communalities; methods of rotation; interpretation of factors; cluster analysis. Prereq: 6060. |

**College of Business Administration**
The College of Communications offers two graduate degrees with a major in Communications, the Master of Science (M.S.) degree and the Doctor of Philosophy (Ph.D.) degree. In addition, communications is available as a minor for students majoring in other departments. Required course work will be selected after discussion with the major advisor and an advisor from the College of Communications.

The College is accredited by the American Council on Education for Journalism. It is a member of the American Association of Schools and Colleges of Communications, the Master of Science in Communication, the Master of Science in Broadcast Education Association.

MASTER OF SCIENCE

The Master of Science degree with a major in Communications is offered for students who primarily desire (1) advanced preparation in effective communication for mass media and other fields of applied communication, or (2) a deeper understanding of the fields of applied communication, or (3) a deeper understanding of the role of the mass media.

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

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

New students may be admitted to the program at any time; however, beginning enrollment is limited to the summer and fall quarters each year. Unless necessary materials are received at least six weeks before registration, applications may not be processed in time for admission to full potential candidate status in the first quarter. In these cases, the student may still qualify for non-degree or post-baccalaureate status.

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

- The academic track is designed for the student who wishes to emphasize advanced study of the theory and effects of communications. A minimum of 45 hours of approved graduate work is required:
  - 12 hours of core courses: Communications 5100, 5120, 5140 and 6100, the first three of which must be taken during the first two quarters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College.
  - 24 hours of selected courses within the College, including at least 9 hours at the 5000 level;
  - 9 hours of thesis work (Communications 5130 to their core);
  - 9 hours of thesis work (Communications 5100, 5120 and 5140, 6100), the first three of which must be taken during the first two quarters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College.
  - 15 hours in a major area within the College, including at least 6 hours at the 5000 level;
  - 9 hours of thesis work (Communications 5100, 5120 and 5140, 6100), the first three of which must be taken during the first two quarters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College;
  - 9 hours of thesis work (Communications 5000);
  - at least 12 hours in a minor area approved by the major advisor, of which at least 6 hours must be at the 5000 level.

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

After the formal program of courses and research in either track is completed, the student must pass an oral examination conducted by his/her graduate committee.

Communications majors in the M.S. program must demonstrate ability to use a typewriter proficiently within their first quarter in residence.

DOCTOR OF PHILOSOPHY

The Ph.D. degree with a major in Communications is intended to prepare scholars for teaching, research, administration, and service in the field of human communications.

The program is interdisciplinary, consisting of a required core curriculum and recommended emphasis outside the
College of Communications

For the teaching or administrative technical competence area: a one-week, non-credit computer program course and Statistics 5211, or Sociology 5320 and Statistics 4250; for the research technical competence area: Statistics 5050 and 5060.

Continuing and Higher Education 5450, Instruction in Higher Education.

Management 5120-20, Organization Theory I and II (or equivalent courses approved by committee).

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

REQUIRED SCHOLASTIC AVERAGE

A student in the College of Communications whose graduate grade point average, not including incomplete grades, is below 3.0 at any time after the end of 12 hours of graduate credit will be placed on probation. A student on probation will be dropped from the program unless his or her cumulative grade point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next 12 quarters of graduate course work attempted which is specified in the student’s degree program.

Exceptions to this policy may be made only with the approval of the Assistant Dean for Graduate Studies of the College of Communications upon the recommendation of the student’s faculty committee.

Communications Research Center

The Communications Research Center is a vital adjunct to the communications graduate program. Objectives of the center are: (a) to conduct original research in mass and public communication; (b) to disseminate research-generated information; and (c) to provide research services to faculty and students, professional communicators, and others interested in improving the quality of human communications.

Departments of Instruction

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

Communications

MAJOR

DEGREES

Communications

M.S., Ph.D.

Professors:

J. B. Haskins, Ph.D. Minnesota; D. G. Hileman, Ph.D. Illinois; R. G. Hite, Ph.D. Northwestern; J. R. Lynn, Ph.D. Southern Illinois.

Associate Professors:

G. A. Everett, Ph.D. Iowa; H. H. Howard, Ph.D. Ohio; E. F. Shaw, Ph.D. Stanford; S. K. Zeigler, Ph.D. Michigan State.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15)

Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated; S/N only.

5100 Introduction to Graduate Studies (3) Scope and methods of advanced study in communications, information sources, literature review methods, scholarly research, professional requirements and procedure, overview of traditional and behavioral research methods.

5120 Research Methods (3) Communications research methodology including data collection process, bases for derivation and verification of hypotheses, and basic methods of designing research communications.

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

5140 Communications Theory (3) (Same as Speech 5140).

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

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

6000 Doctoral Research and Dissertation

6100 Seminar in Communications Theory (3) Intensive analysis of selected theories and supporting research data dealing with source, message, media, receiver, or situational variables in process of communication. Prereq: 5140. Recommended: 5100.

6200 Seminar in Communication Topics (3) Intensive analysis of special issues and problems in human communication. Each term will cover specific professional area, e.g., international communication, public service communication, political communication. Prereq: 5100. Recommended: 5140. May be repeated.

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

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


Advertising

Professors:

R. Joel (Head), M.A. Wisconsin; D. G. Hileman, Ph.D. Illinois.

Associate Professors:

A. D. Fletcher, Ph.D. Illinois; S. K. Zeigler, Ph.D. Michigan State.

Assistant Professor:

D. S. Bagley, Ph.D. Tennessee.

3650 Advertising Copy and Layout (4) Ideas and their translation into persuasive words and pictures. Principles and techniques of copy and
4000 Advanced Advertising Copy and Layout (4) Creative strategy and execution of advertisements for mass media. Problems in idea creation for development and text. Prereq: 3000 or Marketing 4150.

4360 Television Advertising (3) Media, markets, and audiences. Evaluation of media in relationship to television needs of advertisers. Prereq: 3000 or Marketing 4150 or consent of instructor.

4460 Advertising Campaigns and Problems (3) The case approach to the study of advertising problems. Analysis of campaigns and trends. Prereq: 4000 and 4360 or consent of instructor.

4470 Advertising Campaigns (4) Application of theory in planning and execution of campaigns. Market and consumer research; development and allocation of budgets. Choice of appeals and approaches; media selection; preparation of advertisements. Prereq: 4000 and 4360 or consent of instructor.

4510 Current Issues in Advertising (3) Current socioeconomic, legal, and cultural issues in advertising and communication to determine advertising's role in and responsibility toward society. Emphasis on both marketing and behavioral science aspects of advertising. Consideration of management, personnel utilization, sources of program materials, and research. Research, individual reading, preparation and presentation of papers. Prereq: 4360 or consent of instructor.

4520 Creative Projects (3) Creative or problem-solving projects related to advertising. Designed for the advanced student who wishes to apply theory and skills to specific problems. Prereq: 4360 or consent of instructor. May be repeated.

4970 Independent Study (3) Taken for graduate credit by communications majors.

4040 Advanced Television Production (3) A semi-independent course in program origination, producing, directing, and performing with orientation to the professional broadcast student. Prereq: 4360 or consent of instructor.

4160 Broadcast News Operation (3) Theory and practice in covering local news and public affairs events for print and television. Gathering and production of news broadcasts, using tools of broadcast newswriting. Prereq: 3610 and 3670 or consent of instructor. 2 hrs and 1 lab.

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

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

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

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

5610 Public Affairs Broadcasting (3) News and public affairs function in broadcasting stations and networks, including management, economics, personnel utilization, sources of program materials, and legal aspects. Public affairs program development, particularly news conferences, interviews, and news specials. Prereq: 4361 or consent of instructor.

5620 Broadcast Law and Regulations (3) Socio-political control of broadcasting; effect of laws, regulations, and public pressures upon station policies. Emphasis on unique situation of broadcasting among media in terms of regulation. Prereq: Journalism 4410 or 5210 or consent of instructor.

5630 Broadcast Documentary Writing (3) Role of documentary in radio and television. Research, writing, and critique of documentary programs.

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

5970 Independent Study (3) Taken for graduate credit by communications majors.

4140 Communications Law (3) Statutory law and judicial precedents affecting mass communications media. Libel, contempt of court, invasion of privacy, copyright, broadcasting, advertising, and postal regulations.

3560 Investigative and Specialized Reporting (3) Investigative and interpretive reporting of complex or specialized subjects to place news in perspective or for special interest. Emphasis on writing for publication. Prereq: 2220.

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

3720 Public Relations: Advanced (3) Publicity organization, techniques and tools. Preparation of communications materials to gain support from target publics. Prereq: 3710.

3730 Public Relations Cases (3) Case studies and application of public relations principles to problems in business and industry, government, institutions, organizations, trades and professions. Prereq: 3720.

3810 Specialized Publications (3) Business and industrial publications. Specialized aspects of advertising and design in newspapers and magazines in such fields as agriculture, politics, labor, finance, science, technical as well as general publications. Prereq: 2220 or 2230.

3950 International Communications (3) Communication of news and opinion among nations and international systems; world news organizations; the press as a factor in international affairs; barriers to the flow of information; comparison of world press systems.

4990 Problems in Research (3) An independent work course. Intensive study of some phase of the major field, investigative procedures, report writing.

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

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

5519-20-30 Writing and Editing Projects (3,3,3) Specialized writing or editing interests, such as agricultural, politics, labor, finance, science, technical as well as general publications. Prereq: 2220 or 2230.

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

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

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

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

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

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

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

MATER OF SCIENCE

On the Master's level professional study may be planned (1) in one of the areas listed on page 8, (2) in appropriate combinations of these areas, or (3) in combinations of one or more of these areas with appropriate subjects or areas in other colleges.

SPECIALIST IN EDUCATION DEGREE

This degree may be earned in Educational Administration and Supervision, in Educational Psychology and Guidance, in Curriculum and Instruction, in Safety Education and Service, or in Vocational-Technical Education.

DOCTORAL DEGREES

The College of Education offers programs of advanced study leading to the Doctor of Education degree in the major areas listed on page 8, and to the Doctor of Philosophy degree in Health Education.

Bureau of Educational Research and Service

Four major types of activities—research, development, educational services, and publications—are channeled through the Bureau of Educational Research and Service (BERS), located in Claxton Education Building. The research activities relate to the development of research proposals, conducting research, and assisting others in development of research proposals in the College of Education. Developmental activities relate to change efforts in curricular content and instrumental methodology. Educational services include a wide list of activities such as in-service educational programs, consultant services, and administrative training programs. Official publications of the College of Education are developed through the Bureau. A limited number of graduate student assistantships are available.

The Educational Opportunities Planning Center and the School Planning Laboratory are integral parts of the Bureau of Educational Research and Service.

EDUCATIONAL OPPORTUNITIES PLANNING CENTER

The Educational Opportunities Planning Center (EOPC) works with school districts in the Tennessee-Kentucky area to help meet their desegregation and sex discrimination needs by assisting with needs assessment and by helping develop plans to meet the needs. Staff members provide in-service training for local district personnel. Such training is directed toward solutions of curricular, human relations, and other types of problems created or compounded by school desegregation and sex discrimination. On-site evaluation of locally installed practices and continuing cooperative evaluation of the progress of local programs are additional major efforts. This program is funded by the U.S. Office of Education.

SCHOOL PLANNING LABORATORY

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

Departments of Instruction

Numbers in parentheses following the course titles indicate quarter hours credit offered.
Art and Music Education
Charles H. Ball, Head

Art Education

MAJOR
Art Education

DEGREE
M.S.

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

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

Assistant Professors:

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

The thesis option requires 45 quarter hours as follows:

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

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

Quarter hours
1. Art Education 5210, 5310, 5320, and electives .......................... 21
2. Education Curriculum and Instruction 5800, and electives .......... 9
3. Minor (selected with committee) ........................................ 9
4. Electives ................................................................. 6

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

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

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

3320 Art in School Program (3)
Exploring methods of hand-built forms, glazing and firing procedures. Prereq: 2100; 1 hr and 2 labs.

3350 Textiles in School Program (3)
Exploration of processes of weaving, stitchery, batik, and silk screen. Prereq: 2100; 1 hr and 2 labs.

4120 Designing Teaching Aids for Art in School Program (3)
Design and preparation of charts, exhibitions, slides, films, and other teaching aids for art grades one through twelve. Prereq: 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; technical

Music Education

MAJOR
Music Education

DEGREE
M.S.

Professor:
C. H. Ball (Head), Ph.D. Peabody; A. W. Humphreys, Ed.D. Illinois; W. J. Julian, Ph.D. Northwestern.

Associate Professors:

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

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

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

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

Requirements for non-thesis option:
1. Minimum of 51 quarter hours of course work with a minimum of 26 hours at the 5000 level.
2. Evidence of ability to understand and interpret research through completion of:
   a. Curriculum and Instruction 5610 or equivalent.
   b. Music Education 5710.
   c. Satisfactory performance of research activities in required courses in music education listed below.

3. Curriculum:
   a. Major: at least 27 quarter hours in music education.
   b. Minor: at least 15 quarter hours in music.
   c. 9 quarter hours in professional education, including Curriculum and

Instruction 5610 and Educational Psychology 4760 or equivalents and a 3-hour elective.

With the exception of the required courses listed and with approval of the student's advisor, courses may be selected as described more fully above. This provides the flexibility necessary for the student to pursue in some depth specialized interests and needs in the following areas of music teaching:

Elementary; Secondary (Junior and Senior High); Vocal (Choral); Instrumental (Band and Orchestra); and Supervision.

Specific course requirements:
1. Music Education Foundation (15 quarter hours):
   a. Music Education 5000 (3 hours).
   b. The Role of Music in Education (3 hours).
   c. Research in Music Education (3 hours).
   d. Music Education 5710.
   e. Six quarter hours in applied music (piano; voice; a band or orchestra instrument; or theory and composition).
   f. Education (limited elective of 6 quarter hours): Educational Psychology 4760, Advanced Child Study; or 5050, Children and Adolescent Behavior Modification; or other appropriate course in educational psychology with 3 hours credit.

2. Electives (with approval of advisor):
   a. Music Education: 12 credit hours from courses numbered 5000.

3. Electives (with approval of advisor):
   a. Music: 9 credit hours from courses at the 3000, 4000, or 5000 levels. No courses required in the undergraduate curricula may be included.
   b. Education: 3 credit hours, elected from other departments in Education.

4. Evaluation (in addition to routine examinations in courses):
   a. Written comprehensive examination in major and minor fields.
   b. The student shall elect one of the evaluation procedures below (with approval of advisor):
      (1) Oral examinations in major and minor fields.
      (2) A public recital in principal instrument, piano, or voice.
   (3) The presentation in public performance of an original musical composition(s) accepted by the committee as music suitable for school music performing groups.
   (4) Plan, rehearse and conduct a full public performance of music by junior or senior high school music groups. This shall be worked out as a long-term project under the supervision of the student's committee.
   7. Student's Committee: A minimum of three faculty members—the advisor from music education; one member from music; one member from education.

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


4460 Marching Band Techniques (3) Functions, organization, and direction of a school marching band.
5710 Research in Music Education (3) Prereq: intermediate grades. Survey of research, professional literature and development of bibliography. Laboratory activities. Projects. Prereq: Admission to M.S. program.

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

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

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

Continuing and Higher Education

MAJOR

Adult Education

DEGREE

M.S.

Professors:


Associate Professor:

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

Assistant Professor:


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

5000 Thesis

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

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

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

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

Curriculum and Instruction

MAJORS

Curriculum and Instruction

DEGREES

M.S.

Elementary Education

M.S.

English Education

M.S.

Foreign Language Education

M.S.

Institutional Materials

M.S.

Music Education

M.S.

Science Education

M.S.

Social Science Education

M.S.

Professors:

J. C. Dunning (Head), Ph.D. California (Berkeley); J. E. Alexander, Ed.D. Kentucky; C. B. Allison, Ph.D. Oklahoma; G. L. Brown, M.A. (Emeritus), Ph.D. Tennessee; P. C. Burns, Ph.D. Iowa; J. N. Chiles (Emeritus), A. M. Missouri; M. A. Christiansen, Ph.D. Kansas; E. S. Christenbury (Emeritus), Ph.D. Georgia; A. R. Davis, Ph.D. Ohio State; D. W. Dessert, Ph.D. Maryland; D. E. Doak, Ed.D. Colorado; H. Frandsen, Ph.D. Illinois;


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

THE MASTER'S PROGRAM

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

THE SPECIALIST PROGRAM

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

The program includes a minimum of 90 quarter hours of graduate study. If the student has earned the Master's degree, a maximum of 45 hours of the Master's work may be credited to the 90 hour Ed.S. requirement. (45 hours of 500-level courses are required.) The program must also include the following:

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

THE DOCTORAL PROGRAM

The doctoral major in Curriculum and Instruction may include emphasis upon the following fields: curriculum, social foundations, educational research, elementary education, English education, foreign language education, mathematics education, science education, social science education.

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

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

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

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

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

4210 Curriculum in Elementary School Social Studies (3) Approaches and trends in elementary school social studies. Prereq: Teaching experience or student teaching.

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

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

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

4240 Classroom Instructional Organization (3) Developmental and diagnostic programs relating to grouping, individualization, space utilization, organization, grading, integration, and achieving an effective instructional climate. For elementary classroom teacher. Prereq: Senior standing.

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

4260 Philosophy of Education: Introductory Studies (3) Truth, knowledge, and valuation in relation to the 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: 3200 or equivalent.

4300 Developmental Reading in the Secondary School (3)

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

4393 Language Development of Children: Birth-Preadolescence (3) In-depth view of language development from birth through 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.

4530-60-70 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)

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

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

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

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: Consent of instructor.

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.

4750 Utilization of Instructional Media (3) Introduces the basic communications process, need for instructional media, instructional development, selection and utilization of media, and basic software production techniques. (Same as Library and Information Science 4750 and Vocational-Technical Education 4750.)

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

4860 Programmed Learning (3) Theories of learning as related to technology of programmed instruction; techniques and applications of programing. Prereq: Psychology 3210, Educational Psychology 3736, or consent of instructor. (Same as Psychology 4660.) 2 hrs and 1 lab.

5000 Thesis

5002 Non-Thesis Graduation Completion (1-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
54 College of Education

5040 Seminar in Elementary School Language Arts (3) Special topics in current curriculum issues related to elementary school language arts education. Emphasis on individual student presentations, discussions, and investigations. Prereq: At least 1 yr teaching experience (K-9), or consent of instructor.

5070 Seminar in Intercultural Education (3) Analysis of current cultural issues and the way education to man-power planning and technological change; and others.

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

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


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

5141 Pragmatism in Education (3) Effects of American pragmatist tradition on educational philosophy. Prereq: At least 1 yr teaching experience (K-9).

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

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

5150-5870 Seminar (1-3, 1-3, 1-3) Curriculum, elementary education, secondary education, or social situations as they relate to goals of students' programs. Maximum 9 hrs. S/N/C only.

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

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

5211 Instructional Strategies in Elementary School Social Studies (3) Specific teaching methods and instructional procedures for organizing social studies classrooms. Prereq: Consent of instructor.

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

5230 Diagnosis and Remediation of Arithmetic Difficulties (3) Problems in learning arithmetic concepts. Emphasis on tools and strategies for diagnostic teaching of arithmetic. Prereq: 5290 or 5825, or consent of instructor.

5240 Creative Thinking and Expression in the Elementary School (3) Gives students opportunity to examine development of creative potential across academic curriculum of elementary school. Prereq: Consent of instructor.

5250 Secondary School Instruction (3)

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

5280 The Teaching of Language Arts in the Elementary School (3) Trends, issues, and research in content and method for elementary program.

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

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

5284 Seminar in Teaching Elementary Science (3) Analysis of current curricular issues related to elementary science education. Emphasis on individual student presentations, projects, and investigations. Prereq: 5282 or equivalent, or consent of instructor. At least 1 yr teaching experience (K-9).

5290 The Teaching of Mathematics in the Elementary School (3) Trends, issues, and research in content and method for mathematics program, grades 1-8. Prereq: 3350 and Mathematics 2110-2120 or consent of instructor.

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

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

5302 Psychology of Reading (3) The reading act, relationship between learning theory and teaching, role of reading in child's overall intellectual development. Prereq: Undergraduate reading course or consent of instructor.

5304 Programs and Materials for Reading Instruction (3) Examination, selection, and use of materials in reading program, distinguishing between classroom and materials for teaching reading. Prereq: 3281 or 4300 or consent of instructor.

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

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

5307 Assessment and Correction of Classroom Language Arts Difficulties (3) Classroom approaches to assessing and correcting language arts (other than reading) difficulties. Prereq: 5040 or 5280.

5350 Curriculum Development and Evaluation (3)

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

5365 Mathematics Laboratories in Elementary School (K-8) (3) For elementary school teachers dealing with activity-oriented mathematics laboratory materials and pedagogical strategies. Theoretical considerations and development of curriculum and materials for laboratory. Prereq: Consent of instructor.

5380 Diagnosis of Remedial Reading Problems (3) Prereq: 4280.

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

5382 Developmental Reading Praxisum (3) Diagnosis and teaching children having development and corrective reading needs. Prereq: 4280.

5383 Remedial Reading Praxisum (3) Prereq: 5381.

5390 Organization and Administration of Reading Programs (3)

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

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

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) Prereq: 4810-20.

5640 Newer Trends in Elementary Education (3) Trends in classroom procedures, equipment, and materials of instruction; problems involving improvement of instruction.

5660-60 Curriculum Laboratory for Elementary Schools (3, 3) Production of syllabi, courses of study, source units, and other materials.

5670 Curriculum Laboratory for Early Childhood Education (3)

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

5690 Design of Instructional Media (3) Design and application of instructional development model to arrive at solutions to instructional problems, development and design of a learning sequence or module, using appropriate media in actual learning setting. Prereq: 4790 or consent of instructor.

5691 Advanced Production of Audiovisual Software (3) Lettering, overhead projectals, mounting, preserving, photocopying, non-photographic slides, and videotaping for producing classroom audiovisual software. Prereq: 4750 or consent of instructor. Library and Information Science 4750 or equivalent. (Same as Library and Information Science 5691.)

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

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

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

5685 Research in Instructional Media (3) Media research and its application toward improvement of instruction and learning. Prereq: Consent of instructor.

5686 Practicum in Instructional Media (3) Practicum experience in professional media role as identified by student in various organizational and learning settings. Prereq: Consent of instructor.

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

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

5790 Career Development: Workshop (1-4) (Same as Educational Psychology 5790).

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

5820 Seminar in the Teaching of Mathematics (3) Analysis of teaching strategies related to subject matter and learner problems. Student pres-
5825 Teaching Mathematics in the Middle and Junior High School (3) Problems related to teaching mathematics in middle and junior high schools. Understanding structure of mathematical concepts, strategies, methods, and materials suitable for individualized instruction, technological laboratories, and independent study. Opportunities for individual projects. Prereq: 3350 or 3751-52 or equivalent.

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

5835 Teaching Mathematics in the Senior High School and Community/Junior College (3) Curriculum and teaching problems. Methods of teaching, analysis courses such as Algebra II, trigonometry, analytical geometry and calculus. Prereq: 3751-52 or equivalent.

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

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

5843 Seminar in Early Childhood Education (3) Analysis of research in early childhood education (K-3) with emphasis on application to programs and methods of instruction. Prereq: 5710 or 5800 or equivalent.

5844 Mathematics in Early Childhood Education (3) Behavioral characteristics of children in regard to mathematics, content materials and functional instructional settings, and teaching strategies for development of mathematical ideas. Prereq: 3350 or equivalent.

5845 Social Studies and Science in Early Childhood Education (3) Integrative approaches to and substantive classification systems of content areas of social studies and science for early childhood years. Emphasis on selection of appropriate social studies and science content and approaches for the young child. Prereq: 3270 and 3720 or equivalent.

5846 Language Arts in Early Childhood Education (3) Emphasis on development of young learner in regard to mathematics, content materials and functional instructional settings, and teaching strategies for development of mathematical ideas. Prereq: 3270 and 3820-81 or equivalent.

5850-60-70 Problems in Education: English (3, 3, 3)
5851-61-71 Problems in Education: Mathematics (3, 3, 3)
5852-62-72 Problems in Education: Social Studies (3, 3, 3)
5853-63-73 Problems in Education: Science (3, 3, 3)
5854-64-74 Problems in Education: Language Arts (3, 3, 3)
5855-65-75 Problems in Education: General Curriculum (3, 3, 3)
5856-66-76 Problems in Education: Instructional Materials (3, 3, 3)
5857-67-77 Problems in Education: Foreign Languages (3, 3, 3)
5858-68-79 Problems in Education: Conservation (3, 3, 3)

5899 Field Experience (1-9) Application of curricular and instructional principles, methods, and materials in schools. Program prerequisites must be met, and consent of instructor required. May be repeated. Maximum 12 hrs. S/NC only.

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

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

5902 Teaching Composition in the High School (3) Techniques for teaching rhetoric.

5903 Teaching Fiction in the Secondary School (3) Reading, study, and analysis of literary selections.

5904 Teaching the Mass Media in the English Classroom (3) Nature of mass media and importance to American education and life.

5905 Teaching English in the Community/Junior College (3) Emphasis on thorough understanding of communication needs of community/junior college students and objectives, strategies, and materials for meeting these needs.

5906 Teaching Poetry in Grades 7-12 (3) Materials and strategies for teaching poetry.

5907 Teaching Drama in Grades 7-12 (3) Strategies and materials for teaching drama.

5908 Developing Speaking and Listening Skills in Grades 7-12 (3) Strategies and materials for teaching skills of speaking and listening.

5909 Instructional Theory and Design (3) For those individuals at Master's and doctoral levels who have interest in intensive study of instructional process and its relationship to curriculum and learning.

5910-20-30 Problems in Lieu of Thesis (3, 3, 3)
5911 Directing the Forensic Program (4) Same as Speech 5011.
5912 Play Production in Secondary Schools (4) (Same as Theatre 5912).

5950 The Function of the Thinking Process in Education (3) Analysis of thinking process for purpose of tracing its implications for educational theory and practice.

5960 The Teaching of Natural Science (3) Teaching strategies, testing and evaluation techniques, and professional guidelines for program planning in science.

5961 Seminar in Science and Environmental Education (3) Recent developments in science education of concern to classroom instruction. Particular emphasis on interrelationships of environmental factors on science education.

5970 The Teaching of the Social Studies (3)

5980 Projects, Programs, and Materials in Social Studies (3) Projects and aids associated with each social science discipline.

6000 Doctoral Research and Dissertation

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

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

6030 Research and Theory in Teaching Reading (3) Research and theory in application to teaching of reading; research design as it applies to reading investigations. Prereq: Two 5000-level courses in reading.

6031 Seminar in Reading and Language Arts (3) Topics new to broad area of language arts. Two topics each term chosen by need and instructor(s). Prereq: 5000-level course in reading and in language arts.

6040 Seminar in Curriculum and Instruction (1) Required through Fall. S/NC only.

6060 Advanced Study of Methodology in the Elementary School (3) Consideration to recent and current literature in field and in other instructional practices in guiding learning of children. Prereq: 5450 or consent of instructor.

6080 Advanced Seminar in Philosophy of Education (3) Some selected philosophical issues in education. Prereq: At least 2 courses in history of philosophy of education.

6081 Phenomenology and Education (3) Selected philosophical issues. Prereq: At least 2 courses in history or philosophy of education.

6082 Philosophical Analysis and Education (3) Philosophical analysis of language and concepts in educational research and writing. Prereq: At least 2 courses in history or philosophy of education.

6150 Education as Social Policy (3) Education as instrument of national or cultural well-being; problems faced by society in shaping educational programs; comparison of education in this country and in other nations.

6210 Seminar in Elementary School Social Studies Research (3) Current research in elementary school social studies, status of research in field, needed research-related research from other fields. Prereq: Undergraduate course and one graduate course in social studies, or equivalent.

6220 Programs for Curriculum Improvement (3)

6259 Seminar in History of Education (3) May be repeated with consent of instructor.

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

3630 The Professional Education of Teachers (3) Basic theories, programs, and practices.

6400 The Dynamics of Educational Change (3) Causes of lag between educational theory and practice; factors useful in reducing this lag.

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

6510 Analysis of Early Childhood Education (3) Prereq: 5270 or 5410 or equivalent.

6571 Advanced Studies in Elementary School Language Arts (3) Critical research analysis of selected issues in elementary school language arts. Prereq: 5280 or equivalent and consent of instructor.

6710 Advanced Educational Statistics (3)

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

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

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

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

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

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

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

6899 Internship (1-8) Advanced level experiences in application of principles and practices of curriculum development and instructional improvement. Program prerequisites must be met and consent of instructor required. May be repeated. Maximum 12 hrs. S/NC only.
Educational Administration and Supervision

MAJOR

Educational Administration and Supervision

DEGREES

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

Professors:


Associate Professors:

H. F. Aldmon, Ed.D. Tennessee; G. W. Harris, Jr., Ph.D. Michigan; P. M. Husen, Ed.D. Stanford

Programs are planned for (1) students preparing for administrative positions normally found in the educational structure of the state; (2) students preparing for the position of supervisor of education; (3) administrators and supervisors in service who wish to improve their professional competence; (4) students and teachers preparing for teaching positions involving administrative responsibilities; and (5) students preparing for teaching educational administration or for administrative positions in higher education.

In addition to M.S. and Ed.D. degrees, a special two-year graduate program is offered which leads to the Ed.S. (in educational administration) degree and which provides advanced preparation for applicants judged to be potentially competent school administrators.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15)

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

5100 Internship in Educational Administration (3)

May be repeated with consent of department. Maximum 6 hrs.

5110 Introduction to Educational Administration (3)

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

5220 Philosophy and Theory in Educational Administra-

5220 Seminar in the Behavioral Sciences for Edu-

5290 The Politics of Education (3) Special em-

5310 School Administration in a Multiethnic So-

5420 District Level Administration (3)

5430 Building-Level Administration (3) For begin-

5450 Introduction to Law, Finance, and Business

5450 Organization of the School Program (3)

5470 Introduction to School Facility Planning (3)

5480 Introduction to Supervision and Personnel

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

5530 Introduction to Educational Planning (3)

5580 Analysis and Interpretation for Research for Educational Administrators (3)

5580 Seminar in Communication Skills for Educa-

5711-21-31 Problems in Educational Administra-

5712-22-32 Problems in Educational Administra-

5713-23-33 Problems in Educational Administra-

5714-24-34 Problems in Educational Administra-

5715-25-35 Problems in Educational Administra-

5720 Seminar in Urban School Administration (3)

5730 School Business Management (3)

5740 School Law (3) Constitutional provisions,

5751-61-71 Problems in Educational Administra-

5752-62-72 Problems in Educational Administra-

5753-63-73 Problems in Educational Administra-

5754-64-74 Problems in Educational Administra-

5755-65-75 Problems in Educational Administra-

5756-66-76 Problems in Educational Administra-

5757-67-77 Problems in Educational Administra-

5758-68-78 Problems in Educational Administra-

5759-69-79 Problems in Educational Administra-

5770 Maintenance of School Plants (3)

5780 Supervision (3) Supervisory activities of
county and city school supervisors. Use of com-
mittees, effective techniques for working with
groups, relationships with local and state admin-
istrative and supervisory personnel, and tech-
niques for evaluation of supervisory programs.

5790 School Board-Superintendent Relationships (3)

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

5830 Contemporary Economics and Educational

5890 Decision Making and Decision Theory in Educa-

5980 Administration in Higher Education (3)

6010 Internship in Educational Administration (3)

6210 Modern Trends in the Theory and Practice of Educational Administration and Supervision (3)

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

6460 School Personnel Administration (3) Person-

6480 Special Topics in School Personnel Admin-

6570 Advanced Study in School Facility Planning

6870 Advanced Study in School Facility Planning

6890 Specialized Doctoral Seminar in Politics of Educa-

6991 Specialized Seminar: Theory (3)

6992 Specialized Seminar: Finance (3)

6993 Specialized Seminar: State School Adminis-

6994 Specialized Seminar: Business Manage-

6995 Specialized Seminar: Personnel (3)

6996 Specialized Seminar: School Law (3)

6998 Doctoral Research and Dissertation

6999 Specialized Seminar: Distinguished Service Professor.

6998D Specialized Seminar: School Law (3)

6999F Specialized Seminar: School Law (3)

6999H Specialized Seminar: School Law (3)

6999I Specialized Seminar: School Law (3)

6999K Specialized Seminar: School Law (3)

6999L Specialized Seminar: School Law (3)

6999M Specialized Seminar: School Law (3)

6999N Specialized Seminar: School Law (3)

6999O Specialized Seminar: School Law (3)

6999P Specialized Seminar: School Law (3)

6999Q Specialized Seminar: School Law (3)

6999R Specialized Seminar: School Law (3)

6999S Specialized Seminar: School Law (3)

6999T Specialized Seminar: School Law (3)

6999U Specialized Seminar: School Law (3)

6999V Specialized Seminar: School Law (3)

6999W Specialized Seminar: School Law (3)

6999X Specialized Seminar: School Law (3)

6999Y Specialized Seminar: School Law (3)

6999Z Specialized Seminar: School Law (3)
PreReq: 5290, 5810 or equivalent or consent of instructor.

6996 Specialized Seminar: School Plant (3)

6997 Specialized Seminar in Organization and Structure (3) Organizational theories in education including systematic review of status of organization principles in classroom teaching, evaluation and related disciplines; implications for further research; application of existing theory and research to known educational settings. PreReq: Consent of instructor.

6999 Specialized Seminar: Supervision (3)

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**Educational Psychology and Guidance**

**MAJORS**

- DEGREES: M.S., M.S. in Educational Psychology, M.S. in Educational Psychology, and Guidance. Ed.S., Ed.D.

**Professors:**

- L. M. DeRidder (Head), Ph.D. Michigan

**Associate Professors:**


**Assistant Professors:**


Graduate programs (thesis or non-thesis option) lead to the Master of Science degree with majors in Guidance, with concentrations in elementary or secondary guidance, College Student Personnel, or Educational Psychology with a concentration in school psychology, to the Specialist in Education degree, and to the Doctor of Education degree, both with concentrations in educational psychology, guidance, school psychology, counselor education, counseling in college and mental health centers, educational measurement and research, career development, and sex-fair counseling and teaching. Appropriate courses taken in this department and in the Department of Psychology will satisfy requirements for certification as a school psychologist. Write the department for information concerning the program requirements. Application deadlines to Ed.D. are February 1 and July 15; Ed.S. and M.S. deadlines are October 15, February 1, May 1, and July 15.

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

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

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

4440 General Evaluation Procedures for Public Schools (3) PreReq: 2430 or equivalent.

4455-55-56 Student Leadership Workshops (1, 1, 1) Small group and individualized experiences to develop knowledge and skills in leadership roles. Sections of the course provide for the development of student government leaders, student activities, and other student organizations. PreReq: Consent of instructor. S/NC only.

4460 Standardized Testing (3) Use of interpretations of standardized group instruments in assessment of intelligence, aptitude, achievement, vocational interests, and personality adjustment.

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

4760 Advanced Child Study (3) PreReq: 2430 or 3610 or consent of instructor.

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

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

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

5000 Thesis

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

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

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

5060 Group Approaches with Students (3) Knowledge and skills appropriate to functioning with groups in counseling; psychological and parent education.

5070 Seminar in Elementary School Guidance (3) Trends, roles, functions, and administration of guidance in elementary school.

5099 Field Work (1-4) Practical experience in departmentally approved field placement. Supervision by field and University personnel. Program prerequisites to field work must be met. May be repeated. Maximum 6 hrs. S/NC only.

5100 Developmental Psychology (3) (Same as Psychology 5100.)

5110 Psychology of Women (3) Past and current educational and psychological theory and practice with special attention to assumptions and practice in regard to women: social context in which various theories were developed and current theories and research focusing on women and/or sex differences. PreReq: 4130 or basic course in psychology. S/NC only.

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

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

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

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

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

5210 Interpreting Published Articles: Statistics (3) Descriptive and experimental research in educational psychology, guidance and counseling, and related disciplines; Non-thesis option students only or consent of instructor.

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

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

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

5330 Theory and Research in Human Learning (3) Contemporary learning theory; current research and its influence upon school practice.

5331 Current Developments in Human Learning (3)

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

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

5420 College and University law—Constitutional Rights and Responsibilities of Students (2) Legal precedent affecting student personnel services in public higher education. Student discipline, housing, dress, organizations, activities, fees, tuition, and related federal regulations. (Same as Continuing and Higher Education 5420.)

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

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

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

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

5780 Career Development: Theory and Research (3)

5785 Career Development: Program Development and Implementation (3) Career development and prevocational programs and projects; K-adult with emphasis on development, implementation, and evaluation. PreReq: 5760 or equivalent, or consent of instructor.

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

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

5850-65-70 Special Topic and Problems in Educational Psychology and Guidance (1-6, 1-6, 1-6) May be repeated. S/NC only.

5880 Career Development: Occupational and Educational Resources (3) Gathering, interpreting, and using educational, social, occupational, and community information in the guidance program; sources, types of materials, and occupational filing plans. For use both in group and individual guidance programs.
6910 Special Topics Seminar (3) Exploration of specific research or theoretical topics with students who have necessary background. Topic will vary from quarter to quarter, depending upon instructor. Prerequisite: Acceptance in doctoral program and consent of instructor. May be repeated. S/NC only.

6941-42-43 Practicum in Guidance, Counseling, and Personnel Services (3, 3, 3) Supervised practice in application of guidance tools and techniques. Minimum: 90 clock hours each quarter. Prereq: 5690 and consent of instructor.

6944-45-46 Teaching Practicum in Educational Psychology and Guidance (3, 3, 3) Prerequisite: Acceptance in doctoral program and consent of instructor.

6950 Counseling Supervision (3) May be repeated with consent of advisor. Prereq: 5990, 5940, 6110, 6941. S/NC only.

Special Education and Rehabilitation

DEGREES

MAJORS

Special Education

Vocational Rehabilitation Counseling

M.S.

Professors:


Associate Professors:


Instructors:

J. L. Casselli, Ph.D. Kansas; C. G. Doll, Ed.D. Florida State.

Lecturers:


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

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

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

Under the sponsorship of Social and Rehabilitation Services, a specialized institute for the preparation of professionals to adapt their skills toward services to hearing impaired and deaf people is provided.

For further information write the department head.

EDUCATION OF THE HEARING IMPAIRED

4000 Rehabilitation Practicum (3) Evaluation of client data practicing rehabilitation diagnosis. Prereq: 4230.

4190 Speech Development of Hearing Impaired (3) Anatomy and physiology of speech system. Relationship of hearing to speech development. Theories and techniques of speech development and improvement with hearing impaired children. Prereq: Audiolgy and Speech Pathology 3050. (Same as Audiology and Speech Pathology 4190.)

4200 Practicum in Speech Development of Hearing Impaired (3) Techniques of speech development and improvement with hearing impaired children. Prereq: Audiolgy and Speech Pathology 4210. (Same as Audiology and Speech Pathology 4200.)

4210 Language Development of Hearing Impaired I (3) Systems by which formal language is presented. Prereq: 4210 or consent of instructor. (Same as Audiology and Speech Pathology 4210.)

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

4230 Communication Processes for the Hearing Impaired I (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. Observations and practicum. (Student must acquire a degree of proficiency in use of manual language.) Prereq: Consent of instructor.

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

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

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

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

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

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

4871 Practicum with Hearing Impaired Children (2) S/NC only.
5220 Linguistics in the Education of the Hearing Impaired (3) Recent research and developments in linguistics relating to the education of the hearing impaired.

5240 Seminar in Language Remediation for the Hearing Impaired (3) Current and recent developments in educational methodologies and to research pertaining to language acquisition in hearing impaired. Research and materials current in use of various sign language systems and adaptations for public education programs for children with language deficiency.

5310-20-30 Manual Communication (2, 2, 2) Basic and advanced skills in Signed English and signed forms of communication. Emphasis on ability to express and receive the manual forms. Prereq: Consent of instructor. Must be taken in sequence.

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

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

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

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 teaching and guidance of mentally retarded; methods and materials in special and regular classes. Prereq or coreq: 4110.

4440 High School Program for the Mentally Retarded (3) Prereq: Major in education of mental retardation. S/N/NC only.

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

4811-20-30 Student Teaching Mental Retardation (9) S/NC only.

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

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

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


MULTIPLE DISABILITIES

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

4150 Education Problems of Hospitalized and Homebound Children (3) School and home responsibility for physical care and social relation-
assessment experiences. Prereq: Admission to program in disability evaluation or consent of instructor.

5740 Disability and Work in Society (3) Relationship of work to physical, social, psychological, and economic development of disabled individuals. Prosocial needs and values of vocational rehabilitation, work adjustment services in rehabilitation.

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

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

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

SCHOOL SPEECH AND HEARING THERAPY

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

4320-30-40 Clinical Practice in Speech Pathology (1-1, 1-3, 1-6) (Same as Audiology and Speech Pathology 4320-30-40.)

4341 Clinical Practice in Speech Correction in the Public Schools (3) Prereq: 4300, 4320-30-40 and consent of instructor. S/NC only.

4342 Seminar in Speech Correction in Public Schools (3) Prereq: 4300, 4320-30-40 and consent of instructor.

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

4450-60-70 Clinical Practice in Audiology (1-1, 1-4, 1-6) (Same as Audiology and Speech Pathology 4450-60-70.)

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

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

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

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

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

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

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

EDUCATION OF THE VISUALLY HANDICAPPED

4100 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 responsibilities.

4923 Student Teaching of the Partially Seeing (3) Observation and supervised practicum in special and regular classes. S/NC only.

GENERAL COURSES

3333 Education of the Exceptional Child (3) Principles, characteristics, federal, local, and state programs for diagnosis and care; educational provisions in regular or special classes; some teaching methods, assessment and educational guidance.

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

4250-60-70 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 development of diagnostic and remedial methods employed in measurement of educational needs of children and adults who are mentally retarded, learning disabled, multiply handicapped or physically handicapped.

5000 Thesis

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

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

5400 Assessment and Remediation of Learning Disabilities (3) Identification and remediation of learning problems of children: neurological and medical aspects; task analysis of cognitive, affective, and psychomotor skills; formal diagnostic testing material emphasizing cognitive development. Optimizing teaching instruction combined with a prescriptive teaching approach to learning disabilities.

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

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

5403 Resource Teachers for the Handicapped (3) To help students acquire the skill to maintain mildly handicapped children in regular public education. Includes an introduction to teaching, and expectations, interpersonal relations, assessment of abilities, modifications of curriculum content, and applied teaching methodology.

5410 Instructional Media for the Handicapped: Design, Production, and Evaluation of Prototypical Curriculum Materials (9) Perception, communication, and learning theories; media design and advanced production techniques; evaluation procedures. Emphasis on planning and producing prototype media materials specifically designed to meet needs of handicapped learners. Enrollment limited to persons holding major responsibility in program for handicap or similar setting. Prereq: 4410 or equivalent. (For Summer Media Institute only.)

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

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

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

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


5790 Career Development: Workshop (1-8) (Same as Educational Psychology 5790.)

5830 Seminar: Issues and Theories in the Education of the Exceptional Child (3) Current trends in education of exceptional child, application of philosophical approaches to education, analysis of educational theories and structures applied to exceptional child. Current research concerning education and/or rehabilitation of exceptional persons. Prereq: Admission and Instruction 5800 or Educational Psychology 5310 and consent of instructor.

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

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

VOCATIONAL-TECHNICAL EDUCATION

MAJORS

M.E.orgia Agricultural Education M.S.

M.S. Business Education M.S., M.A.C.T

D.S. Education D.S.

D.S. Economics Education D.S.

Industrial Education M.S.

Vocational-Technical Education M.S., Ed.S., Ed.D.

Professors: R. M. Rumm (Emeritus), Ph.D. Ohio State.


Industrial Education: J. Bies, Ph.D. Missouri; D. F. Ed. Kansas State; R. Hanson, Ph.D. Purdue.


THE MASTER’S PROGRAM

Each vocational service area (agricultural education, business education, distributive education, home economics education, industrial education, and vocational-technical education) offers similar programs leading to the Master’s degree. Both thesis and non-thesis options are available. Details regarding the Master’s programs of each of the service areas may be obtained from the chairpersons of the different services. The MACT is also available in the business education area.

THE SPECIALIST PROGRAM

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

THE DOCTORAL PROGRAM

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

The Vocational-Technical Education doctoral curriculum consists of the following: professional education core, 15 hours; service area, 18 hours; vocational-technical education, 18.27 hours; cognate fields, 9-18 hours; research techniques, 6-12 hours; and dissertation, 36 hours. A minimum of 120 hours above the baccalaureate is required.

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

5000 Thesis

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

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


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

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

5100 Organization and Operation of Area Vocational-Technical Schools (3) (Same as Industrial Education 5140.)

5110-20-31 Graduate Seminar in Current Problems (3) Graduate Seminar in Business Education (1, 1, 1) Prereq: Curriculum and Instruction 5140 or equivalent.

5120 Curriculum Planning in Vocational-Technical Education (3) Prereq: Curriculum and Instruction 5140 or equivalent.

5130 Administration of Vocational-Technical Education (3) Administrative principles and relationships to vocational and technical training.

6110-12-13 Internship in Vocational and Technical Education (3, 3, 3) Field experiences in selected areas of vocational and technical education. S/NC only.

Agricultural Education

4510-20-30 Problems in Agribusiness Education (1, 1, 1, 1) Prereq: 4350 or consent of department head. May be repeated. Maximum 9 hrs.

4710-20-30 Seminar in Agricultural Education (1, 1, 1) Prereq: 4350 or consent of department head. May be repeated. Maximum 9 hrs.

6110-20-30 Seminar in Agricultural Education (1, 1, 1) Prereq: Curriculum and Instruction 5140 or equivalent.

6120-20-30 Seminar in Business Education (2, 2) Prereq: Curriculum and Instruction 5140 or equivalent.

6150 Organization and Operation of Area Vocational-Technical Schools (3) (Same as Industrial Education 5140.)

6210-20-30 Seminar in Agriculture Education (1, 1, 1) Prereq: Curriculum and Instruction 5140 or equivalent.

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

6230 Evaluation of Vocational-Technical Education Programs (3)

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

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

Business Education

4230 Curriculum Construction in Business Education (3) Aims, principles, practices and problems in construction of business curricula for various types of educational institutions in which business subjects are taught.

4410-20-30 Problems in Business Education (3, 3, 3)

5000 Thesis

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

5011 Problems in Lieu of Thesis (3)

5110 Graduate Seminar in Current Problems (3)

5111-12-13 Graduate Seminar: Current Problems in Business Education (1, 1, 1)

5120 Graduate Seminar in Tests and Measurement (3)

5130 Graduate Seminar in Guidance (3)

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

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

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

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

5612-22-32 Problems in Business Education: Shorthand (3, 3, 3)

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

5640 Methods and Materials for Vocational Office Education (3) Methods and materials for vocational office education programs. Development of instructional aids, recent developments and research, individualized instruction, and occupational clusters for VOE.

5650 Methods and Materials for Business Education: Bookkeeping and Accounting (3, 3)

5651-25-35 Problems in Business Education: General Business: General Business (3, 3, 3)

5680 Organization and Management of Vocational Office Education Program (3) (Same as Vocational Office Education 5140.)


5720 Placement, Follow-up and Evaluation Procedures in Agricultural Education (3) Methods and procedures in establishing placement programs, student supervision, and curriculum revision in agricultural education.

5730 Occupational Program Development for Disadvantaged Persons (3) Problems of the academic, socioeconomic, cultural and/or other handicaps that prevent individuals from succeeding in regular vocational education programs.

5750-60-70 Problems in Vocational-Technical Education (1-6, 1-6, 1-6) May be repeated. Maximum 60 hrs.

6000 Doctoral Research and Dissertation

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

6990 Advanced Studies in Business Education (1, 1, 1) Prereq: Curriculum and Instruction 5140 or equivalent.

6990 Problems in Agribusiness Education (1, 1, 1, 1) Prereq: 4350 or consent of department head. May be repeated. Maximum 9 hrs.

7100 Graduate Seminar in Current Problems (3)

7110 Graduate Seminar: Current Problems in Business Education (1, 1, 1)

7120 Graduate Seminar in Tests and Measurement (3)

7130 Graduate Seminar in Guidance (3)

7140 Organization and Operation of Area Vocational-Technical Schools (3) (Same as Industrial Education 5140.)

7410-20-30 Practicum in Business Education (2, 2)

7510 Evaluation of Research in Business Education (3) Prereq: Curriculum and Instruction 5610 or equivalent.

7511-21 Problems in Business Education: Typing (3, 3)

7512-22-32 Problems in Business Education: Shorthand (3, 3, 3)

7523-33 Problems in Business Education: Bookkeeping and Accounting (3, 3)

7540 Methods and Materials for Vocational Office Education (3) Methods and materials for vocational office education programs. Development of instructional aids, recent developments and research, individualized instruction, and occupational clusters for VOE.

7550 Methods and Materials for Business Education: Bookkeeping and Accounting (3, 3)

7560-25-35 Problems in Business Education: General Business: General Business (3, 3, 3)

7580 Organization and Management of Vocational Office Education Program (3) (Same as Vocational Office Education 5140.)


7620 Teaching Agricultural Mechanization in Vocational Agriculture (3) Prereq: 4350.

7630-60-70 Problems in Agricultural Education (3) Administration of Vocational-Technical Education (3) Administrative principles and relationships to vocational and technical training.

7640 Methods and Materials for Vocational Office Education (3) Developing educational programs, guidelines in cooperatives, laboratory and model office programs. Physical facilities, instructional aids, related instructional activities (clubs), enrollment, instructor and advisory committees.

7650 Problems in Business Education: Administration (3)

7660-20-30 Current Issues in Business Education (3, 3, 3)

7670-20-30 Advanced Studies in Business Education (3, 3, 3)

7680 Higher Education for Business (3)

Distributive Education

4100 Areas of Distribution (3) Marketing, product or service technology, social skills, basic skills, and distribution as these areas affect the distributive education curriculum in secondary and postsecondary programs.

4100 Supervised Distributive Experience (3) Minimum 200 hours experience in approved distributive business; concurrent analytic project.

4110 Organization and Operation of Distributive Education Programs (3) Program analysis of development needs, federal and state legislation; cur-
4320 Methods and Materials in Distributive Education (3) Prerequisite: Consent of instructor.

4330 Coordination Techniques in Distributive Education (3) Selecting training agencies; job analysis; supervision of students; advisory committees; adult and other community services. Prerequisite: 4310, 4320.


5000 Thesis

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

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

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

5210-20-30 Special Problems in Distributive Education (3, 3, 3) Material research, conferences, and/or workshops in teaching and supervising high school, postsecondary, and adult programs.

5616-26-33 Problems in Distributive Education: Retailing (3, 3, 3)

Home Economics Education

5000 Thesis

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

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

5130 Furthering Good Human Relationships in the Classroom (3) Relationships between problems in human relations, basic needs of individuals, techniques of interpersonal relations and social values in developing more effective teacher education programs.

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

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

5440 Curriculum Development and Implementation in Family Relationships Instruction (3) Content for teaching family relationships. Selected materials and methods, appropriateness for reaching curriculum objectives in family relationships.

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

5530 Organization of the Homemaking Curriculum in Secondary Schools (3) Recent advances in home economics education. Development of teaching material in relation to total homemaking program in secondary school—day-school, adults, home experience, and Future Homemakers of America.

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

5820 Wage Earning Programs in Home Economics (3) Planning, establishing, and implementing wage earning programs in home economics.

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

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

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

Industrial Education

3110 History and Philosophy of Industrial Education (3)

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

3310 Shop Organization and Management (3)

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

3340 School Shop Safety (3)

3610 Development and Utilization of Advisory Committees (3, 3) Selection, organization, implementation, and utilization.

4110 Foremanship Training by the Conference Method (3)

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

4150-11-12 Seminar in Industrial Education (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. Prerequisite: 6 hrs. drafting.

4662 Construction Processes (3) Construction processes of industry and their relationship to careers. Prerequisite: 3682.

4670 Manufacturing Processes (3) The manufacturing processes of industry and their relationship to careers. Prerequisite: 2621, 2641, 2660, 3651, or consent of instructor.

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

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

5000 Thesis

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

5110-20-30 Administration and Supervision of Industrial Education (3, 3, 3) Principles of vocational education; relationships with general education and trade and labor organizations; administration and supervision of vocational and technical education programs in area schools. (Same as Business Education 5140.)

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

5310 Methods of Research in Industrial Education (3)

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

5420 Advisory Committees and Apprentice Training (3)

5430 Vocational School Administration and Management (3)

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

5510-20-30 Seminar in Industrial Technical Education (3, 3, 3) Ramifications of vocational and technical innovations in trade and industry in relation to increasingly technically oriented society. Prerequisite: B.S. in Industrial Education and teaching experience.

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

School of Health, Physical Education, and Recreation

Madge M. Phillips, Director

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

THE MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: Physical Education, Recreation, Safety Education and Service, and School Health Education. Forty-five quarter hours are required for the M.S. Approximately 23 quarter hours of work selected from courses numbered 5000 and above are included in the M.S. requirement. Course selection shall be

5000 Thesis
made according to each student's professional interests in health, physical education, safety, or recreation with the approval of the major professor. Non-thesis options are available in all M.S. degree programs. A 3 quarter-hour course in research techniques and/or statistics and/or a seminar in research will be required. Each non-thesis degree candidate will take a final comprehensive examination.

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

DOCTORAL PROGRAMS

The Doctor of Education and the Doctor of Philosophy degrees are offered in the College of Education. See further description under Education Health. The Doctor of Education degree is offered with a major in Physical Education and two collateral areas of study. The curriculum to be pursued will be determined by the student and a doctoral committee. Selection of this curriculum will be based on the past training, experience, and interest of the student. The basic requirements for admission are:

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

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

c. A superior grade point average.

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

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

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

Assistantships are made available by local schools, agencies, and the School of Health, Physical Education, and Recreation in return for part-time services rendered. The services may consist of teaching physical education classes, teaching health classes, teaching safety classes, leading recreational activities, supervising Recreation Health students, and/or directing or helping to manage extracurricular programs. Students interested in these opportunities should file their applications before February 1. Letters should be addressed to: The School of Health, Physical Education, and Recreation, The University of Tennessee, Knoxville, Tennessee 37916.

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

Departments of Instruction

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

Division of Health and Safety

MAJORS

Health Education

Public Health

Safety Education and Service

School Health Education

DEGREES

Ed.D. in Health Education

M.P.H.

M.S., Ed.D.

M.S.

Professors:

R. H. KYR (Chairperson), H.S.D. Indiana;
W. J. Huffman, Ed.D. Illinois; B. C. Wallace,
Ed.D. Colorado State.

Associate Professors:

I. Ahmad, Ph.D. Oregon; A. J. Brown, Ed.D.
Tennessee; C. B. Hamilton, Dr. P.H. Oklahoma;
G. Corse, Dr. P. H. California (Los Angeles);
M. A. Milliken (Emeritus), M.A. Yale.

Assistant Professor:

A. F. Thompson, Ph.D. Michigan State.

Lecturers:

M. Duffy, M.D. Pennsylvania; H. P. Hopkins,
Ph.D. North Carolina.

The Health and Safety Division offers the following degree programs:

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

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

Educational Specialist degree in Safety Education and Service.

Doctor of Education degree in Health Education.

Doctor of Philosophy degree in Health Education.

Public Health

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

3210 First Aid and Emergency Care (4) Theory and practice of first aid and emergency care. Instruction in medical self-help. Course leads to Red Cross Certification in Advanced First Aid and Emergency Care. (Applicant must be at least 16 years of age for certification.) (Same as School Health 3210.)

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

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

4120 Community Health Problems—Alcoholism (3) Explores problems of alcoholism regarding overall health of community. Emphasis placed on factors making alcoholism a serious public health problem. Survey of major consumer health and safety 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) Explores problems 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 megacities; industrial health problems of concern to management, supervisor, and industrial workers; control of occupational diseases, poisons, accidents, and other conditions incidental to industry.

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

4410 Consumer Health and Safety Education (3) Survey of public health consumer education programs; 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 of the American National Red Cross Certification as an Advanced First Aid and Emergency Care (AED) holder is required. Certificate must be at least 21 years of age.) Prereq: 3210 or valid Advanced First Aid and Emergency Care Certificate.


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

4730 Workshop in Public Health Education (3-4) 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.

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

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NCS only.
5790 Self-Care Unit (3-5)

5760 Health Services Administration (3-5)

5755 Health Facilities Administration (3-5)

5120-30 Occupational Health and Safety (5, 6)

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

5220 Health and Sickness in the Focus of Public Health Education (2) Formulation of models of positive health within life cycle and within community; types of sickness afflicting individuals and groups. 1 hr and 2 labs.

5410 Epidemiology (3) Incidence and prevalence of disease. Prerequisite: Consent of instructor.

5420 Administration of Public Health (3) Administrative considerations of public health agencies including governmental aspects, legal bases, organizational structures, leadership factors, financial management, and public relations.

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

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

5540 Factors in Problem Solving for Community Health (3) Tests skills in communications and group process as route to problem identification, objective setting, problem solving and planning for health education. 4 hrs and 2 labs.

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

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

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

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

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)

5785 The Training of Paramedical Personnel (3-5)


6000 Doctoral Research and Dissertation

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

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

6210 Health Aspects of Gerontology (3)

6220 Seminar on the Nation's Health (3)

6230 International Health (3)

Safety

3520 Principles of General Safety (3) Deals with principles, practices, and procedures in general safety education problems. For advanced student. Lecture, industry, home, and other public areas.


4110 Driver and Traffic Safety Education (5) Preparation of teachers of driver education in schools and colleges. Students are required to teach at least one lesson and to teach a valid driver's license required. 3 hrs and 2 labs.

4210 Advanced Driver and Traffic Safety Education (5) Development of competence in teaching driver education through use of simulation, multimedia, and multiple-car driving range. Emphasis placed on teaching skills and supervision. Prerequisite: Problem 4110.

4306 Sports Safety (5) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and relationships in sports injury and control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hrs and 2 labs.

4720 Workshop in Safety (3-6) Deals with special safety education problems. For advanced student. Lecture, recreation, industry, home, and other public areas.

5000 Thesis

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

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

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

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

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

5720-30-40 Graduate Workshop in Safety (3-6, 3-6, 3-6) Deals with special safety problems. Special safety problems in a concentrated period of time.


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

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

School Health

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

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

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

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

3610 Methods in Elementary Health Instruction (3) Preparation and presentation of health topics. Teaching method emphasized and student participation stressed. Required for elementary teachers. Prerequisite: Problem 3510 or Public Health 1110 or Nutrition 1230.

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

3650 Methods in Secondary Health Instruction (3) Preparation and presentation of health topics. Teaching method emphasized and student participation stressed. May be repeated.

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

5000 Thesis

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


5020 Teaching of Sex Education and Human Sexuality (3) Analysis and exposition of theory, methods and materials for planning, organizing and teaching sex education and human sexuality in schools and other community settings.

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

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

5530 School Health Program Surveys (3) Techniques and standards used in surveying school health service, including health instruction, health services, and healthful environment as each contributes to well being of individual students. Survey of existing school health program.

5520 School Health Administration and Supervision (3) Analysis of various types of administrative control; budgetary problems; education-public health dilemma; responsibilities of school health personnel. Resource materials include case studies of on-going school health programs.

5530-40 Workshop in School Health Education (3, 3) Designed for graduate students, inservice teachers, and other health professionals. Emphasis in any workshop to be on one critical health issue.

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


6000 Doctoral Research and Dissertation

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

6950-60 Seminar in Health Education (3, 3) (Same as Public Health 6950-60).

Division of Physical Education

MAJOR

Ph.D. (Doctor of Philosophy) M.S. (Master of Science) Ed.D. (Doctor of Education)

Associate Professors:

J. E. Acker, M.D. Tennessee; G. F. Brady (Emeritus), Ph.D. Iowa; E. K. Capen (Emeritus), Ph.D. Iowa; J. D. Davis (Chairperson), Ph.D. Illinois; D. J. Kozar, Ph.D. Michigan; W. P. Lienhoorn, Ph.D. Iowa; M. M. Phillips, Ph.D. Iowa; B. L. Morgenegg, Ed.D. Teacher's College, W. J. Morgan, Ph.D. Minnesota; H. B. Watson, Ph.D. Michigan; H. G. Welch, Ph.D. Iowa.

Professors:

E. T. Howley, Ph.D. Wisconsin; K. E. Lay, Ph.D. Florida State; K. J. Mead, Ph.D. Purdue.

Assistant Professors:


The Physical Education Division offers the following degree programs:

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

Doctor of Education degree in Physical Education with concentrations in exercise physiology, anatomy and kinesiology, adaptive physical education, and general physical education.

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

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

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

3430 Adaptive Physical Education Laboratory (1) Practice in producing and adapting student teaching, supplementing 4110.

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

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

4010 Advanced Dance Technique (2) Develop- ment, integration, and synthesis of previous dance vocabulary; emphasis on analysis and practice of dance principles; solo and group work. Prereq: 3020.

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

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

5000 Thesis

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

5110 Administrative Problems in Health and Physical Education (3)

5120 Problems of the Curriculum in Physical Education (3)

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

5140 Advanced Philosophy of Sport (3) Critical examination for the non-thesis student not other- wise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

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

5200 Readings in Physical Education (3) Comprehensive review of literature in physical education and related areas.

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

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

5320 Seminar in Research Techniques in Physical Education (3) Evaluation of appropriate re- search techniques in physical education.

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

5500 Advanced Kinesiology (3) Action of muscles involved in fundamental movements, calisthenics, and gymnastics. Prereq: 5520 or equivalent.

5510 Selected Topics in Anatomy (3) Intensive study of various systems of human body. Prereq: 5550 or equivalent. May be repeated with consent of instructor.

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

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

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

5610 Advanced Exercise Physiology (4) Prin- ciples of energy transfer in man with special emphasis on integration of organ systems in adapting to requirements of muscular exercise. Prereq: Zoology 4940 or equivalent. Recommended: 1 yr chemistry, physics, and mathemat- ics, 3 hrs and 1 lab.

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

5650 Scientific Bases for Physical Education (3) Psychophysical, psychological, and sociological foundations.

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

5910-20-30 Problems and Projects in Physical Education (1-3, 1-3, 1-3) Problems of professional interest and value to the individual student, selected by the student and approved by the major professor. S/NC only.

6000 Doctoral Research and Dissertation

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

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

6410 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: 5310, 5550 and Physics 2210 or equivalent. May be repeated with consent of instructor. S/NC only.


6610 Seminar in Applied Physiology (2) Prereq: 5610. May be repeated with consent of instruc- tor. S/NC only.

6680 Research Participation in Applied Physiology (1-4) Advanced research techniques under supervision of faculty member whose research supervision of faculty member whose research.

6910-20-30 Problems and Projects in Applied Physiology (1-3, 1-3, 1-3) Laboratory course in experimental methodology and instrumentation. Respiratory and blood gas analysis, human calciometry, blood chemistry, and pulmonary function tests. May be repeated with consent of instructor. S/NC only.
Division of Recreation

**Major Degree**

**Recreation**

**Professor:**

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

**Assistant Professors:**


The Recreation Division offers the following degree program:

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

**4130 Recreation Administration (3)** Introduction to recreation administration, including planning, personnel, areas and facilities, program services, finances, and public relations. Prereq: 3140, 3200, 3880, or consent of instructor.

**4200 Survey of Recreation for Special Populations (3)** Responsibility of recreation profession to minority groups whose leisure opportunities and needs may require special servicing. Prereq: 3140, 3200, 3880, or consent of instructor.

**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. Prereq: Consent of instructor. May be repeated with consent of division. Maximum 9 hrs.

**5000 Thesis**

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

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

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

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

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

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

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

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

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

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

**5360 Management and Operation of Recreation Facilities (3)** Management process as it pertains to operation of recreation facilities.
Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science degree, the Master of Engineering degree, and the Doctor of Philosophy degree. For a listing, consult majors and degrees available on page 8.

OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEOTAPE-ELECTROWRITER

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

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

YEAR-IN-JAPAN M.S. PROGRAM

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

Although the language of communication in Japan would be English, cultural understanding is one of the important objectives of the program and as such a participant would be asked to begin Japanese language study. At the option of the department, up to 6 hours of graduate credit may be allowed for language study, either at UTK or in Japan.

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

Engineering Experiment Station

F. N. Peebles, Director
W. K. Stair, Associate Director

The Station is organized to conduct investigations in fundamental engineering science and to aid in the development of the state's resources and industries as far as funds available will permit.

The Station may also make special arrangements with any person or company to study any technical question within the capacity of its resources, and to report the results exclusively to the company requesting the study. In such case, the whole expense will be carried by the parties requesting the investigation.

Engineering Administration

MAJOR DEGREE

Engineering Administration M.S.

Committee:

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

To be admitted to the Graduate School as a potential candidate for a Master's degree, with a major in Engineering Administration, the applicant must submit reasonable evidence of ability to pursue graduate studies at an acceptable level of performance. In general, the applicant should have graduated from an accredited undergraduate institution in engineering with a satisfactory grade point average. In addition, applicants must satisfy one of the following experience requirements:

1. At least two years of engineering experience after graduation if a full-time student or (2) current employment in engineering work if a part-time student.

THE MASTER'S PROGRAM

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

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

2. A Business Administration Core, 15 hours of graduate credit consisting of Accounting 5810, Finance 5050, Marketing 5050, Management 5130, and Transportation 5210.

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

The program requirement totals 51 hours of graduate credit. No thesis is required. A final oral and written examination must be passed on the work offered for the degree. Course prerequisites for the program are Accounting 2110, Computer Science 3150, Industrial Engineering 4520, and Statistics 3450 or their equivalents. None of these prerequisites may be counted as part of the 51 hours of credit offered for the degree. These course prerequisites will be waived upon presentation of evidence of competency in the course subjects.

Other prerequisite courses may be required, depending upon the student's background and the electives chosen.

5002 Non-Thesis Graduation Completion (3-15)

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

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

Departments of Instruction

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

Chemical, Metallurgical, and Polymer Engineering

MAJORS
Chemical Engineering
Metallurgical Engineering
Polymer Engineering

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

Professors:
H. F. Johnson (Head), D. Eng., Yale;
D. C. Bogue, Ph.D., Delaware; B. S. Borie, Ph.D., Massachusetts Institute of Technology;
C. R. Brooks, Ph.D., Tennessee; E. S. Clark, Ph.D., California (Berkeley); L. W. Crawford*,
Ph.D., Cincinnati; O. L. Culberson, Ph.D., Texas;
J. F. Fellers, Ph.D., Akron; G. C. Frazier, Ph.D., Johns Hopkins; J. M. Holmes, Ph.D., Tennessee;
H. W. Hsu, Ph.D., Wisconsin; S. H. Jury (Emeritus), Ph.D., Cincinnati; C. D. Lundin, Ph.D., Pennsylvania;
R. A. McElroy, Ph.D., Tennessee; B. F. Oliver, Ph.D., Pennsylvania;
J. J. Perona, Ph.D., Northwestern; J. W. Prados, Ph.D., Pennsylvania;
H. P. Schurill, Ph.D., Pennsylvania; E. E. Stansbury; Ph.D., Cincinnati;
C. O. Thomas, Ph.D., Tennessee;
R. A. Vandermerrde, Ph.D., Illinois Institute of Technology; J. J. Watson, Ph.D., Tennessee;
J. J. White, Ph.D., Delaware; M. A. Wright, Ph.D., Wales.

Associate Professor:
W. T. Becker, Ph.D., Illinois.

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

Lecturers:
R. J. Grover, Ph.D., Princeton; H. W. Hoffman, D.Eng., Johns Hopkins; R. N. Lyon, Ph.D., Michigan;
D. L. McElroy, Ph.D., Tennessee;
T. D. Parsh, Ph.D., Rice; W. H. Seaton, Ph.D., Ohio State;
E. von Hall, Ph.D., Tennessee;
M. E. Whaley, Ph.D., Iowa State.

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

THE MASTER'S PROGRAM

Minimum departmental requirements include the satisfactory completion of:

1. A major consisting of 18 to 27 quarter hours of graduate courses in chemical engineering, metallurgical engineering, or polymer engineering. The polymer engineering major must include Polymer Engineering 4920, 5110, 5230, 5310, and 5510.*

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


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

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

THE DOCTORAL PROGRAM

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

Department requirements consist essentially of the satisfactory completion of:

1. Graduate courses in chemical engineering, metallurgical engineering, or polymer engineering amounting to approximately 36 quarter hours, at least 12 of which must be in 6000 series courses. The polymer engineering major must include Polymer Engineering 4920, 5110, 5230, 5310, 5510, and Chemistry 5140.

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

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

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

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

PROGRAM OPTIONS IN POLYMER SCIENCE AND ENGINEERING

M.S. and Ph.D. degrees with specialization in polymer science and engineering are available in the programs of chemistry and polymer science. The specialization program in this department requires, for the M.S. degree, a thesis in the field, completion of Polymer Engineering 4910, 4920, 5110, and either 5230 or 5210 plus active participation in the Polymer Seminar. The Ph.D. candidate must meet the above requirements, pass a special written examination in polymer science and engineering, and complete an additional academic program to be specified by the student's committee.

M.S. and Ph.D. degrees in the joint specialization program with the chemistry department require a thesis or dissertation in the field. Chemical and metallurgical engineering departmental requirements include completion of...
Polymer Engineering 4910 and 4920, Chemistry 5531 and 5140, plus active participation in the Polymer Seminar. Ph.D. students must also pass a special written examination as well as complete the above requirements.

### Chemical Engineering

#### 4310 Flow of Fluids (4) Diffential and overall momentum, energy, and mass balances; frictional energy balances; flow in tubes, piping systems, and packed beds; metering devices, pumps. Prereq: Chemical and Metallurgical Engineering 2020, Mathematics 2850. 3 hrs and 1 lab.

#### 4320 Heat Transfer (4) Differential and overall energy balances; steady and unsteady state, heat conduction in simple geometries; heat transfer in tubes and heat exchangers; conduction and boiling; radiation. Prereq: 3410. 3 hrs and 1 lab.

#### 4440 Staged Stage Operations (3) Analytical and graphical methods applied to staged separa-
tory operations. Prereq: Chemical and Metallurgical Engineering 3040.

#### 4540 Diffusional Operations (3) Diffusion, sim-
laneous heat and mass transfer, and applications including humidification, gas absorption, extraction.
Prereq: 3420, Chemical Engineering 3040.

#### 3610 Introduction to Process Dynamics and Con-
trol (3) Concepts, processes, and control of chemical processes and systems. Prerequisites: Mathemat-
ics 2840, Chemical Engineering.

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

#### 4110 Chemical Engineering Data Analysis (3) Analysis and experimental identification of sys-
tem extremes; statistical properties of samples and source systems; empirical modeling of pro-
cesses; statistical process control. Prereq: 3420 and Mathematics 3150.

#### 4260 Probabilistic Chemical Engineering Sys-
tems (3) Experiment designs, simulation of stochastic phenomena, and analysis of networks in the process industries. Prereq: 4110.

#### 4130 Introduction to Optimization (3) Principles and applications of optimization techniques to chemical process design and operation. Prerequisites: Mathemat-
ics 2840, Chemical Engineering 3420.

#### 4470 Sulfur Removal from Coal and Related Pro-
blems (3) Chemical and physical properties of domestic coals, desulfurization by physical and chemical methods, fluidized bed combustion with both natural and synthetic coal, formation and removal of SOx, scrub-
bing. Prereq: Consent of instructor.

#### 4480 Coal Processing to Liquid Fuels (3) Charac-
terization of various coals with respect to current liquefaction methods; modeling of conver-
sion processes and estimation of maximum yields; water and oxygen requirements, pyrolysis; catalytic hydrogenation; reactor design considerations. Review and critique of selected articles from both the current literature and patents. Prereq: Consent of instructor.

#### 4530 Chemical Engineering Reaction Kinetics (3) Chemical reaction rates in closed and flow sys-
tems; interpretation of laboratory and pilot plant data; reactor design. Prereq: 3420, Chemistry 3430, Chemical and Metallurgical Engineering 3430.

#### 4540 Fluid-Solid Operations (3) Heat and mass transport in fixed and fluidized beds: applica-
tion of physical and chemical principles to biological systems. Prereq: 3440-50.

#### 4620 Process Modeling, Simulation, and Control of Chemical and Biochemical Processes (3) Con-
escence optimization, solution of real-life problems, feedback control concepts. Prereq: 3620 or equivalent background in basic control theory and differential equations.

#### 4730 Mass and Energy Flow in Biological Sys-
tems (3) Basic physicochemical and organiza-
tional principles applicable to biological systems. Derivations of general equations, data reduction, and energy transfer. Thermodynamics of transport and equilibrium in biological systems. Discussion of Volterra's equation and biological clocks. Prereq: Consent of instructor.

#### 4740 Introduction to Transport Phenomena in-
cluding chemical processes and biological systems. Transfer of chemical energy and various cellular active transports; structure and rheology of physiological fluids, membrane and interfacial phenomena; analysis and design of artificial or-
gans. Prereq: 3440, 3450 or consent of instructor.

#### 4750 Microbiological Process Engineering (3) Ap-
lication of chemical engineering principles and design concepts to microbiological processes. Prereq:
3440, 3450 or consent of instructor.

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

#### 4781-82-83 Topics in Chemical Bioengineering (3, 3, 3) Problems of interest in chemical bio-
engineering. Prereq: Consent of instructor.

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

#### 5000 Thesis

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

#### 5050 Engineering Analysis (3) Analytical formula-

tion and solution of chemical, metallurgical, and polymer engineering problems involving defor-
mation of solids, heat transfer and motion of fluids, stress and strain analysis. Prereq: Chemical Engi-
neering 4050 and Polymer Engineering 5050.

#### 5120 Heat Convection (3) Analysis of heat con-
vection in fluids under viscous and turbulent conditions; design of convective heat transfer appa-
raoch; simultaneous diffusion of momentum and heat. Prereq: 5050.

#### 5130 Methods of Optimization (3) Principles and applications of various mathematical program-
ing techniques to chemical process design and control; applications of Lagrange multipliers, principle, dynamic programming, and geometric program-
ing. Prereq: 4130.

#### 5210 Process Dynamics (3) Analysis of recycle op-
erations, steady state, optimization and optimi-
tization of typical processes.

#### 5250 Chemical Process Industry Economics (3) Analysis of economic components of chemical processes, line of least resistance, chemical en-
terprise, decision making for investment in capi-
tal facilities. Prereq: 4120-30, 4420.

#### 5310 Thermodynamics of Heterogeneous Equilib-
rium (3) Phase rule; equilibrium between phases; relations between phases; ideal and nonideal solutions. Prereq: 3040.

#### 5220 Statistical Thermodynamics (3) Basic con-
cept of statistical mechanics and application to eval-
uation of thermophysical properties. Prereq: 5310.

#### 5410-30-30 Research and Design in Chemical En-
geering (3, 3, 3) Selected diffusional opera-
tions; interpretation of laboratory data and design of experiments in chemical engineering research.

#### 5610 Chemical Reactor Design (3) Nonideal flow patterns in chemical reactors; diffusion and re-
action in two phase systems; interaction to heterogeneous catalysis and reactor stability. Prereq:
4530.

#### 5620 Staged Stage Mass Transfer Operations (3) Equilibrium stage processes applied to mass transfer operations, emphasizing nonisothermal and multicomponent systems.

#### 5640 Differential Mass Transfer Operations (3) Differential mass transfer operations; falling film, packed tower, and column contacting de-

#### 5710 Mechanics of Viscous Flow (3) (Same as Engineering Science and Mechanics 5220.)

#### 6000 Doctoral Research and Dissertation

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

#### 6210 Advanced Diffusional Operations (3) Fixed and fluidized bed operations, stage wise and dif-
ferential mass transfer bed concepts. Prereq: Consent of instructor.

#### 6250 Venture Analysis in the Process Industries (3) Interactions among line functions of typical chemical company in application of modern deci-

#### 6310 Thermodynamics of Irreversible Processes (3) Thermodynamic treatment of irreversible chemical processes, transport processes, cou-

#### 6320 Statistical Thermodynamics of Nonequilib-
rium System (3) Review of elementary kinetic theory, introduction to modern kinetic theory, development of equations for thermal conductiv-

ty, viscosity, and diffusion coefficients for pure gases and gas mixtures. Prereq: 5320.

#### 6410 Stability Phenomena in Chemical Engineer-
ing (3) Instability Systems in chemical pro-
cess systems, including reactors and separation equipment. Emphasis on formulation of model; associated conservation, equations, and methods of solution. Prereq: 5510.

#### 6420 Stability Phenomena in Chemical Engineer-
ing: Continuous Systems (3) Hydrodynamic in-
stabilities and instabilities in fluids based upon

6510 Applied Chemical Reaction Kinetics (3) Chemistry of wet gas and liquid phases, heterogeneous catalysis, catalyst effectiveness and its determination, and mechanisms of reaction kinetics. Emphasis on development of phenomenological description although mechanistic models are discussed. Prereq: 5510.

6520 Catalytic Reactor Design (3) Principles of kinetic and chemical reactor analysis applied to the design and analysis of heterogeneous catalytic reactors. Prereq: 6510.

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

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

Metallurgical Engineering

3110 Engineering Materials I (4) Introductory course correlating the atomic, crystal, and microstructure of solids with mechanical, physical, and thermal properties of engineering significance. 3 hrs and 1 lab.

3120 Engineering Materials II (3) Extension of 2110 or 3110 with emphasis on control of mechanical properties of materials by specification of process conditions and mechanical treatment; correlation of resultant properties with service performance. Suggested for mechanical, civil, and industrial engineering students.

3130 Engineering Materials III (3) Extension of 2110 or 3110 with emphasis on control of electrical and magnetic properties of materials by specification of composition, thermal, and mechanical treatment; correlation of resultant properties with service performance. Suggested for electrical engineering students.

3140 Engineering Materials IV (3) Extension of 2110 or 3110 with emphasis on materials processing, specification and evaluation. Suggested for mechanical and industrial engineering students.

3150 Engineering Materials V (3) Extension of 3110 with emphasis on the mechanisms and control of reactions of engineering materials with aqueous, gaseous, and nonaqueous environment. Prereq: 3110 or equivalent.

3160 Engineering Materials VI (3) Extension of 2110 or 3110 with emphasis on materials of significance for nuclear and mechanical engineers. Prereq: 3110 or Chemical and Metallurgical Engineering 2030.

4710 Production Metallurgy (3) Thermodynamic and kinetic principles of roasting, smelting, refining. Prereq: Chemical and Metallurgical Engineering 3440.

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

4740 Mechanical Metallurgy II (3) Ductile and brittle fracture, creep and stress rupture, fatigue, and fracture in materials. 3 hrs, or 2 hrs and 1 lab.

5110-80 Plastic Deformation I (3, 3) Fundamentals and techniques of cold and warm plastic deformation. Suggested for mechanical and materials engineering students. 3 hrs, or 2 hrs and 1 lab.

5170-80 Plastic Deformation III (3) Fundamental principles of mechanical deformation and failure; fatigue and fracture in materials. Suggested for mechanical and materials engineering students. 3 hrs, or 2 hrs and 1 lab.


5750 Corrosion (3) Analysis of corrosion processes in terms of polarization measurements and the Pourbaix diagram. Influence of stress, temperature, and localized conditions contributing to pitting, crevice, and stress corrosion. Prereq: 5110.

5930-50 Metallurgy of Deformation and Fracture (3, 3) Theoretical and experimental analysis of stress state, strain rate, environment, temperature, and metallurgical structure on
5910-20-30 Metallurgical Thermodynamics (3, 3, 3) Phases of solid state physics applicable to metals, alloys, ceramics, and composites; introductory quantum theory of specific heats, electron theory, electrical and thermal conductivity, magnetic properties, theory of transformation. Prereq: 4610. Physics 3720; Mathematics 4550 and consent of instructor.

6210-20-30 Rate Process in Metallurgy (3, 3, 3) Practical and theoretical considerations of rate processes in solids such as diffusion, recrystallization and grain growth, and phase transformations.

6320-30 Solidification and Crystal Growth II and III (3, 3) Fluid flow, magnetohydrodynamic effects in incompressible liquid conductors, morhological stability of steady state coupled heat and mass transfer processes in liquids to solid transition, multiphase solidification, composites, non-equilibrium, hyperbolic phenomena, some nucleation phenomena. Prereq: 5310.

6410-20 Thermodynamics of Solids (3, 3) Classical and statistical thermodynamic analysis of stability of solid solutions, compounds and ordered phases. Prereq: 5910-29-30 or consent of instructor.

6810 Mechanical and Physical Properties of Crystals I (3) Anisotropic behavior of crystalline materials treated by matrix and tensor techniques. Property classification according to transformation behavior. Prereq: Core curriculum in Mechanical Engineering and Mathematics 5065 or 4710 or consent of instructor.

6820 Mechanical and Physical Properties of Crystals II (3) Continuation of Metallurgical Engineering 6810 with emphasis on transport phenomena and irreversible thermodynamic. Prereq: 6810 or consent of instructor. May be repeated.

6830 Seminar in Anisotropic Properties of Crystals (3) Selected topics of current interest in the study of anisotropy of mechanical, electrical, optical, and magnetic properties. Prereq: 6810 or 6820, or consent of instructor. May be repeated.

Polymer Engineering

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

4920 Polymer Processing (3) Rheological properties of polymer melts and solutions, 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.

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

4940 Polymers Fibre Textile Operations (3) Lecture and laboratory course treating unit operations of the plastics industry. Types and mechanisms of operations of extrusion and the structure and properties of fabricated parts. Operations to include extrusion, coextrusion, injection molding including injection of thermoplastics and blow molding, rotational molding.

5000 Thesis

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

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

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


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

5510 Modern Research Tools and Instruments for Polymer Properties (3) Laboratory course on methods of characterization of polymers; gel permeation chromatography, intrinsic viscosity, spectrophotometry, rheology, melt flow properties, calorimetry, and dynamic mechanical measurements. Coreq: 5310.

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

5810 Physical Properties of Polymer Structures (3, 3, 3) Molecular weight and composition distributions in copolymers plus structures of two phase block polymers and polymer mixtures as related to gas liberation and crystalline phases, phase compatibility, thermal-mechanical, and optical properties.

5910-20-30 Selected Topics in Polymer Science (3, 3, 3) Application of modern polymeric materials to research of current interest to engineers. Prereq: 4910, 4820 or equivalent.

6000 Doctoral Research and Dissertation

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

6150 Advanced X-Ray Diffraction Methods for Characterization of Macromolecules (3) Classical and modern x-ray diffraction; Rietveld and Fourier functions; helical nets and Bessel function techniques; levels of order, thermal motions, defects, order-disorder transitions and paracrystallinity. Precision and Weis- senberg photography, single crystal and powder diffraction applications to synthetic and biological macromolecules.

6210 Nonlinear Viscoelasticity (3) Tensor formulation of constitutive equations of viscoelastic materials subjected to large deformations. Integration, differential equations and relaxation tensor formulation. Applications to polymer flow properties. Prereq: 5000 or equivalent. (Same as Engineering Science and Mechanics 6800.)

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

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

6610 Advanced Industrial Polymer Chemistry (3) Chemistry and properties of new polymeric engineering materials; highly integrated engineering and chemical approach. Prereq: Consent of instructor.

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

Civil Engineering

MAJORS

DEGREES

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

Engineering Science and Mechanics M.E., M.S., Ph.D.

Emeritus Professors: F. C. Larson, M.S. Virginia Polytechnic Institute, P.E.; E. G. Shellhorn, MCE Brooklyn Polytechnic, P.E.


The Department of Civil Engineering offers degrees leading to the Master of Science, Master of Engineering, and Doctor of Philosophy. A major in Civil Engineering, concentrating in environmental engineering, structural engineering, soils engineering, and materials and transportation engineering; and to the Master of Science and Master of Engineering in Environmental Engineering with concentrations in water quality, water resources, and air quality.
THE MASTER'S PROGRAM

The Master of Science programs in Civil Engineering and in Environmental Engineering are minor degrees within the framework of recognized undergraduate curricula. Specific departmental requirements for the M.S. degree include the following: 1. A minimum of 36 quarter hours credit beyond the Bachelor’s degree, exclusive of thesis credit for the M.S. thesis. Of this number, a minimum of 36 quarter hours credit in Doctoral Research and Dissertation will be required. 2. A minimum of 36 quarter hours of graduate courses in the Civil Engineering Department, exclusive of thesis or dissertation credit, at least 9 hours of which must be 6000-level courses. 3. Supporting courses in related, scientific and engineering fields, amounting to approximately 36 quarter hours, subject to approval by the student’s faculty committee. These related field courses may include such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 12 quarter hours of thesis credit will be required beyond the civil engineering undergraduate requirements. 4. One foreign language if the student’s committee feels that a reading knowledge of a foreign language is crucial to the student’s research efforts. 5. Upon completion of at least one-half of all course work, each student must pass a preliminary examination. 6. After completion of the dissertation, prior to graduation, each student must pass a final examination administered by a faculty committee.

Civil Engineering

4120 Concrete Design (3) Reinforced concrete beams and floor slabs; footings, and retaining walls. Prereq: 4110 and 4410.
4220 Foundations and Substructures (3) Foundation exploration; principles of design of dry and subaqueous foundations. Prereq: 3310.
4230 Legal and Ethical Aspects of Engineering (3) Legal principles underlying engineering work; laws of contracts, torts, agency, real property; problems of professionalism and ethics. Prereq: 4220 or consent of instructor. 2 hrs and 1 lab.
4240 Structural Design (3) Plastic theory, eccentric connections, industrial building design, timber design. Prereq: 3230 and 4410. 2-3 hr periods.
4280 Photogrammetry (3) Methods of plotting maps from aerial photographs; stereoscopic plotting instruments; applications. Prereq: 2580 or Forestry Summer Camp for forestry majors.
4420 Analysis of Framed Structures (3) Maximum stresses due to moving loads; 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: 4510-4520 Advanced Structural Design (3, 3) Plastic design in steel in 4510; design of typical steel plate girders in 4520. Prereq: 4510; and 3230 and 4110 for 4520.
4530 Cost Comparison in Design and Construction (3) Cost of engineering and construction. Cost comparison of alternate designs with emphasis on applications to civil engineering problems. Prereq or coreq: 3230, 4110.
4550 Engineering Behavior of Soils (3) Plastic and elastic behavior of soils, determination and use of engineering properties of in-situ soils. Prereq: 4220 or consent of instructor. 2 hrs and 1 lab.
4560 Stabilization of Soils (3) Mechanical stabilization of soils by compaction, drainage, and blending; chemical stabilization of soils with admixtures, waterproofing and of the disads with additives. Prereq: 3310. 2 hrs and 1 lab.
4620 Airport Planning and Design I (3) Emphasis on airport master planning. Included for consideration on the air side are runway configuration, capacity, geometrics and lighting; on the land side are included terminal layout and design, and ground access systems and parking. Prereq: 3600 and 3610.
4640 Traffic Engineering (3) Characteristics of driver, vehicle and roadway and their interrelationship; traffic studies; basic considerations of traffic control and the elements of urban transportation planning studies.
4660 Airport Planning and Design II (3) Integration and application of principles of airport master planning for purposes of site selection and design of an aircraft facility through a comprehensive team project, includes environmental evaluation of design. Prereq: 4620. 1 hr and 2 labs.
4710 Portland Cement Concrete Mix Design (3) Properties and tests of portland cement concrete, methods of concrete mix design, non-destructive concrete testing, use of concrete admixtures. Prereq: 3710. 2 hrs and 1 lab.
4720 Asphalt and Bituminous Concrete (3) Properties and tests of asphalts and asphaltic mixes, mix design of bituminous concrete. Emphasis on use of asphalt in transportation construction projects. Prereq: 3710. 2 hrs and 1 lab.
4731-32 Earthquake Resistant Structures I, II (4,4) (Same as Architecture 4731-32.)
4800 Introduction to Civil Engineering Systems (3) Methods of modeling civil engineering systems and their specific application to problems of transportation, environment, water resources and materials. Prereq: Senior standing or consent of instructor.
4850 Elementary Structural Matrix Methods (4) (Same as Engineering Science and Mechanics 4850 and Architecture 4850.)
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5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5110-20 Statically Indeterminate Structures (3, 3) Analysis of beams and trusses; analysis by force methods and by slope-deflection in 5110; analysis by moment distribution and other displacement methods in 5120.
5140 Statically Indeterminate Structures (3) Analysis of simple plane frames. Prereq: 5110 and 5120.
5150 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, stability considerations, statics, stiffness and force methods of plane trusses, general members and structures composed of general members. Prereq: 4540 or consent of instructor.
5160 Analysis and Design of Plate Structures (3) Bending and buckling of plates; analysis and design of bridge and building floors and structural plate components. Prereq: 5110.
5170 Introduction to Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; elastoplastic behavior considered; and use of approximate design methods developed. Prereq: 5120, 5150.


5220 Pavement Design (3) Pavement loads; pavement design; design practices; construction and maintenance. Prereq: 3319.

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

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

5270 Planning and Transportation (3) Preparation of transportation elements of comprehensive development plans. Analysis of relationships between transportation modes and between transportation and other community features. (Same as Planning 2570.)

5310 Engineering Practice (3) Valuation and feasibility studies; association and use of life engineering economics.

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

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

5430-40-50 Construction Management I, II, III (3, 3, 3) Management and organization of heavy and building construction projects. Prereq: 4430 or consent of instructor.

5460-70 Construction Estimating I, II (3, 3) Project costs, estimating techniques; market cost conditions and feasibility of design as it applies to costs. Prereq: 4430 or consent of instructor.

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

5660 Soil Mechanics— Elastic Behavior (3) Stress-deformation characteristics, consolidation, settlement analysis. Prereq: 3310 or consent of instructor.

5570 Soil Mechanics—Seepage (3) Saturated flow through embankments, filter design criteria, seepage forces and velocities, subdrains, and embankment failures. Prereq: 3310 or consent of instructor.

5610 Behavior of Steel Structures (3) Behavior of structural steel members due to static and fatigue loading; relation between research results and current specifications for design. Prereq: 4120.

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

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

5800 Urban Systems: Engineering and Management (3) Management of various urban systems, usually under city manager and/or city engineer.

Organization, finance, personnel administration, purchasing, management of urban streets, management, and dealing with engineering consultants as each deals with municipal public works. Prereq: Graduate standing for Environmental Engineering or consent of instructor.


5810 Traffic Engineering—Characteristics (3) Driver-vehicle-roadway-system, level-of-service concept of capacity. Coreq: Statistics 3450 or 5511. 2 hrs and 1-2 hr lab.

5820 Traffic Engineering—Operations (3) Fixed-time and volume-density controllers; progressive systems; one-way operations; reversible flows; system operation, including computerized networks; legal aspects of operational controls. Prereq: 5810. 2 hrs and 1-2 hr lab.

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

5850 Functional Design of City Streets and Urban Freeways (3) Analysis of urban growth and development; classification and function of streets; design features, including thoroughfares, minor streets, urban parks, parking, effect of mass transportation; channelization; marketing; licensing; freeway, frontage road, and street systems. Prereq: Consent of instructor.

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

5870 Public Transit Planning (3) Person movement by bus, rapid transit, and light rail transit. Nature of public transit; its various roles and how they fit community's need; user preferences, modal split models; total social, political, economic and technical impacts of public transit. Prereq: 4500 or graduate standing.

5890 Traffic Accident Reconstruction (3) Proper traffic accident data collection and analysis as basis of designing accident prevention or control programs. Many contributing factors to an accident; proximate and secondary accident causes as they relate to roadway improvements. Prereq: 4640 or 5810 or consent of instructor.

5900 Special Problems in Civil Engineering (1-4) Course subject to approval by the instructor. May be repeated. Maximum 9 hrs. S/NC only.

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

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6100 Behavior of Steel Bridges and Buildings (3) Behavior; analysis, and design of plate girders, columns and composite members subject to static and dynamic loading. Prereq: 5710 and 5761.

6740 Behavior of Reinforced Concrete Beams and Frames (3) Ultimate strength and behavior of statically indeterminate reinforced concrete structures; application of elastic analysis to framed structures; limit analysis. Prereq: 5120 and 5740.

6750 Behavior of Reinforced Concrete Slabs (3) Behavior, analysis, and design of reinforced concrete slabs; finite element solutions; ACI Code methods; yield-line theory. Prereq: 5740, 5160 or Engineering Science and Mechanics 6310.

6830 Traffic Flow Theory (3) Queuing theory, Markov processes, Monte Carlo methods, simulations of various conditions and/or designs. Prereq: 5450 or Mathematics 3150, 5620.


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


6910-20-30 Special Topics in Civil Engineering (3, 3, 3) Advanced theoretical and experimental work. Prereq: Consent of instructor.

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

Environmental Engineering

3000 Introduction to Environmental Engineering (3) Introduction to human interaction with the air, water, and land environment in which one lives; role of engineering in environmental control.


4100 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 resource structures and systems, including reservoirs, dams, control works, and open channel design. Dam safety control; environmental impact of reservoir projects. Prereq: 3330 or consent of instructor.

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

4320 Hydrologic Design (3) Application of frequency and regression analysis to design hydrologic design of water resources system; unstable surface runoff and streamflow modeling; urban peak runoff design using kinematic wave theory; evaluation of effects of land use changes on streamflow quantity and quality. Prereq: 3330.

4510 Elements of Water and Wastewater Transportation Systems (3) Introduction to theory and design of water transportation and distribution systems and wastewater collection systems. Prereq: 3000, 3120 and 3330.

4520 Elements of Water and Wastewater Treatment Systems Design (3) Introduction to treatment and design of water transportation and distribution systems and wastewater collection systems. Prereq: 3000, 3120 and 3330.
processes in design of water and wastewater treatment plants. Prereq: 3000 and 5120.

4530 Sanitary Engineering Laboratory (3) Physical principles, techniques, applications, testing of emission, control, and treatment devices for urban areas. Prereq: 5120. 3 hrs.

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

4700 Air Pollution-Air Resources Management (3) Introductory course on concepts of air pollution; air quality, meteorological and environmental impact statement with emphasis on federal-state relations, recent legislation and court decisions, and enforcement. Prereq: 3000.

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

4820 Environmental Engineering Law (3) Legal aspects of water and air pollution, drainage, land use control, and environmental impact statements with emphasis upon federal-state relations, recent legislation and court decisions, and enforcement. Prereq: 3000.

5000 Thesis

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

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

5160 Planning and Utilities (3) Planning for adequate water supply and sewage waste disposal in the urban environment. Impact of utility patterns on area development, and problems of utility service policies. Not for civil engineering majors. Prereq: 3000. (Same as Planning 5160 and Water Resources Development 5160.)


5232 Sediment Transportation (3) Sediment properties and measurements; bed loads and suspended load movement; erosion, scour, transport and deposition of sediments by flowing water; silting of reservoirs and related topics. Prereq: 5230.

5234 Flood Damage Reduction (3) National, local flood problems; hydrologic design criteria; traditional flood control measures; land use controls and adjustments; floodproofing, flood insurance, and other flood damage reduction elements; interdisciplinary approach in floodplain management; case studies. Prereq: Consent of instructor.

5261 Basic Principles of Remote Sensing (3) Applications of remote sensing in agriculture, engineering, forestry, meteorology, land and soil planning, and resource management; properties of electromagnetic radiation including wave theory, physical optics, geometric optics, and the interaction of EM radiation and matter; current data handling technology. Prereq: Consent of instructor.

5262 Remote Sensing Data Acquisition (3) Active and passive remote sensing; sensors and systems; special application and limitation; description of remote sensing platforms, including the Earth Resources Satellite Communications System; mission planning. Prereq: 5261 or consent of instructor.

5263 Remote Sensing Data Analysis and Interpretation (3) Manual and automatic methods of data analysis and interpretation, formatting and display, pattern recognition techniques; use of automated data processing equipment for data storage, retrieval, analysis and classification. Prereq: 5261 or consent of instructor.

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

5302 Stormwater Modeling II (3) Continuous and discontinuous records interpreted using methods of stochastic hydrology, including flow frequency and time series analysis. Hydrologic design of water systems using streamflow simulation techniques including autoregressive and fractional gaussian noise models. Prereq: Consent of instructor.

5410 Water Resource Management (3) Dynamics of flow in porous media with emphasis on physical processes important in subsurface hydrology, including anisotropy, layered soils, and unsaturated flow phenomena. Analytical solutions of flow equations, Dupuit approximations, and numerical methods. Principles of Hele-Shaw and graphical solutions. Prereq: Engineering Science and Mechanics 3110 or consent of instructor.

5500 Descriptive Hydrology (3) Occurrence and description of elements of hydrologic cycle, effects on earth and relation to man. Not for civil engineering majors. (Same as Water Resources Development 5330.)

5400 Introduction to Environmental Systems (3) Models of air and water quality, water resources, solid waste disposal, and location of central facilities; exposure to current literature on environmental management problems; optimization of these system. Prereq: 5330. (Same as Water Resources Development 5330.)

5501 Water and Wastewater Treatment Theory I (3) Theory of unit operations employed in sanitary engineering. Prereq: 4520.

5502 Water and Wastewater Treatment Theory II (3) Theory of unit processes employed in sanitary engineering. Prereq: 5501.


5530 Environmental Engineering and Natural System Behavior (3) Relationship between environmental engineering and natural system behavior, focusing on eutrophication and limiting nutrient concept in relation to research and translation into law and wastewater engineering practice. Seminar-open discussion format. Prereq: Graduate standing or consent of instructor.

5551 Water Quality Management (3) Water quality control objectives, methods, and philosophies; water quality criteria; effect of various uses on water quality. Prereq: Graduate standing or consent of instructor.

5561 Environmental Management of Water Quality (5) Water quality management and concepts of quality as a dimension of water; effects of agricultural, domestic, and industrial use upon water quality; legal and administrative aspects; waste assimilative capacity and wasteload allocation; modeling and management of water quality via nonstructural as well as biological, physical/chemical and advanced treatment processes. Prereq: 3000 or equivalent.

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

5593 Advanced Sanitary Engineering Laboratory (3) Laboratory techniques and applications for advanced sanitation and wastewater. Application of modern instrumental procedures for physical, chemical, and biological analysis. Prereq: 4520. 3 hrs.

5600 Solid Wastes (3) Magnitude and characteristics of solid waste problem; methods for collection and disposal of solid wastes, including sanitary landfill, incineration, and composting; new technologies and recycling. Prereq: Graduate engineering major or consent of instructor.

5610 Solid Waste Disposal (3) Problems in the areas of landfill design and costing, incinerator design and costing, and special topical areas. Prereq: 5600.


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

5710 Air Pollution Control Engineering (3) Emission control systems for industrial and power generating processes, stack sampling methods, air monitoring, dispersion of pollutants. Prereq: 4700 and Engineering Science and Mechanics 3110.


5723 Air Pollution Control Device Design (3) Design and evaluation of systems used to control emission of gaseous and particle air pollutants; comprehensive review of specific devices and systems. Prereq: 5720.

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

5740 Dynamical and Physical Meteorology (3) Physical principles of the atmospheric sciences. Atmospheric energetics, general circulation, perturbation theory, worticity theory, the equation of motion, solar and terrestrial radiation, thermodynamics of dry and moist air. Prereq: Mathematics 4550 and Engineering Science and Mechanics 3110 or equivalent.

5750 Turbulence in the Atmosphere (3) Theoretical boundary layer mean wind and temperature profiles derived and related to observations. Estimating surface fluxes, energy spectra, and cospectra. How theories can be applied to observations in turbulence in air flow over urban areas. Mechanisms of formation of clear air turbulence in shear zones in free atmosphere. Prereq: 5740.

5760 Diffusion in the Atmosphere (3) Movement and dilution of natural or man-made material released into the atmosphere. Basic theory. Rise of buoyant plumes, relation between Eulerian and Lagrangian spectra, differences between
The 72 quarter hours of course work must satisfy the following requirements:

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

b. A minimum of 12 quarter hours of 4000-level course work. At least 3 quarter hours of this work must be in an area other than the student's major area.

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

Many of the electrical engineering courses are offered in the evening. Engineers working in industry are encouraged to participate in the department's graduate program.

The College of Engineering provides special opportunities for academic and research work in areas pertinent to atmospheric and space flight. These opportunities are also available at the Space Institute, Tullahoma.

3010 Transient Analysis (3) Analysis of transient response of networks and systems; Laplace transform method and classical differential equation methods for system analysis; complex frequency concept, pole-zero concepts; applications to engineering problems. Prereq: 2403.


3050 Basic Field Theory (3) Forces between charges, electric and magnetic fields, Gauss's law and divergence theorem, potential and line integrals, material bodies, polarization, magnetic circuits. Maxwell's equations, dynamic potentials. Prereq: Mathematics 2850. 3 hrs including laboratory.

3060 Propagation I (3) Plane waves, reflection, guided waves, transmission lines, standing waves, impedance, impedance matching, graphical methods, rectangular wave guide. Prereq: 3050. 3.5 hrs including laboratory.

3080 Energy Conversion (3) Magnetic circuits, transformer theory and operation, principles of electromechanical energy conversion with emphasis on input-output characteristics, steady-state
state analysis of induction motors and d.c. machines. Prereq: 3040. Includes biweekly lab.

3060 Energy System Operation (3) Synchronous machines, transmission-lines, and transformers as power system elements; power system representation, symmetry, network components, and fault studies. Prereq: 3080. Includes biweekly lab.


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

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

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

3180 Logic Design of Digital Systems (3) Introduction to Boolean algebra and design of combinational circuits. Presents gate and flip-flop characteristics. Design of clocked sequential circuits and other systems containing memory. Introduction to microprocessor architecture and system components that include basic structure and function of arithmetic, storage, input-output, and control circuits. Includes set associated with arithmetic and machine language programming. Prereq: 3010, Computer Science 3150. 3 hrs including biweekly lab.

3190 Plasma I (3) Engineering applications of plasma phenomena, plasma effects and devices. Topics include electrostatic precipitators and plasma light sources, laser operation and applications (electro-optics), and MHD control. Use of the operational amplifier in signal conditioning. Prereq: 3040 concurrently. 3 hrs including biweekly lab.

3210 Linear Systems Analysis (3) Steady-state and transient response; log-frequency, gain-phase, and polar plots; block diagram transformation; signal flow graphs; analogue systems, properties of second order systems; introduction to feedback theory; stability criteria. Prereq: 3010. 3 hrs including occasional labs.

3810 Electronics I—Basic Electronic Processes (3) Current conduction in semiconductors and high-voltage electronics; transistors, diodes, 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 RC coupled amplifiers; tuned amplifiers; basic power amplifiers; bias stability, feedback. Prereq: 3010 and 3820. Coreq: 3720. 3 hrs including biweekly lab.

4020 Direct Electric 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: current demonstrations. Prereq: 3060, 3190 and 3810.

4030 Microwave Circuits and Electronics (3) Circuits represented by wave shattering, isolators, gyro's, couplers, microwave vacuum diodes by microwave 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 for microwave integrated circuits. Prereq: 3060. 4 hrs.


4410 Power System Components and Control (3) Analysis of power system components and their interconnection. Studies in control of power and power quality, 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 (3) Sensitivity, resolution (frequency requirements; system protection against faults. Prereq: 3090.

4460 Lasers and Masers (3) Introduction of principles of laser and maser operation based on quantum electronics, quantum theory, and physical electronics. Prereq: 3190.

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

4480 Plasma III (3) Macroscopic plasma equations, particle orbits, interactions, oscillations and waves. Prereq: 3190, 3150. 3 hrs including occasional labs.

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


4570 Electromagnetic Acoustics (3) Reproduction of monophonic and stereophonic sound, microphones, loud speakers, disc recording, magnetic recording, film recording; acoustics of studios, auditoriums.

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

4610 Analog-Digital Systems (3) Principles of analog computing components. Applied to analog computing to include problem set-up and solution. 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 modes of operation, synchronous-asynchronous time sequencing and micrometer/Timing of control functions. Prereq: 3180. 3 hrs including biweekly lab.

4650 Bioelectric Instrumentation (3) Nature and origin of bioelectric potentials, transducers, analog-to-digital converters, recording systems and noise problems.

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

4690 Communications Electronics (3) Oscillators, modulation and 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: 3820.


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 structures are described. Minicomputer and microcomputer systems are developed. Project oriented, contract course. Completion of two projects, one utilizing a microprocessor and the other a microcomputer, is minimal course requirements. Prereq: 3180.

4810 Discrete-Data Systems (3) Introduction to analysis and design of discrete data control systems including 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. Pre-
5400 Modern Transform Methods (3, 3) La- place transform and complex variable theory. Z-transform, difference equations and distributed parameter systems.


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


5170 Bioengineering Systems I Models, Systems Analysis and Simulation (3) Modeling techniques applied to physiological systems. System behaviors, stability, parameters, and storage are investigated. Analog and digital simulation of biological systems. Prereq: 4370 or consent of instructor.

5180 Bioengineering Systems II Bioelectric Phenomena (3) Electrical phenomena associated with biological systems as stimuli and responses. Quantitative theories in neurophysiology, electrophysiology and electrocardiography. Prereq: 4860 or consent of instructor.

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

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

5230 Advanced Electrical Machinery Applications (3) Linear motors; pole amplitude modulation and other speed control techniques; variable frequency operation. Prereq: 5210.

5240-50-60 Control Systems (3, 3, 3) Analysis and design of control systems; introduction to control systems; control systems using classical and modern techniques. Feedback theory; system modeling; stability analysis; system response analysis; design of estimator and observer; system compensation. Emphasis on control aspects of control systems. Coreq: 5070 or equivalent.

5310 Basic Requirements for Plasma Fusion (3) Historical study of fusion systems in nature. Lawson break-even criterion, inertial fusion systems—hydrogen and deuterium, e-beam and electro- tion-beam fusion. Magnetically-confined plasma systems, tokamak, mirror system, and exotic systems. Confinement, stability, and heating. Possibility of fusion-lisson hybrids. Prereq: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.


5330 Engineering of Fusion (3) Materials in a tokamak: stainless steels, superconductors, graphite, etc. Applications. Prereq: 4780 or consent of instructor.


5370 Advanced Direct Electrical Energy Conversion I (3) Theory, latest devices, and applications for production of electrical energy by solid state means of thermionic and photovoltaic effects. Prereq: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5380 Advanced Direct Electrical Energy Conversion II (3) Theory, latest devices, and engineering applications for production of electrical energy by gaseous means of thermionic, magnetohydrodynamic, and electrodynamic effects. Prereq: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5390 Advanced Direct Electrical Energy Conversion III (3) Theory, latest devices, and engineering applications for production of electrical energy by solid state means of thermionic, magnetohydrodynamic, and electrodynamic effects. Prereq: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5410 Power System Networks (3) Sequence impedances for transmission lines, machines, and transformers. Formation of system network characteristics. Computer design techniques, computer methods. Prereq: Graduate standing or consent of instructor.


5440 Distribution Systems (3) Electric power distribution with particular reference to utility systems. Production of energy, evaluation and regulation. Prereq: 4410, 4425, 4430 or equivalent.

5460 Selected Topics in Power Systems (3) To meet special needs of students. Possible topics: power systems reliability, interconnected system theory, power plant operation, electrical transmission in power systems, and power system protection. Prereq: Consent of instructor. May be repeated with consent of department.


5570-80-90 Electronic Switching Circuits (3, 3, 3) Switching circuits using active devices; clipping circuits, clamping circuits, comparator circuits, logic circuits, exponential and logarithmic circuits, time-base generators, blocking oscillators, gates, counting and timing circuits, synchronizing circuits, division. Transient response and high-speed operation. Coreq: Mathematics 4510 or 4710.


5670 Pattern Recognition (3, 3) (Same as Computer Science 5840-50).

5690 Artificial Intelligence (3) (Same as Computer Science 5210).

5710 Random Process Theory for Engineers (3) Probability and random variables as approaches by signal theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral
5740 Digital Processing of Signals (3) Analysis of discrete signals; sampling theorem and its implications; frequency-domain design of digital filters; time domain design of digital filters; quantization effects; processing of digital signals; discrete Fourier transform. Prereq: 4100 or equivalent.


5770 System Identification (3) Various identification schemes; deterministic, stochastic, and hierarchical methods. Applications in all areas of engineering and science. Prereq: Consent of instructor.

5800 Power Transmission Lines (3) New and unconventional power transmission systems. Transmission line parameters for overhead and underground lines and radial structure of high voltage transmission. Insulation coordination and protection. Design procedures for high voltage transmission. Prereq: 4410-20-30 or equivalent.

5810-20 Electromagnetic Fields (3, 3) Vector analysis, Maxwell's equations, special relativity, plane waves, spherical waves, Hertzian dipole, linear antennas, impedance loop surfaces, directional devices, parameter measurement and control of sequential machines including decomposition, partition-pairs and semi-algebraic structure of sequential machines. Prereq: 5710 or consent of instructor. Correq: Mathematics 4510 or 4710.


5830 Linear Antennas and Antenna Arrays (3) Hertzian dipole, linear antennas, impedance loop antennas, receiving antennas, linear arrays. Prereq: 5820.

5840 Aperture Antennas (3) Huygens principle, equivalence principle, field properties of linear and planar media, guided waves, rectangular and cylindrical wave guides, radiation from current elements. Correq: Mathematics 4510 or 4710.

5850 Microwave Electronics (3) Space charge waves on electron beams, coupling between beams and guided waves, Klystrons, magnetrons, traveling wave amplifiers and backward wave oscillators. Prereq: 5820.

5860 Electromagnetic Wave Propagation (3) Wave propagation in isotropic and anisotropic media, transmitted power, stored energies, propagating and nonpropagating modes, orthogonality properties, boundary and radiation conditions, sources. Prereq: 5820.

5870 Introductory Microwave Networks (3) Circuit equivalents for n-port, junctions, obstacles, loading and fillings, one way and two way devices, directional devices, parameter measurements, reflection charts. Prereq: 5810. Coreq: Mathematics 4510 or 4710.

5840-50 Advanced Small Computer Systems (3, 3) Real-time applications, memory and CPU organization, interface software, and peripheral devices. Minicomputer and microprocessor system are studied. Project-oriented, supported by hardware and software interface design. Prereq: Consent of instructor. (Same as Computer Science 5940-50.)

5800 Doctoral Research and Dissertation

6240 Advanced Systems Theory (3) Advanced analytical methods for systems with deterministic inputs; treatment of discrete-data, nonstationary and nonlinear systems. Prereq: 5820 or equivalent.

6250 Stochastic Processes in Engineering Systems (3) Analysis and design of systems with stochastic inputs. Methods of batch and sequential estimation; time domain and frequency domain methods of optimum filter design. Prereq: 5740 or equivalent.

6280 Modern Control System Design (3) Design of optimum control systems via variational calculus, maximum principles, dynamic programming, and gradient methods. Prereq: 5240-50 or equivalent.

6270-80 Special Topics in Control Systems Theory (3, 3) Advanced problems, new developments in current literature. Prereq: 5240-50 and consent of instructor.


6500-10 Electrical Conduction in Gases and Plasma Physics (3, 3) (Same as Physics 6500-10.)


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


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

Engineering Science and Mechanics

MAJOR

Engineering Science

DEGREES

M.S., Ph.D.


Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in Engineering Science are available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. Program options include solid mechanics, fluid mechanics and biomedical engineering. In the biomedical and engineering science option, interdisciplinary programs are arranged to meet individual needs or interests. Each applicant will be advised as to any prerequisite courses before entering a program; the student's program of study must be approved by his/her advisory committee, and must comply with the requirements of the Graduate School. The student's major professor may be selected from a department other than the Department of Engineering Science and Mechanics.

A departmental application is required in addition to the Graduate School application. The names and addresses of four references must be included with the departmental application.

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

THE MASTER'S PROGRAM

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

In Plan I a minimum of 45 quarter hours, including the thesis, is required. In Plan II a minimum of 48 hours is required. The requirements include the following:

**Hours Credit**

| Plan | Mathematics Engineering courses (Major option; may include but is not restricted to courses offered by the Engineering Science and Mechanics Department.) Related courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.) | 18 | 27* |

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

**The Doctoral Program**

General policies and requirements of the Graduate School relating to admission, residence, languages, research, examinations, faculty advisory committee, and admission to candidacy apply to this program. Specific departmental requirements for the Ph.D. degree include:

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

2. A minimum of 36 quarter hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 5000 and above, with at least 12 quarter hours of 6000-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.

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

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

5. Active participation in graduate seminars and colloquia.

* Engineering courses under Plan II may include advanced laboratory work or special problem work, for example Engineering Science and Mechanics 5190 or analogous courses in other departments.

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

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

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


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

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

3430 Perspectives on Medical Ceramics (3) Details development of implant material from both an engineering and a medical viewpoint. Demonstrates results of combined efforts of physician and biomedical engineer. Audiovisual aids and models are used to reinforce lecture topics. Prereq: 3410 and Metallurgical Engineering 2110.

3439 Medical Ceramics Laboratory (1) Surgical observation and laboratory experiments to illustrate design and application parameters. Design project or paper required. Coreq: 3430.

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; collinear friction; kinematics of rigid bodies using force, mass, acceleration; work-energy; impulse-momentum. Not for departmental graduate credit. Prereq: 2705 or Basic Engineering 1320, Mathematics 2840.

3710 Intermediate Dynamics (3) Three-dimen- sional dynamics of particles and rigid bodies; dynamics of continuous bodies with arbitrary internal force motion; LaGrange's equations. Prereq: 3700, Mathematics 2850.

4420 Engineering Aspects of Infection Control (3) Biomedical engineer's role in infection control will be related to hospital and clinical activities. Fluid flow phenomenon, pressure measurement methods and analysis, basic bacteriological and mycological tests will be demonstrated. Course identifies new and critical role for biomedical engineering in which care systems, and includes analysis of hospital facilities and monitoring systems. Prereq: 3410 or consent of instructor.

4430 Orthopedic Biomechanics (3) Introduction to engineering principles and applications in orthopedics 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) Conois 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: Mathematics 1800 or consent of instructor.

4520 Biomedical Fluid Mechanics (3) Discusses objective, review foundations and present developments in biomedical fluid mechanics, properties of human blood and blood vessels, determinants of cardiac performance, analysis and measurement of flow and pressure in arteries, nontraumatic study of circulatory system, mechanisms of microcirculation. Applications to areas of orthopaedics, cardiovascular, etc. Prereq: 4500 or a course in fluid mechanics or consent of instructor.

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

4530 Biomechanics (3) Discusses objective, review foundations and present developments in areas of mechanical properties of living tissues, biomechanics of injury and prosthetics, material compatibility of prosthesis material, surgical tools, and mechanical problems related to impact. Prereq: 4500 or consent of instructor.

4540 Fracture-Safe Design (3) A critical review of mechanical properties of materials that are indicative of fracture resistance, including transition temperature, R-curves, stress intensity factors, and J-integrals; the use of these properties in design. Prereq: 3310 and Metallurgical Engineering 2110. (Same as Metallurgical Engineering 4540.1, 2 hrs and a 3-hr lab.)

4610 Experimental Stress Analysis (3) Basic concepts: theory, techniques, and instrumentation of strain gage tests: theory and techniques of ultrasonic testing, and other stress analysis methods. Prereq: 3310, Electrical Engineering 2010 or 3110. 2 hrs and a 3-hr lab.

4620 Dynamic Data Acquisition (4) Instrumentation of measuring systems for dynamic events and responses; signal conditioning; oscilloscopes, oscilloscopes and magnetic tape recording; telemetering and data transmission; computer data processing. Prereq: 3311, 3700, Electrical Engineering 3120. 3 hrs and a 3-hr lab.

4630 Introductory Photomechanics (3) Introduces fundamentals of photomechanics, Moire method, interferometry, and holography. Prereq: 3310, Physics 2320, 2 hrs and a 3-hr lab.

4710 Fundamentals of Vibrations (3) Free and forced vibrations of damped and undamped lumped parameter systems; energy methods. Prereq: 2720, Mathematics 2830.


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

4850 Elementary Structural Matrix Methods (Same as Civil Engineering 4850 and Architectur-4860.)

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

5000 Thesis
5130 Introduction to Turbulence (3) Macroscopic effects; energy spectra, diffusion; application of turbulent jets and pipe flow. Prereq: 5800.

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

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

5220 Mechanics of Viscous Flow (3) Viscous flows; Navier-Stokes equations; numerical methods of solutions; stress-optimized methods of laminar flow analysis. Prereq: Mathematics 4610. (Same as Chemical Engineering 5610.)

5310-20 Advanced Materials of Mechanics (3, 3, 3) Advanced topics in mechanics of materials; elementary theory of elasticity. Prereq: 5311 and Mathematics 5811.

5410-20 Theory of Elasticity (3, 3) Stress, strain in three dimensions; torsion and bending of prismatic bars; axisymmetric stress distribution; stress concentration; plane stress, plane strain. Prereq: 5860.

5430 Thermal Stresses (3) Heat conduction; thermoelastic equations; thermal stresses in beams, rings, plates, and shells; thermal buckling and convergence concepts. Prereq: 5311 or 5310-20-30, and Mechanical Engineering 3440.

5450 Theory of Linear Viscoelasticity (3) Linear viscoelasticity of solids; quasistatic problems; viscoelasticity and dynamic problems; stability problems; foundations of three-dimensional linear viscoelasticity. Prereq: 5600.

5530 Fracture Mechanics (3) Equilibrium cracks and flaws; crack growth; critical fracture toughness. Prereq: 5140 or 5310-20-30, and Mechanical Engineering 5540.

5550 Photoelasticity (3) Light scattering, polarized light, basic principles of photoelasticity, equipment and techniques, application to two-dimensional and strain concentration in real objects. Interpretation in photoelastic stress analysis, photoelastic coating methods, three-dimensional photoelasticity. Prereq: 5311, Mathematics 4610, and consent of instructor. Prereq: 5460: 2 hrs and 3 labs.

5570 Advanced Dynamics (3, 3) Physical laws of motion; Lagrange's equations; Newton's laws; hamilton's principle. Prereq: 3710 or 4710, Mathematics 4610.

5570 Advanced Vibrations (3) Vibrations of multiple degree of freedom systems; planar and axially symmetric stream functions; Navier-Stokes equation, exact solutions, creeping flow and boundary layer solutions; nonviscous flow, potential theory, complex potentials, conformal mapping. Prereq: 5800.

5630-40-50 Theory of Turbulence (3, 3, 3) Mathematical description of turbulence; isotropic turbulence; Kolmogoroff's hypothesis; large and small eddy structure by turbulent flows; turbulent diffusion by continuous movement; application of turbulence to wakes, pipe flow, and boundary layers. Prereq: 5110-20-30 or equivalent; Mathematics 4610, 4540-50, 4710. (Same as Environmental Engineering 6110-20 and Mechanical Engineering 6110-20.)

5640 Advanced Finite Elements Methods in Fluid Dynamics (3) Computational fluid dynamics using finite element methodology. Formulation for two- and three-dimensional, multispecies compressible flows, second-order turbulence closures, parabolic Navier-Stokes equations of differentiable equations. Prereq: 5800 or 5310, or Mechanical Engineering 5540, or consent of instructor.

5860 Introduction to Continuum Mechanics (3) Fundamentals of mechanics of solids and fluids; Cartesian tensors; stress, deformation, and flow in continuous media; constitutive equations; applications to solids and fluids. Prereq: 3130 and 3311 or equivalents; Mathematics 4610.


5890 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments. Prereq: Consent of instructor. May be repeated with consent of department.

6000 Doctoral Research and Dissertation

6110-20 Advanced Topics in Fluid Mechanics and Convective Heat Transfer (3, 3) Survey of literature on advanced convective momentum, heat, and mass transfer; boundary layer theory based on the Navier-Stokes equations; boundary layer stability analysis; phenomenological theories of turbulence; turbulent boundary layer flow; high flow of fluids in nonreacting and reacting systems. Prereq: 5110-20-30 or equivalent; Mathematics 4610, 4540-50, 4710. (Same as Environmental Engineering 6110-20 and Mechanical Engineering 6110-20.)


6310 Theory of Plates (3) Classical theory of bending of plates of various shapes; thick plates; plates of variable thickness; buckling and large deflection problems. Prereq: 5310-20-30.

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


6340 Theory of Plasticity (3) Yield conditions; strain hardening; general constitutive equations; plastic potentials; plastic flow criteria; incremental and variational principles; problems in perfectly plastic solids; finite plastic deformations; plane-strain linear plasticity. Prereq: 5410 and Mathematics 4550.

6610 Photoelasticity (3) Stress-optic law in three dimensions and index ellipsoid, rotaional effects in three-dimensional photoelasticity, techniques and applications of three-dimensional photoelasticity, scattered light method, dynamic photoelasticity, photophysical measurements, plasticity and photoelasticity, recent developments in photoelasticity. Prereq: 5640, 5420 and consent of instructor. 2 hrs and 3 labs.

6710 Impact and Stress Waves in Solids (3) Mechanical impact; wave propagation in elastic solids; impact and waves in elastic rod, beams, and plates; contact problems; applications of linear elastic bodies; dynamic loading in viscoelastic and plastic materials; dynamic properties and materials. Prereq: 5110-20. Coreq: 5630.

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

6810 Energy Methods (3) Virtual work, minimum potential energy, and complementary energy; Castigliano's theorem, Hamilton's principle, and Lagrange's equations; applications of variational methods; examples from theory of structures, plates and shells, buckling, vibrations, and advanced dynamics. Prereq: 5710-20 and Mathematics 5610-20-30.

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

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

Industrial Engineering

MAJOR

DEGREES

M.S., M.E.

Professors: J. N. Snider (Head), Ph.D. Ohio State, P.E.; D. L. Beiler, M.S. Stanford, P.E.; H. P. Emerson (Emeritus), S.B. Massachusetts Institute of Technology, P.E.; R. M. LaForge, (Emeritus), M.S. Massachusetts Institute of Technology, P.E.; H. L. Lovelace, M.S. North Carolina State, P.E.

Assistant Professors: J. R. Buchan, M.S. Georgia Institute of Technology; W. W. Claycombe, Ph.D. Virginia Polytechnic Institute and State University; J. E. Utherson, Ph.D. Georgia Institute of Technology; W. G. Sullivan, Ph.D. Georgia Institute of Technology, P.E.

Assistant Instructor: E. L. Deporter, Ph.D. Virginia Polytechnic Institute; M. L. Eaton, M.S. Clarkson, P.E.; M. K. Goodman, M.S. Tennessee, P.E.

THE MASTER'S PROGRAM

A graduate program leading to the degree of Master of Science is open to graduates of recognized undergraduate curricula in industrial engineering or to graduates of other engineering curricula who have taken up to 15 quarter hours of prerequisite course work. A non-thesis option with 45 hours of course work plus a 3-hour design project is available.

Graduate work in Industrial Engineering provides for concentrations in operations research, human factors, systems engineering, reliability, work measurement, facilities planning and engineering economy. Either one or two minors can be elected in Engineering, Mathematics, Psychology, Business, Computer Science, Statistics or Economics.

Masters of Engineering Program

This professional degree program is intended as a culminating year in a five-year baccalaureate-master program which emphasizes engineering design and professional practice. Admission requirements are as stated above plus the requirement of a Bachelor's degree from an ECPD-accredited engineering program. This 45-quarter hour program requires 18 hours of course work in an industrial

4880 Project Control with CPM and PERT (3) A study of production 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.

4170 Automatic Process Control (3) Characteristics of automatic processes and controllers; elementary open and closed loop analysis, and applications to industrial control systems. Prereq: Mathematics 2860 and Engineering Science and Mechanics 2720.

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

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

4520 Engineering Economy (3) Methods and problems in selection or replacement of equipment, involving capital recovery, economic life of equipment, and rate of return on investment. Not available for graduate credit for industrial engineering students.

4530 Case Studies in Engineering Economy (3) Extension of basic engineering economy principles to actual problems encountered by companies and regulated industries. Case studies taken from literature form basis of classroom discussion. Out-of-class assignment is made which involves working with local companies to evaluate make or buy options, leasing versus cash purchases, equipment replacement studies, energy source economies. Prereq: 4520.

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

4590 Simulation (3) Generation of outcome of complex random process by computer. Models of complex systems using available simulation languages. Simulation as design tool in industrial system. Prereq: 3510 and Computer Science 3150.

4830 Health Systems Engineering (3) Hospital management systems and means by which they may be improved or reproduced in other industrial engineering principles and techniques. Prereq: 3230.

5000 Thesis and dissertation open and closed loop analysis, and operation participation. Prereq: Motion and time study or design project.

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

5110 Work Design (3) Advanced methods analysis, design and control of work systems, human factors, workers' response and management participation. Analysis and design of time and space study or work and work methods.

5210 Advanced Work Measurement (3) Characteristics of predetermined time systems, application of principles of motion and time study or work methods and design.

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


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

5340 Applied Decision Theory (3) Application of decision theory to make decisions in industrial engineering, such as selection of equipment, location of plants, investment in research and development, and other complex tasks. Prereq: 5700 and 5360.


5420 Reliability Engineering (3) Reliability concepts, failure distribution, equipment reliability, time dependent and Markov dependent systems, Maintenance data analysis and replacement problems. Prereq: Statistics 3450.


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


5710 Linear, Quadratic and Dynamic Programming (3) Mathematical programming; linear programming, quadratic programming, and dynamic programming. Computer solutions to programming problems. Prereq: Computer Science 3150 and matrix algebra.

5720 Queuing Models, Inventory, and Simulation (3) Waiting line models and inventory systems. Simulation methods and computer simulations applied to inventory and waiting line problems. Networks and maximal flow with applications to transportation problems. Prereq: 5700 and 5360.

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


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


5900 Design Project (1-9) Industrial engineering topic to fulfill design project requirement in non-thesis program limited to industrial engineering students in non-thesis program. May be repeated. Maximum 9 hrs.

5910-20-30 Special Topics in Industrial Engineering (G, J, S) Special problems for students qualified to do individual research. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6730 Dynamic Programming (3) Solving multi-stage optimization problems as sequence of single-stage optimization problems. Computational and theoretical aspects of dynamic pro-
GRADUATE PROGRAMS

Aerospace Engineering and Mechanical Engineering are available to the degrees of Master of Engineering, Master of Science, and Doctor of Philosophy with concentrations in solar energy, energy conversion, and bioenergy. In addition to the general policies and requirements of the Graduate School, each student must satisfactorily complete a program of study which has been approved by the student's committee. Specific program requirements are given below.

MASTER OF ENGINEERING PROGRAMS

Entrance into the Master of Engineering program is restricted to qualified graduates of ECPD-accredited undergraduate curricula in mechanical or aerospace engineering. At least one-third of the program of study must be classified as engineering design. The student's advisor will assist in planning the program of study to ensure that it includes the necessary design content.

Three program options (thesis, course, and problems) are described below. Note that some students may not be eligible for the course option.

MASTER'S PROGRAM OPTIONS

Three program options are available:

1. A. The Thesis Option. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 36 quarter hours of course work which includes at least 18 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally 9 quarter hours of course work (4000-level or above) in mathematics.
   2. A minimum of 24 quarter hours credit in Selected Engineering Problems (5900).
   3. A written report must be presented for each program investigated.

2. B. The Course Program. The student must satisfactorily complete a program of study that includes:
   1. A minimum of 36 quarter hours of credit in non-aerospace engineering graduate courses numbered 5000 and above, with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis, problems or dissertation credit.
   2. Participation in the departmental seminar program.

3. C. The Problems Option. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 36 quarter hours of course work which includes at least 18 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally 9 quarter hours of course work (4000-level or above) in mathematics.

DEGREES

Aerospace Engineering

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

Mechanical Engineering

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

MAJORS

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

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

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DEGREES

Aerospace Engineering

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

Mechanical Engineering

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

MAJORS

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3. C. Problems Option. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 36 quarter hours of course work which includes at least 18
tems; applications to mechanical and aerospace engineering problems.
3440 Heat Transfer (3) Heat transfer processes, heat conduction, thermal radiation.
3520-30-40 Thermal Sciences (3, 3, 3) Fundamental principles of thermodynamics and transport phenomena; applications to engineering design. To be taken in sequence.
3810 Mechanics of Machinery—Kinematics (3) Machine motions, graphical and analytical methods; instantaneous centers; velocities; accelerations.
3820 Mechanics of Machinery—Dynamics (3) Applications of Newton's laws, work, energy, and impact to machinery. Force analysis of mechanisms, balancing, gyroscopic effects, flywheels. Prereq: 3610.
3850 Mechanics of Machinery—Vibrations (3) Free and forced vibrations of single and multiple degree vibrating systems. Balancing of machinery.
3950 Introduction to Machine Design (3) Ductile-brITTLE behavior of materials under static and cyclic loading. Stress concentration, design factors and theories of failure. Changes in material behavior in processing and fabrication. 2 hrs and 1-2 hr lab.
3880 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 finishes. 2 hrs and 1-2 hr lab.
3910 Engineering Analysis (3) Advanced analysis techniques for problems of aerospace and mechanical engineering. Emphasis on approximate methods.
4140 Energy Conversion Systems (3) Laws governing energy transformations and their application to power plants.
4160 Energy Conversion Systems (3) Operating and design characteristics of new technology energy conversion systems, selected direct conversion techniques.
4180 Energy Conversion Systems (3) Economic and technical design parameters as applied to power plants for public utilities or industrial applications; selected design and layout problems.
4170 Turbo-Machinery (3) Basic principles of turbo-machinery; systematic methods or analysis, design, performance evaluation.
4180 Energy Production and Utilization (3) Thermodynamic constraints on energy production of power systems; generation methods; evaluation of new energy sources and concepts; energy conservation schemes.
4220 Environmental Noise (3) Basic principles of acoustics—measurement and control of noise in industrial and community environments.
4240 Heat Transfer (3) Heat transfer by free and forced convection, heat transfer in phase change, heat transfer in high speed flow, heat exchanger applications.
4250 Lubrication (3) Hydrodynamic theory of lubrication of sliding bearings; application of Navier-Stokes equations to infinite and finite bearings; analytical and numerical solutions; applications to design.
471-3 Experimental Mechanical Engineering (3, 3) Experimental methods and measurements of force, length, time, temperature, pressure, transport rate, physical properties, and analog computer solutions. Not for departmental graduate credit.
4920-30 Creative Design (3, 3) Application of engineering principles to the solution of current problems with emphasis on design innovation.
4921 Manufacturing Processes (3) Comparison of manufacturing methods; plastic production; metrol-
yogy.
4922 Tool Design (3) Principles underlying tool and die design, design of high-volume production tools and molds, work holding fixtures.
4924 Manufacturing Engineering Systems Design (3) Design of complete manufacturing system for a particular product: manufacturing planning, tool and fixture design, selection of manufacturing operations, redesign of product to reduce cost.
4925 Manufacturing Process Engineering I (3) Product specification: dimensional analysis of size and form; true position tolerance theory; tolerance analysis; and workshop control for production to tolerance.
4931 Energy Methods in Mechanical Design (3) Application of strain energy principles in complex beams and structures.
4932 Application of Lagrangian Mechanics in Vibration Problems (3) Generalized coordinates and multiple degree of freedom vibrating systems.
4933 Matrix Analysis (3) Application of matrices to solution of complex structured and lumped parameter vibrating systems.
4940 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.
4960 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design of machine elements, springs and shawling, selection of sleeve and rolling element bearings.
4980 Machine Elements (3) Application of strength and properties of materials, design factors, theories of failure to design of machine elements, springs and shawling, selection of chains and belts.
4990 Machine Design (3) Innovative design of complete machine; documentation including specifications, calculations, working drawings and cost analysis. Written and oral report.
5110 Conduction Heat Transfer (3) Equations of viscous fluid flow, energy equation, convection analysis of internal and external flows including effects of variable heat flux, surface temperature, and fluid properties. Prereq: 5310 or equiv.
5140 Phase Change Heat Transfer (3) Prereq: 5120.
5210 Classical Thermodynamics (3) Macroscopic thermodynamics with emphasis on First and Second Law analyses, equilibrium criteria, and thermodynamics of phase relationships. Prereq: 3330.
5220 Microscopic Thermodynamics (3) Thermodynamic properties, kinetic theory and statistical mechanics. Prereq: 5210.
5230 Special Topics in Thermodynamics (3) Prereq: Consent of instructor.
5210 Intermediate Fluid Mechanics (3) Vector descriptions in fluid mechanics; derivation of basic equations; two-dimensional potential flow; viscous flow; emphasis on boundary-layer theory. Prereq: 3410.
5410-20-30 Research in Mechanical Engineering (3, 3, 3) Design of experiments; data analysis; experimental investigation.
5520-30-40 Mechanical Engineering Design (3, 3, 3) Design of mechanical engineering units and systems.
5560-20-30 Experimental Stress Analysis (3, 3) Theory of elastic and plastic methods; photoelasticity, strain gages, lacquer coatings.
5540-60 Advanced Machine Design (3, 3, 3) Design of bearings, gears, shafting; lubrication.
5670-80-90 Dynamics of Machinery (3, 3, 3) Dynamics of machinery; vibrations; balancing; flywheels and governors.
5710 Metal Machining (3) Analytical approach to mechanics of machining. Basic phenomena—plastic flow, fracture, friction and wear. Prereq: 3650, 3440, and Metallurgical Engineering 2110.
5800 Transfer Matrix Methods in Elastome-
chanics (3) Application of transfer matrix methods to static and dynamic lumped parameter elastic systems in mechanical engineering. Calculation of forced response, mode shapes, and natural frequencies of beams and rotating shafts having complex end conditions. Balancing of rotating shafts. Accuracy and numerical considerations. Prereq: Graduate standing in engineering and consent of instructor.
5840-50-60 Turbomachinery Systems (3, 3, 3) Design, development, and systems integration of turbomachinery components and systems. 4th year graduate standing and consent of instructor.
5870 Dynamic Modeling and Simulation (3) Modeling physical systems including mechanical, thermal, hydraulic, pneumatic and electromechanical systems for experimental purposes; determining system parameters, Analog and digital computer simulation techniques. Prereq: 3650, 4420, and Aerospace Engineering 3511.

5900 Selected Engineering Problems (3-9) Selection of problems that will enable student to fulfill requirement of Problems Program. Enrollment limited to students in Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.

5950 Seminars (1) All phases of mechanical engineering, including reports on current research at the University of Tennessee, Knoxville. May be repeated. S/NC only.

5990 Special Topics in Mechanical Engineering (1-3) May be repeated.

6000 Doctoral Research and Dissertation 6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) (Same as Engineering Science and Mechanics 6110-20.)


6420 Selected Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium of pure substance; metastable states. Prereq: Consent of instructor.

6430 Selected Topics in Thermodynamics (3) 6610 Engineering Vibrations (3) Mechanical vibrations. Linear and nonlinear single degree of freedom systems. Prereq: Consent of instructor.

Aerospace Engineering

3520 System Dynamics (3) Analytical models for physical elements; linearization and superposition. Elementary natural and forced motions. Dynamic characteristics and stability of systems.

3610 Dynamics (3) Newton's Law: work-energy impulse-momentum, Lagrange equations, central force, linearization and superposition effects. Applications to aerospace systems.

3620 Mechanical Vibrations (3) Free and forced vibrations of single and multiple degree vibrating systems, balancing of rotating machinery.

3630-40 Structural Analysis of Aerospace Vehicles (3, 3) Fundamentals of structural analysis as applied to configurations of aerospace interest. Introduction to aeroelasticity phenomena. Must be taken in sequence.

4110 Aerodynamic Fundamentals (3) Atmosphere, dynamics and thermodynamics of perfect gases, fluid flow types, airfoil theory, wing theory, drag. For non-aerospace engineering majors only.

4120 Aircraft Propulsion and Performance (3) Propellers, propulsion systems for aircraft, static performance and special performance problems, maneuverability, control surfaces, stability and control. For non-aerospace engineering majors only.

4210 Compressible Flow (3) One-dimensional internal flow; shock and expansion waves; friction and nonadiabatic flow.

4220 Low Speed Aerodynamics (3) Potential flow theory; kinematics and dynamics of perfect gases; fluid analysis and design of aerodynamic bodies.

4230 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow; compressibility effects; numerical solution methods.

4240 Astronautics (3) Propulsion, trajectories, guidance, control, and atmospheric reentry of space vehicles.

4250 Propulsion (3) Principles of propulsion devices: turbojet, ram-jet, and rocket engines.

4260 System Design (3) Synthesis of aerospace system. Design report on the system.

4471-81 Experimental Aerospace Engineering (3, 3) Experimental methods with laboratory experiments; wind tunnel tests, laboratory experiments, supersonic flow measurements, boundary-layer measurements. Prereq: 4220 or Mechanical Engineering 5510, Mathematics 4250.

5120 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory experiments; hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests, wind tunnel experiments, supersonic flow measurements, boundary-layer measurements. Prereq: 4210-20-30 or Mechanical Engineering 5310.

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

5210-20 Aeroacoustics of Compressible Flows (3, 3) One-dimensional flow; waves; small perturbation theory, slender body theory; similarity rules; nonlinear acoustics. Prereq: Consent of instructor. Prereq: 5210 for 5220 and 5210 for 5220.

5240 Dynamics of Viscous Flows (3) Equations of viscous fluid flow; laminar and turbulent flow; transition; separation; boundary layer theories; exact and approximate solutions. Prereq: Mechanical Engineering 5310 or equivalent.

5250 Introduction to Hypersonic Flow (3) Slender body flow; similarity; Newtonian theory; blunt body flow; hypersonic free molecular and rarefied gas flow. Prereq: 5240.

5260 Selected Topics in Aerodynamics (3) Transonic, supersonic, and hypersonic flow theories. May be repeated. Prereq: Consent of instructor. Prereq: Mechanical Engineering 5310 or equivalent.

5270-80-90 Aerospace Ground Test Facilities (3, 3, 3) Aeronautical models and similarity considerations. Aerodynamic test facilities including wind tunnels, test stands, indoor and outdoor ranges; propulsion test facilities for air breathing and rocket engines. Space environment. Theoretical analysis of operating conditions of space environmental test facilities. Prereq: 5240, Mechanical Engineering 5130 and 5230.

5310 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics, thermodynamic and therophysical properties of gas plasmas; governing equations and applications. Prereq: 4220 and Mathematics 4710.

5340-50 Atmospheric Entry (3, 3) Motion and heating along ballistic and lifting trajectories; dynamic stability; heat protection systems. Prereq: 5220. Recommended: 5240.

5440-50 Transonic Flow (3, 3) Theoretical and experimental aspects of transonic flow; the interaction of transonic flows and delineation of specific problems—nonlinear nature of flow, strong viscosity effects, development of small disturbances and similarity parameters, shock wave in transonic flow and assumption of inviscid motion, shock wave phenomena. Prereq: 5450, 5410. -Shock-wave boundary layer interaction and consequent surface heating; experimental testing at transonic speeds, interference problems. Prereq: 5220 or equivalent.


5620 Aerodynamics (3) Special topics and recent research results in field of aerodynamics. Turbomachinery noise, jet noise, and general theoretical developments, empirical equations. Prereq: 5610.

5610 Aviation Systems: An Overview (3) Aviation systems, present and future, emphasis on systems approach. Socioeconomic base, aerospace and propulsion technology, meteorology, air traffic control, airport-community interface, and technological trends and developments pertaining to the status and role of air transportation. For non-aerospace and non-mechanical engineering majors only. Prereq: 4120.


5900 Selected Engineering Problems (3-9) Selected problems in aerospace engineering to fulfill requirement of Problems Program. Enrollment limited to students in Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.
5950 Seminars (1) All phases of aerospace engineering, including reports on current research at The University of Tennessee, Knoxville. May be repeated. S/N/Only.

5990 Special Topics in Aerospace Engineering Credit to be arranged; 3 hrs maximum each quarter.

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6320 Magnetohydrodynamics II (3) Continuum magnetohydrodynamic equations. Alfven and shock waves, exact solutions for magnetohydrodynamic channel flows, one-dimensional model of channel flow, magnetohydrodynamic boundary layer. Prereq: 5310, Mathematics 5620.

6330 Magnetohydrodynamics III (3) Engineering applications of magnetohydrodynamics, propulsion and power generation. Prereq: 5320, Mathematics 5630.

6410 Physical Gasdynamics (3) High-speed, high temperature flows of gas from molecular point of view: molecular concepts and simple kinetic theory; equilibrium properties of gases and gas mixtures; nonequilibrium kinetic theory, chemical thermodynamics, and statistical mechanics. Prereq: 5220 and Mechanical Engineering 5220.

6420 Physical Gasdynamics (3) Continuation of 6410. Mixtures in local thermodynamic and chemical equilibrium; physical and chemical basis of rate equations; flow with vibration and chemical nonequilibrium. Prereq: 6410.

6510-20-30 Advanced Aerodynamics (3, 3, 3) Subsonic, transonic, supersonic, and hypersonic flows treated in a generalized and unified manner with combined inviscid/inviscid effects. Relationships among various regimes of fluid flows. Fundamental assumptions, limitations of approximations and consequences. Foundations of gas dynamics with emphasis on applications to aircraft, rocket, ground testing, and jet propulsion. Discussion of special topics according to students' interest. Prereq: 5110, 5220, and 5420 or equivalent.


6910 Advanced Topics in Gasdynamics (3) Selection of topics based on particular interests of students: nonequilibrium transport phenomena, radiation gasdynamics, nonequilibrium gasdynamic flows, advanced kinetic theory, perturbation techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

Nuclear Engineering

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

Professors:
- P. F. Pasqua (Head), Ph.D. Northwestern, P.E.
- P. N. Stevens, Ph.D. Northwestern, P.E.

Associate Professors:
- H. L. Doder, Ph.D. Tennessee.
- J. F. Bussell, Ph.D. Georgia Institute of Technology; H. C. Roland, Ph.D. Tennessee.
- O. J. Lashway, Ph.D.

Assistant Professors:
- E. M. Katz, Ph.D. Tennessee; L. Miller, Ph.D. Texas A & M, P.E.

College of Engineering

THE DOCTORAL PROGRAM

Students in the field of nuclear engineering desiring to study for the degree of Doctor of Philosophy must have a Bachelor of Science or Master of Science degree from a recognized university, with a major in engineering or physics, and present at least a B average. All candidates will be required to demonstrate general competence in the preliminary examinations in the fields of engineering science, mathematics, and physics. At the same time, all candidates will be required to demonstrate special competence in nuclear science.

Specific course requirements for the Ph.D. degree in Nuclear Engineering include:

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.

2. A minimum of 36 quarter hours credit in Nuclear Engineering Practice.

3. A minimum of 45 quarter hours in nuclear engineering courses numbered 5000 and above (or the equivalent), with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.

4. A minimum of 18 quarter hours in mathematics, computer science, or statistics in courses beyond nuclear engineering prerequisites required. These must be numbered 4000 or above.

5. A minimum of 9 quarter hours in courses numbered 5000 or above from a department other than nuclear engineering. The choice depends on the student's overall program and should expand his/her knowledge in a given field.

6. A reading knowledge of one foreign language will be determined by the student's doctoral committee.

4110-20-30 Introduction to Nuclear Reactor Theory (3, 3, 3) Nuclear structure; radioactive decay laws; neutron interaction; fission process; chain reactions; diffusion equation; multigroup diffusion theory; neutron moderation; reactor criticality; reactor design; reactor analysis. Prereq: Physics 3730 or consent of instructor.

4140 Thermonuclear Systems (3) Fusion reactions; properties of plasmas; plasma containment; plasma diagnostics; thermonuclear devices; plasma physics. Prereq: Physics 3730, Mathematics 4550.

4210-20-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation; counting statistics, half-life and decay schemes, gamma spectrometry, cross-section measurements, analog computation, diffusion properties of neutrons, critical loading experiments, control rod calibration, statistical weight, shielding, xenon poisoning, prompt critical reactor behavior, fission density and adjoint flux. Prereq: Physics 3730.

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 plant; economic, safety, and environmental aspects of nuclear power. Prereq: Mathematics 4610, non-nuclear-engineering students only.

4710 Energy Transport (4) Development of differential and integral forms of conservation equations: conduction, convection, and radiation heat transfer; applications to nuclear reactor fuel element heat transfer; applications to nuclear reactor fuels. Prereq: M.E. 5410.

4720 Reactor Thermal Design (4) 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 non-nuclear heat transfer and power conversion system, economic evaluation; optimization procedures, description of typical systems. Coreq: 4130.

4810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation, shield design. Prereq: Physics 3730, Mathematics 4550.

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

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

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

5000 Thesis

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

5110-20-30 Transport Processes in Nuclear Engineering (3, 3, 3) Momentum and heat transport; development of conservation equations; elementary theory of turbulence; heat transfer and flow through conduits; conduction; radiation; reactor core thermal analysis. Prereq: 4720 or equivalent, Mathematics 4710, 4550.

5210 System Dynamics (3) Transient analysis, Laplace transforms; frequency response, stability (linear and nonlinear); and sensitivity analysis by state variable methods. Dynamic analysis of distributed systems. Prereq: Consent of instructor.

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


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

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

5510-20-30 Nuclear Systems (3, 3, 3) Various reactor types; flow diagrams, thermodynamic analysis, control methods, component descriptions of power systems using various reactor types and nuclear power economics. Prereq: 4610-20-30 or equivalent or consent of instructor.

5710-20-30 Nuclear Design (3, 3, 3) Analytical techniques for neutronic aspect of nuclear reactor core design. Multigroup discrete ordinate theory, multigroup PN theory, integral transport theory, perturbation theory, and others. Generation of required multigroup constants formulated with available point data and Nordheim treatment in slowing down region and gas kernel in thermal region. Prereq: 4130 or equivalent.

5740 Reactor Shielding (3) Application of analytic solutions of Boltzman transport equation to shield design problems. Spherical harmonics, moments methods, numerical solutions, adjoint calculations, and invariant imbedding cases studied. Prereq: 4810.


5840-58 Fast Breeder Reactors (3, 3) Special characteristics of fast breeder reactors; emphasis on LMFBR. Need for breeders; neutron physics and thermal characteristics of reactor core; development status of engineering components; fuel cycle cost analysis; safety; coolants other than sodium; world status of development.

5970 Special Topics in Nuclear Engineering (3) Lectures and recitation on recent advances in nuclear engineering. Prereq: Consent of instructor. May be repeated with consent of department.

5980 Nuclear Engineering Practice (3-12) Experiences in solving and reporting on engineering problems. Prereq: Approval of Nuclear Engineering Department. May be repeated. Only Alternate Plan students may take this course. S/NC only.

6000 Doctoral Research and Dissertation

6110-20-30 Selected Topics in Reactor Theory (3, 3, 3) Transport theory, control rod theory, and perturbation theory. Selected topics from literature. Prereq: Consent of instructor.

6140 Radiation Shielding (3) Advanced topics in radiation shielding. Monte Carlo techniques and space radiation problems. Natural space radiators; emergency radiators, dose conversion, probability. Selected neutron, gamma, and space-radiation shielding problems. Prereq: Consent of instructor.

6150 Reactor Dynamics (3) Special topics in reactor dynamics and control. Prereq: Mathematics 5630.

6710 Two-Phase Flow and Heat Transfer (3) Pool boiling and flow boiling; hydrodynamics of two-phase flow, boiling crises, two-phase instabilities. Prereq: 5130 or equivalent.
Graduate study programs lead to the degree of Master of Science in Child and Family Studies; Consumer Studies and Housing; Public Policy; Crafts, Interior Design, and Housing; Food Science; Food Systems Administration; Home Economics Education; Nutrition; and Textiles and Clothing. Graduate study programs lead to the degree of Doctor of Philosophy in Home Economics with three options: interdisciplinary, food science, and nutrition. Graduate programs provide advanced specialized training needed for college and university teaching, for leadership positions in governmental and professional agencies, in the various professions in business, for secondary school and adult teaching, for research and for extended services.

GENERAL REQUIREMENTS FOR GRADUATE STUDENTS

Requirements for graduate study are prescribed by the Graduate School and by the student's major department. Students lacking adequate preparation may be required to take additional courses at the undergraduate level as prerequisites to graduate study. A student deficient in English may be required to take courses as necessary to remove the deficiency.

APPLICATIONS FOR ADMISSION

Two copies of the student's transcript and an application for admission are submitted directly to the Graduate School. In addition, a College of Home Economics application and three letters of reference are sent to the Associate Dean of the College of Home Economics for the interdisciplinary doctoral program.

PROGRAMS LEADING TO THE DEGREE OF MASTER OF SCIENCE

Thesis Option:

Majors and minors are offered in the following areas: Child and Family Studies, Consumer Studies and Housing, Public Policy, Crafts, Interior Design, and Housing, Food Science, Food Systems Administration, Nutrition, Textiles and Clothing.

*Requirements include Crafts, Interior Design, and Housing 5615 or Child and Family Studies 5710; Child and Family Studies 5700 or Planning 5100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5600. Three-hour course in research methods or statistics. Twenty-four hours in consumer studies or housing to include 9 hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5060 or Child and Family Studies 5000 or Planning 5100 or Economics 5060 (6 hours), or Child and Family Studies 5120; Food Science 4040; Textiles and Clothing 5180; Agricultural Economics 4710; Economics 4340, 5050-60; Finance 5210-20; Political Science 5641, 5670, 5710; Library and Information Science 5250.

Housing courses to be selected from Agricultural Mechanization 5110, 5610; Crafts, Interior Design, and Housing 4330, 5615, 5610-20-30; Planning 5360-40, 5460; Geography 5250.

**Requirements include those listed under the thesis option for the major in Consumer Studies and Housing: Public Policy** will consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000 level. A minimum of 27 hours of 5000- and 6000-level courses is required in the program. Some majors may require 9 hours in one collateral area.

College of Home Economics

Lura M. Orland, Dean
Grayce E. Goertz, Associate Dean
Virginia S. Anagnost, Assistant Dean

The Graduate Record Examination scores for the aptitude test including the quantitative, verbal, and analytical sections are required for the application for admission in the interdisciplinary doctoral program, the Master's program in Child and Family Studies, and the Master's program in Consumer Studies and Housing: Public Policy.

In submitting applications for admission to graduate study in home economics, students are requested to indicate choice of major area of study.

GRADUATE ASSISTANTSHIPS AND FELLOWSHIPS

Information and application forms regarding graduate assistantships, fellowships and general requirements for admission to graduate study may be obtained from the department head in the area of the student's major interest or from the Associate Dean of the College of Home Economics for the interdisciplinary doctoral program.

Non-Thesis Option:

The non-thesis option is available for all majors listed under the thesis option and is the only option available for public health nutrition.

In addition to the regulations of the Graduate School, the non-thesis program of study for all majors except Consumer Studies and Housing: Public Policy will consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000 level. A minimum of 27 hours of 5000- and 6000-level courses is required in the program. Some majors may require 9 hours in one collateral area.

Two copies of the student's transcript and an application for admission are submitted directly to the Graduate School. In addition, a College of Home Economics application and three letters of reference are sent to the Associate Dean of the College of Home Economics for the interdisciplinary doctoral program.

PROGRAMS LEADING TO THE DEGREE OF MASTER OF SCIENCE

Thesis Option:

Majors and minors are offered in the following areas: Child and Family Studies, Consumer Studies and Housing, Public Policy, Crafts, Interior Design, and Housing, Food Science, Food Systems Administration, Nutrition, Textiles and Clothing.

*Requirements include Crafts, Interior Design, and Housing 5615 or Child and Family Studies 5710; Child and Family Studies 5700 or Planning 5100 or Economics 5340 or Agricultural Economics 4320; and Home Economics 5600. Three-hour course in research methods or statistics. Twenty-four hours in consumer studies or housing to include 9 hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5060 or Child and Family Studies 5000 or Planning 5100 or Economics 5060 (6 hours), or Child and Family Studies 5120; Food Science 4040; Textiles and Clothing 5180; Agricultural Economics 4710; Economics 4340, 5050-60; Finance 5210-20; Political Science 5641, 5670, 5710; Library and Information Science 5250.

Housing courses to be selected from Agricultural Mechanization 5110, 5610; Crafts, Interior Design, and Housing 4330, 5615, 5610-20-30; Planning 5360-40, 5460; Geography 5250.

**Requirements include those listed under the thesis option for the major in Consumer Studies and Housing: Public Policy** will consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000 level. A minimum of 27 hours of 5000- and 6000-level courses is required in the program. Some majors may require 9 hours in one collateral area.

Note: Nine hours is the maximum credit allowed for special problems work and seminar work in any one area of home economics.
Request for the non-thesis option must be made in writing to the department head, not later than the end of the first term in residence.

DOCTORAL PROGRAMS

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

The doctoral program with a major in Home Economics requires:
1. A minimum of 96 quarter hours in courses beyond the Bachelor's degree exclusive of credit hours for the Master's thesis to include a minimum of 12 quarter hours of 6000-level courses.
2. Selection of an option and fulfillment of the requirements as supervised by the faculty committee.
3. The faculty committee for each doctoral student shall determine whether a reading knowledge of a foreign language is required.
4. Written preliminary examinations.
5. Doctoral research and dissertation (minimum 36 hours; maximum 48 hours) may be included in the 96 hours presented for the degree.
6. A final examination.

Option Requirements:

Interdisciplinary option:
1. Home Economics 6110-20, 6210.
2. Twenty-four to 36 hours from at least two departments in the College of Home Economics, representing one of the following concentrations:
   - Individual and Family Behavior as related to development and change throughout the human life cycle. Emphasis may be on normal developmental processes in individuals and families; socialization through childhood, adolescence, and adulthood; behavior in diverse environmental and cultural settings; interaction processes within families; community services and planning to meet development needs of individuals and families.

Phases of Development and Well-being in humans throughout the life cycle. Emphasis for particular age groups may be on: physiological response to nutrient intake, improvement of nutritional status through informed community action; cultural, economic and technological influences on food selection.

Environmental Factors in design, space planning, housing, food service systems, clothing, textiles, and crafts as they relate to human needs. Emphasis may be on the impact of: cultural, sociological, psychological, and economic change; technology through informed consumption; aesthetics in improving the quality of the environment.

Consumers' Economic and Social Well-being throughout the life cycle. Emphasis may be on: the relationship between family structure and decision-making processes in the use of human resources; the effects of social, macro- and microeconomics and political decisions on consumption patterns and other behavior; community programs to meet the socioeconomic needs of consumers.

3. Fifteen to 24 hours in cognitive or supporting courses (mainly from departments in the University) including courses to give sufficient competence in statistics or research methods needed for dissertation research. Additional courses will complement the option emphasis and dissertation research area.
4. Doctoral research and dissertation will be based on a problem within the interdisciplinary option concentration.

Food science option and food science with concentration in food systems administration:
1. Three hours in research methods from Food Science 5510 or 5520 or Food Systems Administration 5210; 6 hours from Food Science 5610-20-30-40, 6110, Food Systems Administration 6110; and Zoology 5350 (Biometry) or equivalent. 2. Twenty-four hours in 5000- and 6000-level courses in food science or in food systems administration.
3. Nine hours in a collateral area (upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area may be substituted for 5000 and 6000 courses in food science or in food systems administration).
4. Minimum of 4 hours of credit in doctoral seminar.

Nutrition option:
1. Thirty hours of 5000 or 6000 courses in nutrition exclusive of research and Zoology 5350 (Biometry) or equivalent.
2. Nine hours in a collateral area (upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area beyond the 9 hours may be substituted for 5000 and 6000 courses in nutrition).
3. Minimum of 4 hours of credit in doctoral seminar.

SPECIAL WORKSHOPS

Workshops on special topics of current interest are offered periodically by the different departments in the College of Home Economics. These are of special interest to those desiring to work for advanced degrees. Announcements are sent upon request.

Each summer the craft workshop program in Gatlinburg, Tennessee, is made possible through cooperative efforts between the crafts, interior design, and housing department and the Pi Beta Phi Arrowmont School of Crafts. The program provides advanced instruction in designer-created crafts through classes taught by nationally known craftspersons. Cooperation with national and local craft organizations has so stimulated the work of craftspersons throughout the area that their work has gained national recognition. See also page 90.

GRADUATE PROGRAMS FOR HOME ECONOMICS EXTENSION

Graduate programs at both the doctoral and Master's levels are available for students interested in home economics extension. At the doctoral degree level, programs of study may be planned in the interdisciplinary or in the food science or the nutrition options. A Master's degree major in Consumer Studies and Housing: Public Policy is particularly suitable for students interested in home economics extension, although Master's programs may be planned in any subject matter area of home economics with agricultural extension education as a collateral area. Additionally, four-week courses are offered in February each year for students particularly interested in home economics extension. Students interested in a graduate program and/or the four-week courses should contact the Associate Dean of the College of Home Economics.

Departments of Instruction

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

Child and Family Studies

MAJORS

Child and Family Studies

Consumer Studies and Housing: Public Policy

Home Economics

DEGREES

M.S.

Ph.D.

Professors:
R. L. Hightberger, Ph.D. Iowa; J. L. Kuipers (Head), Ph.D. Michigan State.

Associate Professors:

Assistant Professors:

4110 Student Teaching in Preschool Settings (6)
Increasing responsibility for planning and guiding groups of young children under supervision of head teacher includes 2 hr weekly seminar. Prereq: 1500, 3110, 3120, 3210, Coreq: 4111.

4210 Family Finance (3)
Analysis of alternative ways of meeting financial problems encountered during life cycle of family.

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

4230 Development in Infancy (3)
Development during prenatal period and first fifteen months of life. Interaction between infant and environment. Review of research relating to childrearing practices and prediction of later behavior. Prereq: 2110 and Zoology 2930 or equivalent.

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

4350 Advanced Child Development (3)
Survey of selected theories relevant to child development with emphasis on research literature and research methodology. Prereq 4 hrs psychology and 6 hrs child development or equivalent.
4420 Learning Experiences with Parents (3) Dynamics of parent-teacher interaction. Emphasis on a variety of techniques for developing communication and working relationships between parents and teachers through experiences in a variety of settings. Prereq: 3610 or 4110 or equivalent.

4430 Family Relationships (3) Interpersonal relationships among family members and societal roles. Prereq: 3510 or 3515.

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

4620 Administration of Programs for Young Children (3) Planning for staffing, housing, feeding, scheduling, and financing for day care of infants and young children, nursery school programs, and specialized programs for deprived preschool children. Prereq: 3110 or 3310 or 4110.

4630 Field Work in Child, Family and Consumer Studies (3-15) Opportunity for students to work in nursery schools or community agencies; focus on children, families, and/or community concerns. Hrs arranged. May be repeated. Maximum 9 hrs.

4710 Contemporary Developments (1-3) Student of current family programs of special focal point(s) pertinent to the field; topics selected to be determined by students and instructor with department approval. Elective credit only. Prereq: Consent of instructor. May be repeated with departmental approval. Maximum 9 hrs.

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


5100 Thesis

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

5000 Practicum (1-12) Field experience in selected organizations that focus on solutions to problems in consumer studies. May be repeated. S/NC only.

5110 Field Work in Family Life (3) School and community programs concerned with education for family living. Prereq: Consent of department head. May be repeated. Maximum 9 hrs.

5140 Consumption and Standards of Living (3) Economic and welfare aspects of consumption. Analysis of factors associated with changes in the standard of living. Review of major consumption studies. Prereq: Crafts, Interior Design, and Housing 4320 or consent of instructor.

5150 Assessment of Family Behavior (3) Methods of measuring factors influencing family behavior. Current methodological issues. Prereq: 5410 or 5530 or consent of instructor.


5170 Consumer Economics (3) Consumer function, education, and policy; structure of consumer markets; government action relating to consumers; factors affecting prices of consumer goods.

5180 Family Financial Consultation (3) Analysis of consumer behavior patterns, common financial difficulties, avenues by which families are assisted. Field experience with consumer consulting services. Prereq: 4210, 4830, or 5170.

5190 Standards in Consumer Protection (3) Product and performance standards in consumer protection. Theoretical and operational questions relating toanda evaluation of various standards and concepts. Prereq: 3 hrs family relationships, 3 hrs sociology. 2 hrs and 1 lab.

5210 Theories of Child Development (3) Prereq: 4350 or equivalent.

5220 Family Life Programs (3) School and community programs in family life; survey and evaluation; students concentrate on type best suited to their experience and future professional orientation. Prereq: 3 hrs family relationships, 3 hrs sociology. 2 hrs and 1 lab.

5310 Theory and Research on Human Sexuality (3) Cultural, social; and psychological dimensions of human sexuality. Major contributions from anthropological, sociological, and personality theory and research.

5410 Advanced Family Relationships (3) Problems in modern family life; individual adjustment and relationships. Prereq: 5310, 4430, or consent of instructor.

5420 Parents and Children (3) Common problems of young children faced by parents and teachers; emphasis on methods available to modify problem behavior.

5430 Families in Crisis (3) Interpersonal transactions in disordered family behavior. Prereq: 5410 or equivalent.

5510 Survey of Research in Child and Family Studies (3) Research literature; locating, abstracting, reporting research studies. Prereq: 5530 or equivalent.


5540 Preschool Curriculum Models (3) Analysis and evaluation of curriculum program models for young children. Prereq: 6 hrs child and family studies or preschool education.

5550 Supervision in Preschool Programs (3) Guidance of students working in nursery school and day care centers. Guiding students through seminar presentation of research findings; role of various evaluation techniques. Prereq: 5540. 3 hrs and 12-hr lab.

5610 Theories of Management in the Family Environment (3) Fundamental management concepts, development and application to current family situations.

5620 Nursery School Administration (3) Organizing and operating schools and play groups for preschool children; housing, staff, schedules, programs, financing. Prereq: 4110 or equivalent.

5630 Seminar in Infant Development (3) Theory and research relating to development during infancy. Prereq: 4230.

5640 Teaching Child and Family Studies (3) Seminar and practice in techniques for teaching child development and family relationships. Prereq: Consent of instructor. S/NC only.


5800 Problems in Child, Family and Consumer Studies (1-3) Advanced study of child development and family variables in family planning programs. Internship in specialized parenthood programs and clinic. May be repeated. Maximum 9 hrs.


5820 Advanced Topics (3) Individual study and group discussion of current problems. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5830 Individual and Family Development—Physiological Determinants (3) Family members' physiological potential for growth and development and to realize the human potential. Prereq: 6 hrs advanced child and family studies, 4 hrs nutrition, 4 hrs physiology, or equivalent.

6200 Individual and Family Development: Cognition (3) Processes through which human individuals learn to recognize their world. Cognitive processes involved in development across life span. Prereq: 5410 or consent of instructor.


6410 Theories of Family Interaction (3) Theories and concepts of family interaction. Critical evaluation of theoretical formulations of contemporary research on family behavior. Prereq: 5410 or equivalent.

6450 Conceptual Frameworks for the Family (3) Theoretical perspectives for understanding family structures, processes, and family behaviors. Prereq: 5410 or consent of instructor.

6540 Seminar in Programs for Infants and Preschool Children (3) Research related to programs for infants and young children. Various program models for education of infants and young children, methods of working with parents, and student training programs. Prereq: 5410 or equivalent.

6619-20 Applied Behavior Analysis in Natural Settings (3, 6) Independent supervision of applied behavior analysis in natural settings. Prereq: 5420 or consent of instructor.

6710 Elements of Consumer Choice (3) Analysis of the consumer decision- making process as a consumer-orienting concept. Consumer choice. Impact of affluence on consumers, and consideration of dynamic aspects of consumer behavior, including roles of aspirations, expectations, uncertainty and information. Prereq: 5170 or consent of instructor.

7290 Consumer Protection (3) Consumer protection, regulatory agencies, standards, information, disclosure and other consumer protection legislation. Assumptions involved in these efforts and implications of studies. Prereq: 5170, 5190 or consent of instructor.

Crafts, Interior Design, and Housing* MAJORS

DEGREES

CRAFTS, INTERIOR DESIGN, AND HOUSING M.S.

Consumer Studies and Housing: M.S.

College of Home Economics: Ph.D.

Professor: R. G. Blakemore (Head), Ph.D., Florida State University.

The Crafts program is under revision.
910 College of Home Economics

Associate Professor: W. Moran, M.S. Wisconsin.

Assistant Professors: A. K. Farkas, Ph.D. Minnesota; K. Tepel, M.S. Massachusetts.

To be admitted to the Graduate School in the craft program a student must have a professional knowledge of media and techniques. Work with creative design concepts is emphasized at the graduate level; media and techniques are important only in so far as the experimentation with these coexists with philosophical and creative orientation of the designer-craftperson. Courses are, therefore, based on theory or philosophical concepts in order to facilitate the development of visual sensitivity in relation to design. Major emphasis will be on the visual image as a personal interpretation of the media. Because the philosophical orientation of the student varies widely, progression is, therefore, based on theory or philosophical concepts in order to facilitate the development of visual sensitivity in relation to design.

A comprehensive course of study includes intensive training in the chosen areas of specialization such as ceramics, weaving, textile design, or interior design as well as courses dealing with the broader aspects of design. All student programs include: Seminar in Design (5040), Advanced Design Studio (5050), and research methods; in addition, crafts majors include: Exhibition Design (4140). An interdisciplinary program in Consumer Studies and Housing; Public Policy is available to students with interest in the social science approach to housing. Courses dealing with the design aspects of housing may be elected.

PI BETA PHI ARROWMONT SCHOOL OF CRAFTS

Graduate students in the area of crafts have an unique opportunity to participate in the summer program at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee; credit is granted through The University of Tennessee, Knoxville. Instructors at the school are nationally and internationally recognized designers of persons who offer, in many instances, different approaches to those of the resident faculty; this further enriches the student's program of study. Craft courses are not offered on the Knoxville campus in the summer quarter. Therefore, students attending UT during the summer for crafts study are required to attend the Pi Beta Phi Arrowmont School of Crafts and pay the additional registration, tuition, and laboratory materials fees required by that school.

ACQUISITIONS AND EXHIBITIONS

For crafts and interior design majors, the department reserves the right of acquisition and exhibition of work completed in its studios under the guidance of the faculty. Prospective graduate students should submit a portfolio of their undergraduate studio work to the department. This portfolio may include slides or original work.

4110 Home Wiring and Lighting Requirements (3) Service of electricity in modern homes; evaluation of lighting and wiring plans in terms of family desires and need for equipment. 1 hr and 2 labs.

4130 Contemporary Design (3) Furnishings and interiors: economic, technological and sociological influences on the development of design; changing living arrangements; interrelation of architecture and furnishings. Significant designers and their work.

4140 Exhibition Design (4) Display of craft and interior designs in relation to materials, props and special exhibition areas. Emphasis on knowledge and application of the design principles and their relation to promotion, design, construction, display and evaluation for two and three dimensional displays. Annual student Craft and Interior Design exhibit culminates quarter. Prereq: 1410 or equivalent.

4155 Interior Space Planning I (6) Analysis, planning and design of office environment; includes contracts specifications. Prereq: 3256 or equivalent.

4156 Interior Space Planning II (6) Studio problems involving large scale nonresidential interior spaces such as restaurants, transportation facilities, stores, institutions. Prereq: 4156 or consent of instructor.

4310 Crafts in America (3) Craft movement; factors that contributed to growth and development. Ecological, philosophical, social, and technological and therapeutic values of crafts. Place of craftperson in society as producer, teacher, designer for industry.

4320 Housing Problems (3) Housing requirements of families. Reading and judging house plans; effective use of space; maintenance problems; housing regulations and restrictions; site selection and neighborhood development; financing procedures. Prereq: 6 hrs from Economics 2110-20.

4330 Care and Repair of Household Equipment (3) Care of equipment to give maximum service in relation to operation and service; under- standing of common repair problems. Prereq: 2430. 1 hr and 2 labs.

4410 Craft Media (4) Possibilities and limitations of variety of craft media; understanding educational and social values of craft work. Designing and executing craft problems using inexpensive materials and tools. 3 labs.

4420 Leather Design (4) Relationship of design to function, techniques and materials. Creating leather objects of original design. Prereq: 1410 or equivalent. 1 hr and 2 labs.

4430 Plastics (4) Possibilities and limitations of various plastics; methods of fabrication; relation of design to function, processes, types of material and use of tools. Prereq: 1410 or equivalent. 1 hr and 2 labs.

5000 Thesis

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

5040 Seminar in Design (3) Intensive reading, discussion and critical evaluation of twentieth-century design concepts, persons, motivation, and creative components leading to visual innovation.

5050 Advanced Design Studio (4) Strength, structural variability, and form potentials of design materials; search for aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in enameling and consent of department head. Each course may be repeated one time.

5120 Historic Interior Design (3) Research studies adaptation of historic interiors. Variable course content, emphasis on interior design, furniture and/or accessories for England, Scan-
dinavia, Mediterranean area and/or America. Prereq: Consents. Maximum 18 hrs.

5210 Furniture Appreciation (3) Aesthetic qualities of past and present styles. Significant structural and formal characteristics.

5310 Interior Design (3) Advanced problems in planning and design of the interior environment; selection of research information in making design decisions. Prereq: Consent of instructor.

5330 Craft Design (3) Fine design in international crafts, designing in basic craft media. 1 hr and 2 labs.

5341-51-61 Metal Design I, II, III (4, 4, 4) Survey of techniques and materials and their relationship to design. Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in metal design. 5351—Advanced experimentation using aesthetic concepts in development of two- and three-dimensional forms in metal design. 5342—Advanced experimentation using aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5342-52-62 Weaving I, II, III (4, 4, 4) 5342—Initial development of theory for investigation of aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5343-53-63 Textile Design I, II, III (4, 4, 4) 5343—Survey of aesthetic concepts for surface decoration of textiles. 5353—Advanced experimentation in unifying aesthetic concepts in surface decoration of textiles. 5363—Experimentation in unifying aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5344-54-64 Wood Design I, II, III (4, 4, 4) 5344—Survey of aesthetic concepts in two- and three-dimensional forms in wood. 5354—Advanced experimentation using aesthetic concepts in development of two- and three-dimensional forms in wood. 5364—Experimentation in unifying aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5345-55-65 Enameling I, II, III (4, 4, 4) 5345—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in enameling. 5355—Advanced experimentation using aesthetic concepts in development of two- and three-dimensional forms in enameling. 5365—Experimentation in unifying aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5346-56-66 Plastics I, II, III (4, 4, 4) 5346—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in plastics. 5356—Advanced experimentation using aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5347-57-67 Ceramics I, II, III (4, 4, 4) 5347—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in ceramics. 5357—Advanced experimentation using aesthetic concepts in development of two- and three-dimensional forms in ceramics. 5367—Experimentation in unifying aesthetic concepts in preparation for graduate exhibition. Prereq: Previous work in ceramics and consent of
department head. Each course may be repeated one time.


5368 Ceramics—Glaze Calculation (4) Experimentation with various types of clay bodies and glazes for reduction and oxidation firing atmospheres. Prereq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5369 Ceramics—Kiln Construction (4) Designs for and construction of various sizes and types of kilns and burner systems which promote reduction and oxidation firing atmospheres. Prereq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5410 Advanced Problems (3) Individual development of techniques and appreciation. Prereq: 9 hrs of art or equivalent; or consent of instructor.

5510 Environmental Factors in Interior Design (3) Human factors and associated research techniques related to design of interior architectural environments. Evaluation of design implications from anatomy, physiology, anthropology, and behavioral sciences. Prereq: 8 hrs behavioral science and 6 hrs natural science or consent of instructor.

5520 Environmental Factors in Interior Design (3) Systematic design methodology as applied to design of microenvironments using human factors information. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5530 Environmental Factors in Interior Design (3) Human factors and systematic design methodology applied to analysis, synthesis, and evaluation of research-oriented interior design projects. Comprehensive design research project by 2- or 3-member teams. Prereq: 8 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5510 Analytical Design (3) Analysis of human factors data in design of group space, task support, and storage furniture pieces and systems; production of construction drawings and scale models. Prereq: Consent of instructor.

5613 Housing Management (3) Role and functions of housing management specialist in problems of private and assisted housing management. Prereq: 4360. 3 hrs related art or equivalent.

5614 Housing Regulations and Controls (3) Functions of regulations and control practices and mechanisms as determinants of nature, availability of housing in local communities by various user groups. Prereq: 4320 or consent of instructor.

5615 Housing Programs and Policies (3) Analysis of private and public programs and policies to promote realization of suitable homes and living environments for families. Economic and social problems relating to national housing objectives. Prereq: 4320 or consent of instructor.

5620 Experimental Methods in Household Equipment (3) Research methods and techniques in determining performance of household equipment. Prereq: 2430 or consent of instructor. 1 hr and 2 labs.

5630 Environmental Requirements for Family Work Centers (3) Trends in planning work center areas such as kitchens and laundries; adequacy of convenience, surface treatment, facilities and costs; problems of installation and remodeling.

5610 Crafts (4) Advanced study in crafts. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 8 hrs.

5820 Interior Design (1-3) Advanced study in interior design. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5830 Problems in Housing (1-3) Advanced study in housing. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5910-20-30 Seminar (1-4, 1-4, 1-4) Hours and credit arranged. Prereq: Consent of instructor.

6110 Contemporary Housing Issues and Problems (3) Individual study and group discussion of various issues and problems related to housing. Prereq: Consent of instructor.

6120 Advanced Topics in Housing Research (3) Various concepts, theories and methodologies of social sciences in housing research. Prereq: Consent of instructor.

6210 Environmental Design Analysis (3) Advanced methodology in psychology of environmental design, multidisciplinary research data and methods. Prereq: 5510-20-30.

6320 Role of Crafts in Society (3) Comprehensive individual and group study of advanced concepts and current problems in crafts. Prereq: 4310, 5040, 6 hrs of graduate level sociology, or consent of instructor.

6410 Conceptual Development in Craft Design (3) Advanced concepts in use of visually perceived design elements as demonstrated in handcrafted objects. Prereq: 5040, 6 hrs of graduate level psychology, or consent of instructor.

6420 Perspectives in Crafts and Interior Design (3) Historical influences related to contemporary concepts in crafts and interior design. Prereq: 5040, 6 hrs of graduate level art history, or consent of instructor.

Courses offered periodically only at the Pitzer Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated.

3211-21-31 Metal Design (1-4, 1-4, 1-4)
3211-21-31 Textile Design (1-4, 1-4, 1-4)
3211-21-31 Wood Design (1-4, 1-4, 1-4)
3271-21-31 Enamelling (1-4, 1-4, 1-4)
4311 Crafts in America (1-4) (Same as 4310.)
4411 Craft Media (1-4) (Same as 4410.)
4421 Leather Design (1-4) (Same as 4420.)
4431 Plastics (1-4) (Same as 4430.)
4511-21-31 Ceramics (1-4, 1-4, 1-4)
4621 Studio Problems in Leather Design (1-4)
4631 Studio Problems in Metal Design (1-4)
4641 Studio Problems in Weaving (1-4)
4651 Studio Problems in Textile Design (1-4)
4661 Studio Problems in Wood Design (1-4)
4671 Studio Problems in Enamelling (1-4)
4681 Studio Problems in Plastics (1-4)
4691 Studio Problems in Ceramics (1-4)
5331 Craft Design (1-4) (Same as 5330.)
5411 Advanced Problems (1-4) (Same as 5410.)
5441-51-61 Metal Design (1-4, 1-4, 1-4) (Same as 5341-51-61.)
5442-52-62 Weaving (1-4, 1-4, 1-4) (Same as 5342-52-62.)
5443-53-63 Textile Design (1-4, 1-4, 1-4) (Same as 5343-53-63.)
5444-55-64 Wood Design (1-4, 1-4, 1-4) (Same as 5344-55-64.)
5445-55-65 Enamelling (1-4, 1-4, 1-4) (Same as 5345-55-65.)
5446-56-66 Plastics (1-4, 1-4, 1-4) (Same as 5346-56-66.)
5447-57-67 Ceramics (1-4, 1-4, 1-4) (Same as 5347-57-67.)
5811-21-31 Problems in Related Art, Crafts and Interior Design (1-4, 1-4, 1-4) (Same as 5810-20-30.)
5911-21-31 Seminar in Related Art, Crafts and Interior Design (1-4, 1-4, 1-4) (Same as 5910-20-30.)

Food Science, Nutrition, and Food Systems Administration

MAJORS

Food Science M.S.
Nutrition M.S.
Food Systems Administration M.S.
Technology Ph.D.

Professors:
R. E. Beauchene (Head), Ph.D. Kansas State; A. M. Campbell, Ph.D. Cornell; G. E. Goertz, Ph.D. Kansas State; M. J. Hitchcock, Ph.D. Wisconsin; L. M. Oland, Ph.D. Wisconsin, D.Sc. Michigan State; J. R. Savage, Ph.D. Wisconsin; J. T. Smith, Ph.D. Missouri; M. A. Smith (Memphis), Ph.D. Tennessee.

Associate Professors:
B. J. Beach, Ph.D. Wisconsin; L. A. Ehrcke, Ph.D. Tennessee; D. W. Hubbard, Dr. P. H. Tulane; D. E. Lyon, M.S. Cornell; M. P. Penfield, Ph.D. Tennessee; M. N. Perry, Ph.D. Tennessee; M. N. Tetrault, M.H. California (Berkeley).

Assistant Professors:
F. E. Andrews, Ph.D. Ohio State; M. D. Brooks (Memphis), M.S. Alabama; G. W. Disney, Ph.D. Tennessee; R. L. Mason, M.S. Tennessee; J. D. Skinner, Ph.D. Oregon State.

Food Science

4000 Origin of Food and Foodways (3) Food origin and development of individual and groups of foods. Prereq: 8 hrs social science or humanities.

4010 Introductory Experimental Food Science (3) Physical and sensory evaluation in experimental cooking with fats, high protein foods, and bitter and doughy systems. Prereq: 3510. 2 hrs and 1 lab.

4020 Experimental Food Science (3) Individual experimentation and its relation to the research literature. Prereq: 4010. Nutrition 3330 recommended. 1 hr and 2 labs.

4040 Food in Contemporary Society (3) Consumer's options, responsibility and potential influence with respect to food supply.

5000 Thesis

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

5140 Foods and Nutrition: Physicochemical Principles (3) Thermodynamics; physical-chemical properties of proteins, carboxydrates and lipids; chemistry of colloidal state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: Nutrition 3330 and Mathematics 1540 or equivalent.

5510 Food Technology (3) Classification of foods according to textural parameters; instrumentation in evaluation of textures. Prereq: 4010 or Food Technology 4920; Plant and Soil Science 3610 or equivalent, or consent of instructor.
Nutrition

3310 Organic Chemistry (4) Emphasis on subjects leading to 3320-30. Textiles and Clothing 3320. Prereq: General Chemistry. 3 hrs and 1 lab. Not for graduate credit for nutrition majors.

3320 Food Analysis (4) Elementary quantitative analysis. Prereq: 3310 or equivalent. 3 hrs and 1 lab. Not for graduate credit for nutrition majors.

3330 Physiological Chemistry (3) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Not for graduate credit for food science, nutrition and food education majors. 3 hrs and 1 lab. Prereq: 3330 or equivalent. Coreq: 3330. 1 lab. Not for graduate credit for nutrition majors.

3350 Community Nutrition (3) Nutrition programs of state and federal agencies; preparation of materials for teachers; extension work. Prereq: Consent of instructor. 3 hrs. 1 lab.

3360 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of in-depth study to be selected in consultation with instructor. Prereq: 3350 and consent of instructor. S/NC only.

5340 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students training at Child Development Center, UT Center for the Health Sciences, Memphis. Prereq: Consent of department head.

5410-20 Human Nutrition (3, 3) Functions of carbohydrates, proteins, fats, minerals and vitamins. Nutritional requirements of man through life span and practical problems in meeting requirements. Prereq: 5410 and 5110.

5430 Physiological Bases for Diets in Disease (3) Developments in dietary treatment of disease in which nutrition plays a major role. Prereq: 5210 or equivalent.


5460 Survey methods in Human Nutrition (3) Food consumption, food practices and nutritional status of population groups. Prereq: 5210 or 5410-20. 2 hrs and 1 lab.

5480 World Food Supply and Human Nutrition (3) Food supplies and food practices as related to human nutrition throughout world. Regional, national and international agencies concerned with food and nutrition problems. Prereq: 5210 or 5410-20.

5470 Nutrition and Aging (3) Nutritional problems of aging individual, nutritional requirements, dietary intakes, and effect of nutrition on rate of biological aging. Prereq: 5210 or consent of instructor.

5610 Nutrition in Mental Retardation and Developmental Disorders (1-12) Interdisciplinary diagnosis and treatment of developmentally handicapped child. Role of nutritionist; clinical experience and lectures at Child Development Center, Center for the Health Sciences, Memphis. Prereq: Consent of department head.

5700 Current Programs and Trends in Nutrition (3, 3) Recent developments in field of nutrition and implications for teachers, extension workers, and dietitians. Prereq: Consent of instructor. May be repeated.

5710 Current Programs and Trends in Food Science (1-3) Recent advances in food science, impact on curricular considerations, and implications for teachers, extension workers, and dietitians. Prereq: Consent of instructor. May be repeated.

5750 Field Experience (3-12) Experience in food-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Science (1-3) Advanced study from field of food science. Prereq: Consent of department head and professor for their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5840 Proteins in Relation to Food Science (3) Physical and chemical characteristics of the proteins of milk, eggs, flour, and meat with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5760 Food Dispensers (3) Physical characteristics of solutions, colloidal dispersions, and suspensions in relation to treatments applied. Prereq: 4010.

5720-190 Structure of Food Plants and Animal Tissues (3, 3) Historical structure of food plants and animal tissues related to physical characteristics and chemical properties of components. Prereq: 5630-40.

5720-190 Food and Sociocultural Change (3, 3) Critical evaluation of factors and interrelations affecting food intake and consumption patterns. Must be taken in sequence. Prereq: 5550 or 5560; or consent of instructor.

6900 Seminar in (1-3) May be repeated. S/NC only.

Nutrition

3310 Organic Chemistry (4) Emphasis on subjects leading to 3320-30. Textiles and Clothing 3320. Prereq: General Chemistry. 3 hrs and 1 lab. Not for graduate credit for nutrition majors.

3320 Food Analysis (4) Elementary quantitative analysis. Prereq: 3310 or equivalent. 3 hrs and 1 lab. Not for graduate credit for nutrition majors.

3330 Physiological Chemistry (3) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Not for graduate credit for food science, nutrition and food education majors. 3 hrs and 1 lab. Prereq: 3330 or equivalent. Coreq: 3330. 1 lab. Not for graduate credit for nutrition majors.

3350 Community Nutrition (3) Nutrition programs of state and federal agencies; preparation of materials for teachers; extension work. Prereq: Consent of instructor. 3 hrs. 1 lab.

3360 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of in-depth study to be selected in consultation with instructor. Prereq: 3350 and consent of instructor. S/NC only.
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Food Systems Administration

4130 Food Systems Administration (3) Functions of management applied to food service systems. Prereq: 3110.

4140 Food Systems Personnel Development (3) Development of training programs for food systems personnel. Prereq: 4130 or consent of instructor.

4150 Design and Layout of Food Service Systems (3) Design of physical facilities and selection and purchasing of equipment for food service systems. Prereq: 3110 or consent of instructor.

4250 Food and Lodging Managerial Cost Control (3) Cost analysis for control. Use of financial statements for decision making for food and lodging systems. Prereq: 4130, Accounting 2130.

4260 Food and Lodging Physical Plant, Planning and Maintenance (4) Feasibility, planning development, and construction of food and lodging physical plant and maintenance. Electrical, mechanical, heating, plumbing, air conditioning and ventilation and illumination systems. Types of building materials and construction. Prereq: 3110, 4150 or consent of instructor. 3 hrs and 1 lab.

4270 Food and Lodging Information Systems (3) Qualitative and quantitative analysis of information systems for decision making in food and lodging operations. Prereq: 4130, 4250, Office Administration 2750.

5000 Thesis

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

5110-20 Experimental Quantity Food Study (3, 3) Analysis of food production, holding environment, and service problems related to quality of food prepared in volume. Management resources. Prereq: 4130, 3110, or consent of instructor.

5210 Methods of Food Systems Research (3) Research methods applicable to food systems administration. Prereq: 4130, Statistics 5211 or equivalent.

5220 Experimental Design of Food System Facilities (3) Environment in which food is prepared, served, and consumed. Prereq: 4150.

5230 Food Systems Evaluation (3) Management resources in food systems. Standards for control. Prereq: 4130, or consent of instructor.


5310 Administration of Food Service Delivery Systems (3) Role and responsibilities of administrator in maintaining desired qualitative and quantitative standards in food service delivery systems. Prereq: 3110 or consent of instructor.

5500 Clinical Training in Health Care Agencies (3) Instructional and supervisory techniques in clinical settings by nurses and dietitians for training of entry-level health care providers. Prereq: Nursing 4760 or 4140 or consent of instructor.

5700 Current Programs and Trends in Food Systems Administration (1-3) Recent advances in food systems administration and implications for directors, school food service directors, and others in related fields. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Systems Administration (1-3) May be repeated.

5850 Field Experience (3-9) Planned administrative experience in food service system. Prereq: Consent of instructor.

5900 Seminar in Food Systems Administration (1-3) May be repeated.

6110 Advanced Topics in Food Systems Administration (3) Comprehensive individual study and group discussion of current problems in food systems administration. Prereq: Consent of instructor.

6210 Manpower Planning and Training for the Food Service Industry (3) Identification of manpower needs by skill levels; preparation for personnel in food service industry. Prereq: 4140, 5210 or consent of instructor.

6310-20 Quantitative Methods to Control Resources in Food Service Systems (3, 3) Interrelationships of resources and evaluation of efficiency and effectiveness in food service systems. Prereq: 5230 or consent of instructor. Taken in sequence. Credit for 8310 contingent upon completion of 6320.

6900 Seminar (1-3) May be repeated. S/NC only.

Home Economics

MAJOR

DEGREE

Ph.D.

Proffessors:

L. M. Good (Dean), Ph.D. Wisconsin, D.Sc. Rhode Island; G. E. Goertz (Associate Dean), Ph.D. Kansas State.

Assistant Professor:

V. S. Anonymous (Assistant Dean), M.S. Tennessee.

5600 Practicum (1-12) Field experience in selected organizations that focus on interdisciplinary solutions to multi-level problems of society. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

5100 International Studies (1-15) Student- or staff-initiated course for study in foreign country of topic(s) pertinent to field. Topic to be determined by student and instructor with department and college approval. May be repeated. Maximum 15 hrs.

5210 History and Philosophy of Home Economics (3) Historical development of home economics; survey of concepts and philosophy of component disciplines and analysis of current programs; emphasis on projection of future developments.

5220 Development of Community Services Programs (3).

5230 Evaluation of Community Services Programs (3) Purposes of evaluation, clarification of objectives and procedures for determining progress.

5600 Home Economics in the Community (3) Role of home economists in community and how interactions among professionals of all community resources facilitate finding solutions for and/or solving problems of individuals, families, and communities related to quality of life. Prereq: Agricultural Economics 4320 or Economics 5340 or Planning 4100 or Child and Family Studies 5700 or consent of instructor.


5800 Problems in Community Services (1-3) Prereq: Consent of professor in charge of investigation. Hrs and credit to be arranged. May be repeated. Maximum 9 hrs.

5900 Seminar in Human Resource Development (1-3) May be repeated. S/NC only.

6000 Doctoral Research and Dissertation

6110-20 Theoretical Issues in Human Resource Development (3, 3) Interdisciplinary approach to development and use of human resources in solution of family and consumer problems. Pre-req: 12 hrs of 5000-level courses representing 2 areas of home economics.

6210 Professional Issues in Human Resource Development (3) Role and philosophy, and administrative issues for human resource development. Prereq: 12 hrs of 5000-level courses representing 2 areas of home economics.

6310 Advanced Topics (3) Comprehensive individual study and group discussion of individual and family behavior, physiological development and well-being, environmental factors, and economic and social well-being. Prereq: 5110. May be repeated.

6500 Methodological Issues in Home Economics (3) Advanced methodology in home economics, interdisciplinary research methods and issues. Prereq: One graduate-level course in research methodology or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

Home Economics Education

Graduate study in home economics education provides for an M.S. in Home Economics Education and opportunity for participation in the Ed.D. program in Vocational-Technical Education in the College of Education. (See page 60 for staff and course offerings.)

Textiles and Clothing

MAJORS

DEGREES

Textiles and Clothing

M.S.

Ph.D.

Professor: A. J. Treece (Head), Ph.D. Ohio State.

Associate Professors: I. M. Ford, Ph.D. Pennsylvania State; B. C. Goswami, Ph.D. Manchester (England); C. J. Noel, Ph.D. Notre Dame.

Faculty Associate: T. L. Vigo, Ph.D. Tulane.

Assistant Professors: C. E. Cox, Ph.D. Tennessee; R. P. Dowlen, M.S. Tennessee; M. F. Drake, Ph.D. Pennsylvania State; L. A. Kocher, Ph.D. California (Davis).

4210 Elementary Textile Microscopy (3) Microscopic techniques as applied to the study of textile fibers and fabrics. Prereq: 4010, 1 hr and 1 lab.

4240 Design Analysis II (3) Interpretation of dress design terminating in finished garments developed through the media of draping.

5000 Thesis

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

5110 Textile Testing and Methods of Research in Textiles (3) Techniques in textile testing and research methodology or consent of instructor.

5130 Advanced Topics (3) Comparison of hand tailoring and trade methods used in making suits, coats, or costumes. 3 labs.

5150 Principles of Design Analysis (3) Application of formal pattern theory to garment design incorporating relationships of fabric geometry, texture, hand, and surface ornamentation to design. Prereq: Consent of instructor. 1 hr and 2 labs.
5160 Review of Literature (3) Intensive survey and evaluation of recent literature; implications for further research.

5170 Social, Psychological and Economic Aspects of Clothing as it relates to human behavior. Prereq: 6 hrs or equivalent from each of following areas: sociology, psychology, economics.

5180 Advanced Textile Economics (3) Economic problems or problem areas of current importance in textile and apparel industries—production, consumption, and governmental policy. Prereq: 3420, 6 hrs economics or consent of instructor.

5210 Evaluation of Instructional Materials in the Field of Textiles and Clothing (3) Evaluating instructional materials in communicating information in various areas of textiles and clothing. 1 hr and 2 labs.

5220 Historic Textiles (3) Development of textile industry in world, fibers used, design, and color.

5240 Practicum (1-9) Off-campus experience with business, industry, governmental agencies and civic groups; preplanned; supervised. Prereq: Consent of major advisor and department head. May be repeated. Maximum 9 hrs. S/NC only.

5250-60-70 Problems in Textile Chemistry (4, 4, 4) Theoretical and experimental study of chemistry of textile fibers including polymerization, reactions, dyeing, and finishing. 5250 must be taken first, 5260 and 5270 need not be taken in sequence. 5250—Emphasis on structure; property relationships and reactions of fibers. 5260—Emphasis on fabric finishes. 5270—Emphasis on dyes and dyeing. Prereq: 3420 or equivalent, 1 qtr organic chemistry. 2 hrs and 2 labs.

5310 Fashion Analysis (3) Fashion as social and economic force; evolutionary theories of fashion operation. Prereq: 6 hrs each of sociology and economics.

5320 Problems in Historic Costume (3) Variable flow of styles in relation to cultural determinants. Prereq: 3480 or consent of instructor. May be repeated. Maximum 9 hrs.

5710-20-30 Current Programs and Trends in Textiles and Clothing (1-3, 1-3, 1-3) Pertinent developments and trends in textiles and/or clothing and implications for new types of programs, techniques, TV and/or curricula approaches. Content and emphasis vary according to changes in field and needs of groups serviced. Prereq: Consent of instructor.

5800 Problems in Textiles and Clothing (1-3) Advanced study selected from field of textiles and clothing. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5900 Seminar in Textiles and Clothing (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6100 Textile Flammability (3) Factors affecting textile flammability as consumer issue. Standards, regulations, test methods, economic impact. Prereq: 5120, 5190, 5250, or consent of instructor.

6170 Physical Performance Behavior of Textile Structures (3) Fundamentals of yarns and fabric structures; relationship of structure to physical characteristics of textile materials. Prereq: 5120, or consent of instructor.

6910 Seminar in Textiles and Clothing (1-3) May be repeated. Maximum 6 hrs.
Aviation Systems

MAJOR
Aviation Systems

DEGREE
M.S.

Lead Professor:
M. A. Wright, Ph.D. Wales.

Professors:
W. W. Frost, Ph.D. Washington; W. F. Jacobs, Ph.D. Goettingen (Germany); A. A. Mason, Ph.D. Tennessee; J. M. Wu, Ph.D. California Institute of Technology; R. L. Young, Ph.D. Northwestern.

Associate Professors:
F. G. Colline, Ph.D. California (Berkeley); R. D. Kimberlin, M.S. Tennessee; J. R. Maus, Ph.D. North Carolina State.

Assistant Professors:
W. B. Baker, Jr., Ph.D. Tennessee; W. J. Boaz, M.S. Florida State; V. K. Smith, III, Ph.D. Georgia Institute of Technology.

The University of Tennessee Space Institute offers a program leading to the Master of Science with a major in Aviation Systems. The Aviation Systems program is designed for those who possess Bachelor's degrees in engineering or science and who wish to study under a "systems philosophy" toward careers in research and development or administration in various phases pertinent to aviation. The program features 18 quarter hours major field credit in various aspects of aviation systems, 6 or more quarter hours credit in each of the areas of research, development and administration, and electives which permit further specialization to either area.

To qualify for admission to this program, the applicant must possess a Bachelor's degree in engineering or science from a recognized institution, show evidence of ability to pursue and benefit from the program, and fulfill the University of Tennessee Graduate School admission procedures and grade point standards. Subject matter prerequisite to the program includes basic knowledge of computer utilization as represented by Computer Science 3150 or equivalent, a background in statistics as represented by Statistics 3450 or equivalent, a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance as represented by Aerospace Engineering 4110 and 4120 or equivalent, a background in accounting as represented by Accounting 5710 or equivalent basic accounting courses, a basic knowledge of economics as represented by introductory economics or equivalent.

Both thesis and non-thesis programs are available for fulfilling the requirements of the program. The thesis program involves satisfactory completion of the following minimum requirements:

1. Eighteen quarter-hour credits in the major field of aviation systems.
2. For the research and development area, 6 quarter hours in Industrial Engineering 5700 and 5710 and for the administration area, 6 quarter hours in Economics 5070 and Accounting 5810, for a total of 12 quarter hours.
3. Six quarter hours of electives selected from the major field, engineering and/or the areas in item 2.
4. Nine quarter hours in Aviation Systems 5000, Thesis, hence demonstrating the ability to conduct and report on an independent investigation.

The non-thesis program will be permitted in special circumstances and involves satisfactory completion of the following minimum requirements:

1. Eighteen quarter-hour credits in the major field of aviation systems.
2. For the research and development area, 9 quarter hours in Industrial Engineering 5700, 5710, and 5720 and for the administration area, 9 quarter hours in Economics 5070, Accounting 5810 and Finance 5510, for a total of 18 quarter hours.
3. Six quarter hours of electives in one of the areas in item 2.
4. Six quarter hours of electives in the major field, engineering and/or the areas of item 2.
5. Satisfactory completion of 3 quarter hours in Aviation Systems 5100, Project in Aviation Systems.
6. Satisfactory completion of a comprehensive final written examination on all course work submitted for the degree and defense of the project course paper.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.

Courses suitable for credit in the major field include: Aerospace Engineering 5810, Aviation Systems—An Overview; Aerospace Engineering 5820, Air Vehicles; Industrial Engineering 5840, Air Traffic Control Systems; Aviation Systems 5070, Airports and The Community; 5080, Collection and Distribution; 5090, Government Policies for Aviation; 5210, Experimental Flight Mechanics, Performance; 5220, Experimental Flight Mechanics, Stability and Control; 5970, Special Topics in Aviation Systems.

Electives typical of those suitable for credit in the area of aviation systems, research and development include: Aerospace Engineering 5150-60-70; Computer Science 3515-20, 4550 and 5655-65-75; Industrial Engineering 4060, 4150, 4230, 5720, 5730, 6700, 6730; Mathematics 4220-30, 4510-20-30; Metallurgical Engineering 5810-20-30; and Statistics 3550.

Electives typical of those suitable for credit in the area of aviation systems, administration include: Accounting 5820; Business Law 5110; Economics 5080; Finance 5100; Industrial Management 5130; Marketing 5100; Transportation 5100, 5130, 5210-20, and 5910.

5000 Thesis

5070 Airports and the Community (3) Structure of airports and their communities. Technology and economics of cargo, baggage, ticket and passenger handling. Airport management, economics and logistics. Interfaces with the community, collection and distribution, demand requirement analyses, types of developments and their projections. Prerequisites: Aerospace Engineering 5810.
5080 Collection and Distribution (3) Capabilities, technology, plans, programs and developments for collecting and distributing passengers and freight to and from various types of airports. Ground, water, air and mixed transportation modes, present and future; requirements analysis, and models and analysis of the system. Prereq: Aerospace Engineering 5810.

5090 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure and administrative and infrastructural procedures. Prereq: Aerospace Engineering 5810.

5100 Project in Aviation Systems (3) In-depth study and formal report on aviation systems topic, normally performed during last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.


5970 Special Topics in Aviation Systems (3) Current problems in aviation systems. Prereq: Consent of instructor. May be repeated with consent. See also course descriptions for Aerospace Engineering 5910, 5920, and Industrial Engineering 5840.

Ecology

MAJOR

Ecology

PHILOSOPHY

J. Frank McCormick, Director, Ph.D. Emory

The Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary ecology for students from undergraduate programs in basic and applied biology, social sciences, mathematics and engineering. Opportunities in both fundamental and applied ecology are intended to prepare students for academic careers as well as professional positions in industry or government. The Environmental Sciences Division of The Oak Ridge National Laboratory and the Tennessee Valley Authority provide advisors and research facilities. The Great Smoky Mountains, Cumberland Plateau, valley and ridge topography, TVA lakes and wild rivers provide locally a spectrum of natural habitats and consequent biological diversity which is truly unique. In this environment, students are encouraged to provide opportunities for student research elsewhere on this continent and abroad.

ADMISSION REQUIREMENTS

Requirements for admission to this program are: (1) admission to the Graduate School; (2) at least 12 hours of college courses with at least 9 quarter hours of college mathematics, and 4 quarter hours of ecology at the upper division level. Candidates for the doctoral degree are expected to take the Graduate Record Examination. Application forms for admission should be obtained from the Graduate School.

Inquiries concerning the admission requirements should be addressed to the Director, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37916.

ADVISORS

Advisors are selected from ecologists in several departments of the University who have competence in the area in which the student expects to work. Entering students should consult early with the Director of the program on the choice of a faculty advisor. The advisor will become the chairman of the student’s faculty committee.

THE MASTER’S PROGRAM

The minimum 45 quarter hours of graduate credit shall include 18 hours of ecology courses (exclusive of thesis), of which 6 hours shall be in Ecology 5210-20-30 and at least 8 additional hours in ecology courses numbered above 5100; 9 hours of thesis in Ecology 5000, and 18 additional hours in ecology or supporting courses. To insure an interdepartmental program, the required minimum 45 hours shall include no more than 18 hours of non-thesis courses from any one department of instruction.

The general requirements for this Master’s degree are listed on page 19. A minor in ecology shall include Ecology 5210-20-30 (6 hours) and at least 3 additional hours in approved ecology courses.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of the Graduate School with the following two exceptions: (1) each student’s faculty committee shall consist of at least two members from the department in which the dissertation is being supervised and at least two from outside this department; (2) this doctoral program must include Ecology 5210-20-30 and at least 9 quarter hours of courses numbered above 5100.

A student cannot enroll for dissertation until the research proposal has been discussed and approved by the doctoral committee.

Shared Faculty


Courses

The following courses are those offered directly by the Ecology Program and those which, although listed in other departments, have been approved to satisfy Master’s degree requirements.

Additional ecology courses are described elsewhere in the catalog under the departments identified in the following list.

Agricultural Biology

1010 Biology of Soil Microorganisms (4)

Agricultural Economics and Rural Sociology

4330 Land Economics (3)

5420 Advanced Land Economics (3)

Anthropology

360 Field Work in Physical Anthropology (3-9)

4640 Zoology and Archaeology (3)

9860 Primate Paleontology (3)

9870 Human Paleontology (4)

9870 Emergence and Early Evolution of Man (3)

Botany

4310 Plant Ecology (4)

5340 Plant Geography (4)

5350 Analysis of Plant Communities (4)

5150-20-30 Systems Ecology (3, 3)

5830 Field Methods in Plant Ecology (4)

6320 Ecosystems of the World (3)

Ecology

5000 Thesis

5100 Special Problems in Ecology (1-3) Individual investigations in ecology. May be repeated with consent of instructor. Maximum 3 hrs.

5210-20-30 Principles of Ecology (2, 2, 2) Theories and problems in ecology. Comparisons between land, freshwater, and marine environment, including humanity’s role in the world’s ecosystems. Must be taken in sequence. Prereq: 4 hrs of ecology at the upper division level.

5310 Ecology for Planners and Engineers (3) Ecological principles and effects that human causes have changed on living organisms. Lectures and field trips. F. Schell, Ph.D. in Graduate School of Planning and Environmental Engineering.

5320 Implementation of Environmental Policy (3) Goals and problems of environmental legislation, especially National Environmental Policy Act; purpose, preparation, and evaluation of environmental policy; cases and similar multidisciplinary studies. Prereq: 2510 or 5310, or Environmental Engineering 4820.

5330 Marine Ecology (4) Relationships of marine organisms to environment and their interactions
with each other. Trophic relationships in neritic, coastal, and estuarine ecosystems; succession; deep-sea ecology; stability. Prereq: One previous ecology course.

5610 Environmental Toxicology (3) (Same as Biochemistry 5610.)

5640 Techniques in Environmental Toxicology (2) (Same as Biochemistry 5640)

6000 Doctoral Research and Dissertation

6100 Special Topics in Ecology (3) Seminars on advanced topics and recent developments in ecology. Prereq: Consent of instructor. May be repeated.

6110 Seminar in Animal Behavior (2)

6120 Seminar in Aquatic Ecology (2)

6130 Seminar in Physiological Ecology (2)

6140 Seminar in Community Ecology (2)

6150 Seminar in Radiation Ecology (2)

6160 Seminar in Systems Ecology (2)

Economics

4260 Economics of Resources and Environmental Policies (3)

Environmental Engineering

4530 Sanitary Engineering Laboratory (3)

4600 Solid Waste Management (3)

4700 Air Pollution-Air Resources Management (3)

5593 Advanced Sanitary Engineering Laboratory (3)

5700 Planning and Air Pollution Control (3)

5710 Air Pollution Control Engineering (3)

Forestry, Wildlife, and Fisheries

4450 Game Mammals (4)

4460 Game Birds (4)

5210 Seminar in Wildlife Conservation (3)

5220 Seminar in Forest Tree Biology (3)

5240 Seminar in Forest Genetics (3)

5460 Predator Ecology (3)

Geography

4720 Data Mapping (4)

4740 Remote Sensing: Types and Applications (4)

5550 Topics in Geography of Land-Surface System (3)

5610 Topics in Climatology (3)

5740 Advanced Topics in Remote Sensing (3)

Geology

4230 Paleocology (4)

4240 Paleobotany (4)

4510 Principles of Geomorphology (4)

5290 Quaternary Problems (4)

5915 Regional Geomorphology (4)

Microbiology

5829 Experimental Microbial Ecology (3)

Nuclear Engineering

5210 System Dynamics (3)

Philosophy

4710 Philosophy of Natural Science (4)

5550-60 Philosophy of Science (4, 4)

6550 Seminar in Philosophy of Science (4)

Plant and Soil Science

4320 Soil Formation, Morphology and Classification (4)

5240 Soil Productivity and Management (3)

5250 Pedology (4)

5810 Crop Climatology (4)

5820 Advanced Crop Physiology and Ecology (4)

Psychology

4900 Aspects of Urban Environment (4) S/NC only.

5750 Ethological Psychology (3)

Sociology

4110 Population Problems (4)

4330 Urban Ecology (4)

5180 Theory and Method of Human Ecology (3)

Zoology

4200 Ichthyology (5)

4240 Animal Ecology (4)

4660-70 Limnology (4, 4)

4700 Arachnology (4)

5570 Animal Populations (3)

5880 Geographic Distribution of Animals (4)

Industrial and Organizational Psychology

MAJOR

Organizational Psychology

DEGREES

M.S., Ph.D.

Committee:

M. E. Gordon (Chairperson); W. H. Calhoun; F. A. Chambin; H. D. Dewhurst; J. M. Larsen, Jr.; J. M. Lounsbury; J. W. Philpot; M. C. Rush; E. D. Sundstrom; G. H. Whittlock.

(For complete Faculty Listing, see Departments of Management and Psychology)

The Master's and doctoral programs are offered jointly by the Department of Psychology and the Department of Management. They are designed to prepare students for personnel, managerial, and organizational research, for university teaching, and for consulting relationships with industry. The emphasis is upon applied research utilizing a thorough theoretical background, including classical and modern organization theory, organizational behavior, psychology, and management. The programs are administered by a joint committee of the two departments appointed by the Vice Chancellor for Graduate Studies and Research on recommendations from the two department heads.

It is intended that students entering the program will represent widely different undergraduate and graduate backgrounds including psychology, business administration, engineering, science, and liberal arts. The first-year program provides the opportunity to take courses which will assist the student to attain a reasonable level of sophistication in areas of deficiency (Psychology 5350-60).

ADMISSION PROCEDURE

Applicants for admission should request forms and materials from both the Graduate Office and the Chairperson, Industrial and Organizational Psychology Program, 419 Stokely Center for Management Studies.

Two separate applications must be completed: one application for admission to the Graduate School and one application for admission to the Industrial and Organizational Psychology program.

Deadline: For fall entrance, all materials should be received by the Vice Chancellor for Graduate Studies and Research no later than March 15 if you wish financial assistantship consideration.

Standards: At least 9 quarter hours of college, mathematics and one course in statistics are required. Ordinarily, an undergraduate grade-point average of 2.5 or above is required, with no evidence of special weakness in mathematics and physical sciences.

Test scores on the Graduate Management Admission Test or on each section of the aptitude portion of the GRE must be reported. Customarily, those students admitted to the Program have performed at or above the 63rd to 65th percentile on each portion of these tests. (This corresponds to a raw score of approximately 500 on each of the tests.) The advanced section for psychology (GRE 81) is required of all applicants regardless of whether their scholastic aptitude is assessed with the GRE or GMAT.

THE MASTER’S PROGRAM

I. Course Requirements

A. Management or Psychology 5170, 5180, 5190 (Proseminar in Industrial and Organizational Psychology).

B. Statistics 5050-60-70 (Behavioral Statistics) and 3 hours of applied psychometrics.

C. Eighteen hours of additional course work to be selected primarily from among the 5000-level course offerings in management and psychology (e.g., Management 5110, 5120, 5230; Psychology 5080 [Current Topics in Applied Psychology]).

D. Nine hours of Psychology or Management 5900 (Master’s Thesis). E. Recommended: Psychology Proseminar.

II. Program Requirements

The Ph.D. program requirements described below in sections II A, II B, and II C comprise the major requirements for a Master’s degree. An oral examination covering the thesis and related topics must also be completed.

THE DOCTORAL PROGRAM

I. Course Requirements

A. Minimum course requirements:

1. Management or Psychology 5170,
By the end of nine quarters a student is expected to choose a major advisor (Chairperson of Doctoral Committee).

F. Completion of an oral examination following the preparation of a doctoral dissertation. This examination covers the field of the doctoral research and related topics, and is to be held at least four weeks prior to the awarding of the degree.

G. Maintenance of at least 3.0 grade point average.

Management Science

MAJOR

Management Science

DEGREE

Management Science

Committee

C. E. Bell (Chairperson), Management Science; R. W. Boiling, Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; R. S. Garfinkel, Management Science; E. Glustoff, Economics; R. E. Rosenenthal, management science; S. Selkow, Computer Science; R. E. Shrieves, Finance; C. C. Thipgen, Statistics.

THE MASTER'S PROGRAM

The M.S. program in Management Science is designed as preparation for a career in the application of quantitative techniques for the solution of management problems in large organizations. The program's flexibility also makes it appropriate as preparation for doctoral study in Management Science.

Management Science course work will expose students to both the theoretical development of quantitative techniques and their application to managerial decision making. In addition to the development of sufficient mathematical maturity for creative use of quantitative skills, the program allows concentrated study in an area of application within the College of Business Administration. With the wide-spread application of scientific methodology, the student may (with the approval of the Management Science Committee) choose an applied concentration in a field outside the College of Business Administration.

Applications are encouraged from all majors, but mathematical background equivalent to the completion of at least two years of college calculus and proficiency in a computer language (e.g., Computer Science 3150) is required. The program is designed to be completed in one calendar year of full-time study, but applications are also encouraged from prospective part-time students.

Course Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Quarter Hours</th>
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</thead>
<tbody>
<tr>
<td>Management Science 5310-20</td>
<td>14</td>
</tr>
<tr>
<td>Applied concentration area</td>
<td>12</td>
</tr>
<tr>
<td>(approved by advisor) Statistics 5110</td>
<td>3</td>
</tr>
<tr>
<td>Statistics elective (5000 level or above)</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics (4000 level or above)</td>
<td>6</td>
</tr>
<tr>
<td>Electives selected from mathematics, statistics, computer science, and/or management science</td>
<td>6</td>
</tr>
<tr>
<td>Electives in any area approved by advisor</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
</tr>
</tbody>
</table>

A thesis option is available which substitutes 9 hours of thesis credit for the following 14 hours of course work: Management Science 5335-40, and one 3-hour course in the applied concentration area and 6 hours of electives in any area. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student's first quarter and must approve all courses on a quarter-by-quarter basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. For example, an undergraduate major in mathematics with strong background may be allowed to take 6 additional hours of electives in place of the mathematics requirement. On the other hand, a student lacking experience in rigorous senior-level mathematics courses will be asked to take such courses to fulfill the 6-hour mathematics requirement. The total course load will remain 50 hours for all non-thesis students and 54 hours for all thesis students; however, the number of hours of electives can be reasonably expected to vary between 6 and 18 as a function of prior background.

Prerequisites for Management Science Courses.

The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose prior course work does not match the prerequisites are encouraged to seek the instructor's guidance and consent to enroll.

For course listings and description of the Ph.D. program in Management Science refer to the Department of Management Science, College of Business Administration.

Water Resources Development

MAJOR

Water Resources Development

DEGREE

M.S.

William F. Brandes, Director, Water Resources Research Center

Specific requirements for admission to this program are a Bachelor's degree in law, engineering, or one of the physical or social sciences from an accredited college or university, and evidence of ability to do work of graduate quality, as ascertained by undergraduate records. Also considered will be a third-year record, if any, and letters of recommendation. The general policies and requirements of the Graduate School apply to this program.

The degree of Master of Science requires 45 quarter hours of graduate study, including 9 hours of thesis work. The exact curriculum of each student is decided in consultation with a faculty committee, depending on the student's prior background and field of interest. If during the undergraduate work the student has, in the opinion of the faculty committee, sufficient training and education in one or
more of the required courses, the student may substitute other elective courses. Electives will consist of advanced work in the student's speciality or in a related field.

3410 Principles of Ground Water Geology (3) (Same as Geology 3410.)

3565 Introduction to Public Administrative Organization and Management (4) (Same as Political Science 3565.)

4110 Managerial Economics (3) (Same as Economics 4110.)

4810 Water Law (3) (Same as Environmental Engineering 4810.)

5000 Thesis

5130 Planning Research Methods I (2) (Same as Planning 5130.)

5160 Planning and Utilities (3) (Same as Environmental Engineering 5160 and Planning 5160.)

5340 Hydrology of Agricultural and Forest Lands (3) (Same as Agricultural Engineering 5340.)

5410-20-30 Interdisciplinary Seminars (3, 3, 3) Problems relating to comprehensive water resource development; flood management, hydroelectric power, navigation, recreation, alternatives in water resource planning, tomorrow in today's planning, project formulation and justification, direct and indirect economic consequences, state and local participation, and municipal and industrial uses of water developments.
INDEPENDENT STUDY

Certain educational goals may best be met through independent study done by an individual under the direction of a faculty member. Students who wish to do such independent work should obtain the approval of the faculty members and the departments concerned prior to embarking upon their study. Credit per quarter will vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

DEPARTMENTS OF INSTRUCTION

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

ANTHROPOLOGY

MAJOR

Anthropology

DEGREES

M.A., Ph.D.

Professors:

W. M. Bass (Head), Ph.D. Pennsylvania;
C. H. Faulkner, Ph.D. Indiana; A. K. Guthe, Ph.D. Michigan; F. W. Parmalee, Ph.D. Texas

Associate Professors:

I. E. Harrison, Ph.D. Syracuse; R. L. Jantz, Ph.D. Kansas.

Assistant Professors:

A. W. Brittain, Ph.D. Pennsylvania State;

The Department of Anthropology offers the Master of Arts and the Doctor of Philosophy degrees with concentrations in physical anthropology, cultural anthropology, archaeology, zooarcheology, and folk culture.

THE MASTER'S PROGRAM

The formal requirements for the Master's degree include:

1. A minimum of three quarters of residence at The University of Tennessee, Knoxville.
2. A minimum of 45 quarter hours for graduate credit, including preparation of thesis. Thirty-six of these 45 hours must be in anthropology. 9 hours may be taken in closely related disciplines (at least one-half of the courses must be at the 5000 level).
4. A thesis. In addition to the two (2) copies required by the Graduate School, one bound copy of the thesis is to be presented to the department and one bound copy to the student's thesis advisor.

THE DOCTORAL PROGRAM

Although there is no minimum credit hour requirement for the Ph.D. degree, students in this program should plan to devote to its attainment no less than 3 years beyond the B.A. level and to complete the following requirements:

1. Admission to Ph.D. program through passing the Graduate Evaluation Examination at completion of first year of study, or through departmental acceptance of a previously earned M.A. degree in Anthropology.
2. Formation of an advisory committee and establishment in consultation with that committee of a program of study. Delineation of field(s) of competence by the student and committee and subsequent presentation to graduate advisor.
3. Demonstration of competence in a foreign language as determined by the student's committee.
4. Successful completion of oral and written comprehensive examinations and admission to candidacy.
5. Successful completion of the dissertation and final oral examination.
3811 Introduction to Museology (3) (Same as Art 3811.)

3900 Human Osteology (4) Intensive examination of the human skeleton. Prereq: 2510 and consent of instructor. 3 hrs and 1 lab.

3920 Principles of Physical Anthropology (3) Survey of materials and methods in physical anthropology. Recommended prereq: 2510.

3930 The Biology of Races of Man (3) Processes of human biological change, racial classification, and relationships among existing stocks; influence of biology and culture in race formation; analysis of studies of racial and ethnic groups, race mixture, constitution growth and nutrition. Recommended prereq: 2510.

3950 Human Identification (3) Introduction to techniques in identification of human skeletal material.

4110 Education in Cultural Perspective (3) (Same as Curriculum and Instruction 4110.)

4111 Non-Western Education: Anthropological Approaches (3) Analysis of traditional educational practices among non-Western peoples and problems encountered from application of Western models of education among those peoples. Particular attention is paid to American Indians, African tribal groups and Asian cultures. (Same as Curriculum and Instruction 4111.)

4200 Contemporary North American Indian (3) Survey of Indian cultures from initial Euro-American contact. Emphasis on cultural change, U.S. Government Indian policy, reservation life. Prereq: 2530 or consent of instructor.

4210 Ethnographic Research Techniques (3) Methods of collecting, ordering, and utilizing data. Prereq: Consent of Instructor.

4240 Applied Cultural Anthropology (3) Applications of anthropological theory, methods and findings in programs of community and national development, public health, international aid, and military assistance. Examination of the roles of anthropologists, questions of values and ethics in international exchange, and of organizational planned changes in applied programs. Intensive analysis of selected case studies. Prereq: 2530.

4250 Medical Anthropology: Lecture (3) A survey of medical anthropology. Emphasis on Western and non-Western cultural aspects of health, disease, treatment, death, and related concepts. Focus on analyzed and descriptions of anthropological fieldwork.

4259 Medical Anthropology: Laboratory (3) Fieldwork in medical anthropology. Emphasis on cultural aspects of health, disease, and death in industrial societies and folk medicine systems which coexist with Western, technical medicine. Coreq or prereq: 4250.

4300 Readings in Anthropology (1-3) Intensive reading, study, and discussion of current debates, research directions, theories, and urban problems. Prereq: 3450 or consent of instructor.

4340 Field Work in Archaeology (3-9) Practicum work surveying, excavating, processing, and analyzing of data, intensive reading. Prereq: 2510-20-30 and consent of instructor. May be repeated. Maximum 9 hrs.

4360 Field Work in Physical Anthropology (3-9) Practicum in collection and analysis of human biological data. May include either skeletal or living populations. Prereq: 2510-20-30 and consent of instructor. May be repeated. Maximum 9 hrs.

4400 Cultural Ecology (3) Survey of concepts and methods for describing and explaining the interrelation between cultures and their environments. Topics include ecological theory, methods of analysis, and application to prehistoric case studies. Prereq: 2520, 2530, 3410 or consent of instructor.

4420 Dynamics of Culture (3) Culture change: innovation, diffusion and acculturation; cultural continuity and stability. Prereq: 2530 or consent of instructor.


4440 Urban Anthropology (3) Survey of theoretical and methodological issues anthropologists encounter researching cross-cultural urban settlements. Focus is on anthropological perspective and urban problems and planning. Prereq: 3450 or consent of instructor.

4480 Current Trends in Anthropology (3) Analytical integrative review in symposium of the current debates, research directions, theories, fieldwork methods, and current issues of the four subfields of anthropology: archaeology, physical anthropology, linguistics, and cultural anthropology.

4490 Cross-Cultural Survey of Sex Roles and Behavior (3) Examination of sex roles and sex behavior from cross-cultural and diachronic viewpoints. Draws disparate and scattered together and attempts to arrive at conclusions on questions as how sex roles are learned, the parameters of acceptable sexual behavior and degrees of tolerance for sexual deviation in various cultures.

4510 Peoples of China II: Chinese Society After 1839 (3) Anthropological survey of Chinese society and culture in the period of intense Western contact, rejection of the West, and development of modern industrial societies and folk medicine systems. Prereq: 2530 or consent of instructor. Recommended: 4500 or an East Asian course.

4550 Indians of the Southeastern United States (3) Survey of Southeastern Indian cultures; emphasis on indigenous tribal groups and Asian cultures. (Same as Curriculum and Instruction 4111.)

4550 Indians of the Southeastern United States (3) Survey of Southeastern Indian cultures; emphasis on indigenous tribal groups and Asian cultures. (Same as Curriculum and Instruction 4111.)

4560 Cherokee Ethnology (3) Intensive survey of ideology and material aspects of Cherokee culture existing at time of first contact.

4570 Peoples of Southeast Asia (3) Survey of representative ethnic groups and indigenous cultures of mainland and island Southeast Asia. Prereq: 2530, 3540 or consent of instructor.

4580 Asians in the Americas Since 1600: Anthropological Perspectives (3) Character, factors, and motivations in Asian immigration to North, Central and South America. Assimilation pattern and enclave communities are major topics. Major emphasis is on United States.

4590 Peoples of Japan (3) Analysis of the cultural diversity and unity of peoples of Japan. Prereq: 2530 or consent of instructor. Recommended: 3610 or an East Asian course.

4600 Method and Theory in American Archaeology (3) Historical development of New World archaeology with emphasis on theory and field techniques. Prereq: 2520 or consent of instructor.

4610 African Prehistory (3) Survey of cultural history in Africa, south of the Sahara, from earliest evidence of human activity to time of European contact. Prereq: 2520 or consent of instructor.

4640 Zootaphology (3) Basic osteological studies of vertebrate classes; emphasis on aboriginal man's utilization of native animals in his subsistence and culture. Identification, analysis, and interpretation of archaeologically derived molluscan and vertebrate remains.

4650 Archaeology of Southeastern United States (3) Intensive study of prehistoric American Indian. Special emphasis on Tennessee prehistory. Prereq: 3610 or consent of instructor.

4660 Prehistory of Northwest North America (3) Survey of archaeological research and prehistoric cultures in Northern Great Basin, Columbia Plateau, Northwest Plains; and Northwest Coast. Recommended prereq: 2520.

4720 American Folklore (3) Anthropological perspectives on folklore of geographical regions
and ethnic groups of the United States. Prereq: 3700 or consent of instructor.

4740 Southern Appalachian Folk Culture (4) Research-oriented course dealing with wide range of traditional culture in Southern Appalachia: settlement patterns, folk housing, economic pursuits, music, dance, and oral traditions and customs. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

4750 Mexican Folklore (3) Anthropological perspectives on folklore of Mexico and Spanish-speaking Southwestern United States. Prereq: 3700 or consent of instructor and a reading knowledge of Spanish.

4870 Cherokee Language (3) Linguistic survey of structure of the Cherokee language.

4930 Physical Growth and Constitution (3) Comparative growth patterns throughout the life cycle of man, skeletal and dental maturation; sex differences in growth; human constitutional types. Prereq: 2510 or consent of instructor. Strongly recommended: Biology 2110.

4950 Primate Studies (3) Survey of field and laboratory investigations of comparative anatomy and behavior of nonhuman primates. Prereq: 2510 or consent of instructor.


4975 Human Paleontology Laboratory (1) Detailed examination of casts and other materials pertinent to study of human paleontology. Prereq or coreq: 4970.

5000 Thesis

5100 Graduate Research (1-9) Independent investigation of special problems in anthropology.

5100 Seminar in Cultural Anthropology (3-9)

5101 Foreign Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5103 Independent Study (1-12) See page 100.

5140 Seminar in Zooarchaeology (3) Approaches to analysis and interpretation of archaeological faunal. Intensive reading; evaluation and discussion of articles, texbooks, guides to identification, methods of presenting faunal data. May be repeated. Maximum 6 hrs.

5149 Laboratory Studies of the Vertebrate Skeleton (4) Examination and comparison of skeletons of major groups of fish, amphibians, reptiles, birds, mammals. Oriented toward identification of archaeologically derived faunas. May be repeated. Maximum 6 hrs.

5150 Laboratory Studies of the Molluscs (4) Examination and identification of terrestrial and freshwater molluscs of eastern U.S. Emphasis on living and archaeologically derived pelecypods. Prereq: 4640. 1 hr and 3 labs.

5160 Seminar in Archaeology (3-9) Theoretical and practical issues central to contemporary anthropological research. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5200 Special Topics in Anthropology (3) Lecture and/or seminar course for advanced students on selected topic of current interest to field of anthropology as a whole. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5210 Community Anthropology: The Local Community (3) Local social, political, and economic issues, researcher models and research methods on local community. Prereq: 4440 or consent of instructor.

5340 Fieldwork in Archaeology (3-9) Practicum work surveying, excavating, processing, and analyzing of archaeological materials. Prereq: 9 hours of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

5400 History of Anthropological Theory (3) Theoretical contributions of more influential anthropologists. Prereq: Consent of instructor.

5440 Peasant Societies (3) Critical analysis of existing literature and theories regarding rural-urban polarities, and different cultural manifestations of agrarian populations. Prereq: Consent of Instructor.

5450 Comparative Social Organization (3) Social structure in nonliterate societies. Kinship, age, sex, locality, and other factors in determining relations between individuals and groups. Prereq: At least one area course.

5460 Quantitative Methods in Anthropology (3) Application of quantitative methods to anthropological data. Correlation and derivative procedures, distance analysis, discriminant analysis, and implementation of computer routines. Prereq: Statistics 2100 or equivalent.

5470 The Healer in Cross-cultural Perspective (3) Graduate seminar dealing with socialization, methods of diagnosis, and therapeutic modes of healers in non-Western, non-Euro-American milieu. Prereq: 4250.

5600 Theory in Archaeology (3) Review of development of archaeological theory. Coverage up to and including recent systems approaches.


5620 Problems in Old World Archaeology (3) Selected topics and research problems in European, African, and/or Asian prehistory. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. (Same as Classics 5620.)

5639 The Maya (3) Intensive survey of Mayan culture of Yucatan and Guatemala. Prereq: 3, 3) Seminar is offered each quarter primarily for doctoral candidates. Prereq: Consent of instructor.

5640 Archaeological Resource Management (3) Theory and practice—public, conservation, contract, and salvage research archaeology. Legislation, contracts, responsibilities, and certification; agencies and policies; project design, implementation, and monitoring; fieldwork, analysis and publication; archaeology and public; conservation archaeology as career. May be repeated. Maximum 6 hrs.

5660 Seminar in Prehistoric Lithic Technology (3) Analysis of techniques employed in production of prehistoric stone industries; raw materials; raw materials utilized; techniques employed. Prereq: Consent of instructor.


5900 Dental Anthropology (3) Dental anatomy, theories of dental evolution, genetic and environmental influences on the shape of dental morphology, comparative primate dental morphology, dental trait analyses, use of dentition for skeletal analysis, and dental disease. Prereq: Consent of instructor.

5910 Measurement of Man (3) Techniques of measuring and describing skeletal material and human subject with emphasis upon practical applications to skeletal anthropometry, human engineering. Prereq: Consent of instructor.

5920 Advanced Physical Anthropology (3) intensive investigation of theory and problems in physical anthropology.

5930 The Human Skeleton in Forensic Medicine (3) Application of physical anthropology to problems in human identification. Determination of age, race and sex of skeleton and preparation of reports for legal medicine. Prereq: 3900.

5940 Skeletal Biology of Early Human Populations (3) Practical and theoretical approaches to analysis of prehistoric human skeletal populations. Demography, vital statistics, pathology, nutrition, and measures of biological relationships as they relate to population as adaptive unit. Prereq: 3900.

5950 Comparative Primate Anatomy (4) Laboratory-oriented course dealing with comparative anatomy of primates. Musculoskeletal system and evolution of various primate adaptive patterns. Prereq: Osteology and one dissection course in zoology.

5950 Paleopathology (4) Identification and descriptive analysis of pathological conditions affecting human skeletal remains. Survey of the literature on the pathological, historical, and gross visual examination of skeletal material. Prereq: 3900 and/or consent of instructor. Lecture and lab.

5960 Dermatoglyphics (3) Methods of dermatoglyphic analysis; genetics and population variation of various dermatoglyphic elements; forensic applications; relationships to various genetic and chromosomal abnormalities. Prereq: Consent of instructor.

5970 Emergence and Early Evolution of Man (3) Ancestry and evolutionary significance of Australopithecines. Prereq: 4970 or consent of instructor.

5980 Neanderthal Man and Human Evolution (3) Morphology, distribution and evolutionary relationships of Neanderthals. Prereq: 4970 or consent of instructor.

5990 Human Variation (3) Nature of human biological variation with emphasis on microevolutionary processes responsible for establishing and maintaining genetic and phenotypic diversity. Prereq: 4970 or consent of instructor.

6000 Doctoral Research and Dissertation

6410-25 Seminar in Cultural Anthropology (3, 3, 3) Seminar is offered each quarter primarily for doctoral candidates. Prereq: Consent of instructor.

6610 Selected Topics in Archaeology (3) May be repeated. Maximum 9 hrs.

6910 Selected Topics in Physical Anthropology (3) May be repeated. Maximum 9 hrs.

7970 Seminar in Human Paleontology (3) Prereq: 4970 or consent of instructor.

Archaeology—Greek and Roman

See Classics
Art

MAJOR

DEGREE

Art

M.A., M.F.A.


The Art Department offers two graduate degrees, Master of Arts and Master of Fine Arts. In order to become a candidate, the applicant must be admitted by the Graduate School and approved by the Department of Art. In addition to the admission requirements of the Graduate School, the Department of Art specifically requires the following:

1. A detailed letter of intent.
2. Three letters of recommendation from former professors or professionals in the field.
3. An undergraduate major in art or evidence of equivalent proficiency.
4. A portfolio to be evaluated by the faculty.
5. Application forms and further information are available by writing to the Department of Art.

MASTER OF ARTS

Areas of concentration consist of painting, communication design, printmaking, and sculpture. One year of residence is required.

Quarter Curriculum:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Area of Concentration</th>
<th>Art History</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

The thesis is a critical essay relevant to the area of concentration. The M.A. thesis may not be used to fulfill the project in lieu of thesis requirements for the M.F.A. A graduate exhibition is required. Final examination is oral.

MASTER OF FINE ARTS

The Master of Fine Arts is the terminal degree in studio art. It is offered with concentrations in: communication design, drawing, painting, printmaking, sculpture, and airbrush. Inter-area concentrations are available with permission of the faculty.

Six quarters beyond the baccalaureate degree are required in residence. Residence is defined by the Department of Art as (1) a minimum enrollment of 6 hours per quarter, and (2) use of Department of Art facilities so that discussion and criticism is available to students. Final examinations are oral, concurrent with project exhibition.

Curriculum:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Project in Lieu of Thesis</th>
<th>Major</th>
<th>Electives</th>
<th>Seminar in Art Criticism</th>
<th>Seminar in Art History</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
<td>12</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>90</td>
</tr>
</tbody>
</table>

DEGREE REQUIREMENTS FOR M.F.A.

1. Successful completion of 30 hours of studio in concentration. Inter-area studies must normally be approved by the faculty no later than the third quarter in residence. Fifteen hours of the major must be in second year courses (5155, 5255, 5355, etc.).

2. Twelve hours of art history for graduate credit.

3. Seminar in Art History (4 hours) and Seminar in Art Criticism (4 hours).

4. Ten hours of electives which may consist of any committee-approved combination of graduate credit courses outside the student's departmental concentration.

5. First year evaluation: At the end of the first three quarters in residence the student must present work for evaluation by the faculty and receive permission to continue in the program.

6. Second year evaluation: With completion of all course work the student must present work for evaluation by the faculty and receive permission to register for Projects in Lieu of Thesis (Art 5999).

7. Art 5999, Projects in Lieu of Thesis (30 hours) is a third year of semi-independent study.

8. Exhibition and oral examination: With the completion of all requirements for the M.F.A., the student must produce an exhibition, and, in the presence of the work, must satisfactorily complete an oral examination.

GRADUATE MINOR IN THE HISTORY OF ART

A graduate minor in Art History may be arranged with the consent of the student's committee, the instructors involved, and the Graduate School.

Prerequisite is an undergraduate Art History minor, or its equivalent, and reading knowledge of French, German, or Italian, unless waived by the art history faculty.

3516 TYPOGRAPHY (4) Theories and techniques of typography and printing as a fine art medium. May be repeated. Maximum 12 hrs.

3517 AIRBRUSH (4) Techniques and creative applications. May be repeated. Maximum 8 hrs. For art majors only.


3705 Northern European Painting: 1350-1600 (4) Painting and printmaking of low countries, France, Germany, and England. Includes inter-

national style manuscripts, Van Eyck, Bosch, Durer, Holbein, and Bruegel.

3715 Early Italian Renaissance Art: 1300-1550 (4) Painting, sculpture, graphic art. Includes Giotto, Masaccio, Donatello, Brunelleschi, Alberti, Botticelli, and Leonardo.


3725 Art of Southern Europe and New World in Seventeenth and Eighteenth Centuries (4) Emphasis on El Greco, Caravaggio, Titian, Velazquez, Bernini, Tiepolo, Goya, artistic relations between Iberia and Latin America, and the urban development of Rome.

3726 Art of Northern Europe in Seventeenth and Eighteenth Centuries (4) Emphasis on Rembrandt, Vermeer, Hals, Rubens, Poussin, Callot, Georges de La Tour, naturalism, emphasis on development of Paris and London, and pilgrimage churches of Southern Germany.

3735 History of Nineteenth-century Painting in Europe and America (4) Fauvism, Die Brücke, Cubism, Surrealist painting, Futurism, Dada and Surrealism, geometric abstraction, social commentary painting, Abstract Expressionism in the U.S.A. and parallels in Europe; Pop, Op, Minimal, and Concept Art.


3746 History of Modern Sculpture in Europe and America (4) From 1800 to 1900: Neoclassicism to Cubism, Constructivism, Expressionism, Assemblage, Pop, Primary Forms, Environments, and Earthworks.

3756 History of North American Art (4) Survey of Indian, Eskimo, and Inuit art, with consideration of art of Central Asia and Southeast Asia.

3776 Chinese Art (4)

3777 Japanese Art (4)

3811 Introduction to Museology (5) Concepts, practices and historical development of museums of art, archaeology, anthropology and science. (Same as Anthropology 3811.)

3835 Film Design (4) Theory and practice of film making. Prereq: 2935.

4015 Individual Problems (4) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

4106 Special Topics in Drawing (4) Student- or instructor-initiated course offered at convenience of Department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.

4115 Drawing IV (4) Prereq: 12 hrs of 3115. May be repeated. Maximum 12 hrs.

4206 Special Topics in Painting (4) Student- or instructor-initiated course offered at convenience of Department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.
ence of department. Prereq: Determined by department. May be repeated. Maximum 18 hrs.

4215 Painting IV (4) Prereq: Consent of Instructor. May be repeated. Maximum 12 hrs.

4315 Watercolor IV (4) Prereq: Consent of Instructor. May be repeated. Maximum 12 hrs.

4406 Special Topics in Sculpture (4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 20 hrs.

4415 Sculpture IV (4) May be repeated. Maximum 12 hrs.

4506 Special Topics in Communication Design (4) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 16 hrs.

4510 and a conference with the student's advisor.

5103 Independent Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5000 Thesis Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty when such a student uses university facilities and/or faculty

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

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

5101 Foreign Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5103 Independent Study (1-12) See page 100.

5115 Graduate Drawing I (2-6) May be repeated. Maximum 18 hrs.

*5155 Graduate Drawing II (2-6) May be repeated. Maximum 18 hrs.

5215 Graduate Painting I (2-6) May be repeated. Maximum 18 hrs.

*5255 Graduate Painting II (2-6) May be repeated. Maximum 18 hrs.

5315 Graduate Watercolor I (2-6) May be repeated. Maximum 18 hrs.

*5355 Graduate Watercolor II (2-6) May be repeated. Maximum 18 hrs.

5415 Graduate Sculpture I (2-8) May be repeated. Maximum 18 hrs.

*5455 Graduate Sculpture II (2-8) May be repeated. Maximum 18 hrs.

5515 Graduate Communication Design I (2-6) May be repeated. Maximum 18 hrs.

*5555 Graduate Communication Design II (2-6) May be repeated. Maximum 18 hrs.

5615 Graduate Printmaking-Lithography I (2-6) May be repeated. Maximum 18 hrs.

5616 Graduate Printmaking-Intaglio I (2-6) May be repeated. Maximum 18 hrs.

5617 Graduate Printmaking-Screen Printing I (2-6) May be repeated. Maximum 18 hrs.

*5655 Graduate Printmaking-Lithography II (2-6) May be repeated. Maximum 19 hrs.

*5665 Graduate Printmaking-Intaglio II (2-6) Individual problems with etching and engraving. May be repeated. Maximum 18 hrs.

*5675 Graduate Printmaking-Screen Printing II (2-6) May be repeated. Maximum 18 hrs.

7770 Seminar in Art History (4)

9900 Seminar in Art Criticism (4) Theory and practice. Intended for majors in studio art.

9955 Reading and Research in Art History (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5999 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by the graduate faculty. May be repeated. May be repeated. May be repeated. May be repeated.

"Graduate II courses must be preceded by successful first year evaluation by the faculty."
Speech and Hearing Science will include:
1. Successful completion of course work in the study of one or more research tools, or other specific scientific methodological vehicles pertinent to the research interests of the candidate. The choice of research tool(s) is subject to departmental approval.
2. A minimum of 9 quarter hours of graduate credit obtained in course work in a cognate field outside the Department of Audiology and Speech Pathology. These hours are in addition to those required in item 1 above.
3. Sufficient course work within the department but outside the area of specialization to give a broad foundation and understanding. A comprehensive examination to demonstrate a general knowledge of the bases of audiology, speech and language pathology, and speech and hearing science; advanced knowledge of the specifics of the area of specialization.
4. Research and dissertation to give at least 38 hours of graduate credit (6000 level).
5. A final oral examination.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>4040</td>
<td>Appraisal of Speech and Language Disorders (4)</td>
<td>Diagnostic procedures for children and adults and analysis of language problems including observation and practice with diagnostic tests. Prereq: 3050. (Same as Special Education 4040.)</td>
</tr>
<tr>
<td>4070</td>
<td>Free Association (4)</td>
<td>Oral and written free association as process for diagnosing and treating communication disorders. Includes didactic self-analysis.</td>
</tr>
<tr>
<td>4190</td>
<td>Speech Development of the Hearing Impaired (3)</td>
<td>(Same as Special Education 4190.)</td>
</tr>
<tr>
<td>4200</td>
<td>Practicum in Speech Development of the Hearing Impaired (3)</td>
<td>(Same as Special Education 4200.)</td>
</tr>
<tr>
<td>4210-20</td>
<td>Language Development of the Hearing Impaired I, II (3, 3)</td>
<td>(Same as Special Education 4210-20.)</td>
</tr>
<tr>
<td>4250</td>
<td>Introduction to the Psychology and Education of the Hearing Impaired (3)</td>
<td>(Same as Special Education 4310.)</td>
</tr>
<tr>
<td>4310</td>
<td>Stuttering (3)</td>
<td>Nature and treatment. Review and integration of various theories. (Same as Special Education 4310.)</td>
</tr>
<tr>
<td>4320</td>
<td>Clinical Practice in Speech Pathology (1-6)</td>
<td>Prereq: 3040, 3050, 3310, 4040, and consent of instructor. (Same as Special Education 4320.) S/NC only.</td>
</tr>
<tr>
<td>4330</td>
<td>Clinical Practice in Speech Pathology (1-6)</td>
<td>Prereq: 4320 and consent of instructor. (Same as Special Education 4330.) S/NC only.</td>
</tr>
<tr>
<td>4340</td>
<td>Clinical Practice in Speech Pathology (1-6)</td>
<td>Prereq: 4330 and consent of instructor. (Same as Special Education 4340.) Preq: 4330 and consent of instructor. (Same as Special Education 4340.) May be repeated. S/NC only.</td>
</tr>
<tr>
<td>4400</td>
<td>Voice Disorders (4)</td>
<td>Etiology, diagnosis, and treatment of organic and functional voice disorders. Prereq: 3050. (Same as Special Education 4400.)</td>
</tr>
<tr>
<td>4450</td>
<td>Clinical Practice in Audiology (1-6)</td>
<td>Prereq: 4720, 4930, or 4840. (Same as Special Education 4450.) S/NC only.</td>
</tr>
<tr>
<td>4460</td>
<td>Clinical Practice in Audiology (1-6)</td>
<td>Prereq: 4450. (Same as Special Education 4460.) S/NC only.</td>
</tr>
<tr>
<td>4470</td>
<td>Clinical Practice in Audiology (1-6)</td>
<td>Prereq: 4460. (Same as Special Education 4470.) S/NC only.</td>
</tr>
<tr>
<td>4520</td>
<td>Speech Pathology (3)</td>
<td>Independent study of special problems in speech pathology. Prereq: Consent of instructor.</td>
</tr>
<tr>
<td>4550</td>
<td>Problems in Speech Pathology (1-6)</td>
<td>Prereq: Consent of instructor.</td>
</tr>
<tr>
<td>4560</td>
<td>Problems in Audiology (1-6)</td>
<td>Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.</td>
</tr>
<tr>
<td>4620</td>
<td>Birth Defect Syndromes and Language Retardation (3)</td>
<td>Examination of research literature relevant to birth defects and language retardation including clinical, educational and sociopolitical implications of such disorders. Prereq: 4610 or consent of instructor.</td>
</tr>
<tr>
<td>4830</td>
<td>Practical Applications of Language Habilitation Techniques (3)</td>
<td>Discussion and demonstration of various methods and procedures used in treating language retarded children. Prereq: 4610 or consent of instructor.</td>
</tr>
<tr>
<td>4640</td>
<td>Parent Participation in Language Habilitation Programs (3)</td>
<td>Nature of counseling and educational relationships with parents of exceptional children including emotional support for families, home management strategies, home training methods. Prereq: 4610 or consent of instructor.</td>
</tr>
<tr>
<td>4650</td>
<td>Speech and Language of the Culturally Different Child (3)</td>
<td>Differences of speech and language differences of children of various minority groups, of different ethnic and class membership and from different geographic regions; their causes, and their effects upon educational programs.</td>
</tr>
<tr>
<td>4660</td>
<td>Topics in Language Retardation and Its Habilitation (3)</td>
<td>Lectures on selected topics by representatives of such fields as speech pathology, educational psychology, genetics, and psychology. Prereq: 4610 or consent of instructor.</td>
</tr>
<tr>
<td>4700</td>
<td>Audiology for Educators of the Deaf (4)</td>
<td>Fundamental aspects of hearing, including physics of sound, anatomy and physiology of the ear, etiology and rehabilitation of hearing loss and basic audiometric techniques. May not be used to satisfy requirements of major in Audiology and Speech Pathology.</td>
</tr>
<tr>
<td>4720</td>
<td>Audiology II (4)</td>
<td>Etiology and rehabilitation of hearing loss including pediatric and geriatric aspects, medical treatment and diagnostic audiometry. Prereq: 4710 or 4700. (Same as Special Education 4720.)</td>
</tr>
<tr>
<td>4750</td>
<td>Noise in the Environment (3)</td>
<td>Discussion of extent to which noise problem exists, introduction to measures of noise, basic techniques in sound and vibration abatement, acoustical factors, and physiological concomitants in noise stimulation. Knowledge of acoustics is advisable.</td>
</tr>
<tr>
<td>4760</td>
<td>Introduction to Hearing Conservation (4)</td>
<td>Roles of noise-hazard evaluation, medical monitoring, health education, hearing protective devices, administrative controls, and acoustical engineering controls in hearing conservation. Prereq: 3710; Coreq: 4720.</td>
</tr>
<tr>
<td>4830</td>
<td>Aural Rehabilitation: Speechreading and Auditory Training (4)</td>
<td>Speechreading as a receptive language process and development of maximum use of residual hearing in acoustically handicapped as Special Education 4830.</td>
</tr>
<tr>
<td>4840</td>
<td>Advanced Aural Rehabilitation (4)</td>
<td>Prereq: 3710 or 4700. Recommended prereq: 4930 and 3050. (Same as Special Education 4840.)</td>
</tr>
<tr>
<td>5000</td>
<td>Thesis</td>
<td></td>
</tr>
<tr>
<td>5002</td>
<td>Non-Thesis Graduation Completion (3-19)</td>
<td>Required for the non-thesis student not otherwise required during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward these requirements. May be repeated. S/NC only.</td>
</tr>
<tr>
<td>5040</td>
<td>Advanced Clinical Practice in Audiology Study and Practice (1-6)</td>
<td>Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. (Same as Special Education 5040.) S/NC only.</td>
</tr>
<tr>
<td>5045</td>
<td>Practicum in Hearing Aid Orientation and Communication Counseling (1-6)</td>
<td>Practical experience in the diagnosis of hearing aid cases and in the counseling of patients and their families concerned with hearing aids. Prereq: 4720. May be repeated. Maximum 9 hrs. S/NC only.</td>
</tr>
<tr>
<td>5050</td>
<td>Practicum in Aural Habilitation (1-6)</td>
<td>Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.</td>
</tr>
<tr>
<td>5051</td>
<td>Practicum in Aural Rehabilitation (1-6)</td>
<td>Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.</td>
</tr>
<tr>
<td>5060</td>
<td>Anatomy and Physiology of Speech (3)</td>
<td>Structure and function of neuromuscular system involved in breathing, phonation, respiration, and articulation. Prereq: 3065.</td>
</tr>
<tr>
<td>5070</td>
<td>Anatomy and Physiology of Hearing (3)</td>
<td>Structure of human ear, pathology of hearing impairment, and psychoacoustics of audition. Prereq: 3710.</td>
</tr>
<tr>
<td>5071</td>
<td>Physiological Acoustics (3)</td>
<td>Techniques for electrophysiological measurement of auditory sensitivity, sound transmission by ear, distality in ear, and ear as analytic mechanism. Prereq: 3710, 4720, 3065, or consent of instructor.</td>
</tr>
<tr>
<td>5100</td>
<td>Comparative Anatomy of the Peripheral Auditory Structures (3)</td>
<td>Tutorial laboratory course in comparative anatomy of temporal bone employing microscopic dissection techniques. Prereq: 5070 or consent of instructor.</td>
</tr>
<tr>
<td>5110</td>
<td>Introduction to Research in Speech and Hearing (3)</td>
<td>Analysis of research techniques, application of statistics, and completion of pilot research project.</td>
</tr>
<tr>
<td>5117</td>
<td>Instrumentation in Audiology and Speech Pathology (2)</td>
<td>Principles of instrumentation used in audiology and speech pathology. Prereq: 3010.</td>
</tr>
<tr>
<td>5119</td>
<td>Laboratory in Instrumentation in Audiology and Speech Pathology (1)</td>
<td>Laboratory assignments designed to familiarize student with instruments for measuring speech and hearing processes. Prereq: 5117.</td>
</tr>
<tr>
<td>5200</td>
<td>Seminar on Stuttering (3)</td>
<td>Current significant research in stuttering. Prereq: 4310 or consent of instructor.</td>
</tr>
<tr>
<td>5201</td>
<td>Aphasia (3)</td>
<td>Historical review of aphasia literature; theories of brain functioning, aphasic classification and diagnosis, and the rationale and competence of testing, etiology, therapy considerations and prognosis for recovery. Prereq: 5060 or equivalent or consent of instructor.</td>
</tr>
<tr>
<td>5250-52-60</td>
<td>Advanced Clinical Practice in Speech Disorders (1-6, 1-6, 1-6)</td>
<td>Prereq: Consent of instructor. Maximum 9 hrs.</td>
</tr>
<tr>
<td>5250-60-70</td>
<td>Advanced Clinical Practice in Speech Disorders (1-6, 1-6, 1-6)</td>
<td>Prereq: 4040, 4540 or equivalent. Maximum 9 hrs.</td>
</tr>
<tr>
<td>5320-30-40</td>
<td>Advanced Clinical Practice in Speech Disorders (1-6, 1-6, 1-6)</td>
<td>Consent of instructor.</td>
</tr>
<tr>
<td>5350-60-70</td>
<td>Advanced Clinical Practice in Speech Disorders (1-6, 1-6, 1-6)</td>
<td>Consent of instructor.</td>
</tr>
<tr>
<td>5380</td>
<td>Cerebral Palsy (3)</td>
<td>Etiology, diagnosis, and clinical management of cerebral palsy. Prereq: 3310. (Same as Special Education 5380.)</td>
</tr>
<tr>
<td>5390</td>
<td>Cleft Palate (3)</td>
<td>Etiology, diagnosis, and clinical management of cleft palate speakers, emphasis on speech. Prereq: 3310. (Same as Special Education 5390.)</td>
</tr>
<tr>
<td>5450</td>
<td>Sound Measurement and Analysis in Hearing Conservation (3)</td>
<td>Noise measuring systems and techniques; factors in military and industrial applications.</td>
</tr>
</tbody>
</table>

College of Liberal Arts 105
Biochemistry

MAJOR

DEGREES

M.S., Ph.D.

Professors:

K. J. Monty (Acting Head), Ph.D. Rochester; J. E. Churchich, Ph.D. Sheffield (England); E. Saito, Ph.D. D. McGregor.

Associate Professors:

S. W. Hawkings, Ph.D. Chicago; J. G. Joshi, Ph.D. Poona (India).

Assistant Professors:

E. B. Brattsten, Ph.D. Illinois; R. Bryant, Ph.D. Illinois; R. H. Feinberg, Ph.D. California (Berkeley); L. Huang, Ph.D. Michigan State.

THE MASTER'S PROGRAM

Candidates usually should offer an undergraduate major in either biology or chemistry. Departmental requirements consist of the satisfactory completion of 45 credit hours of graduate work and the mastery of the subject matter of the following:

1. Introductory Organic Chemistry with laboratory (at least one year)*, Inorganic Quantitative Analysis* (e.g., at least one quarter of analytical chemistry), and at least one quarter of approved physical chemistry.

2. A minimum of 12 quarter hours of approved biology courses beyond the introductory level, including at least 3 hours of genetics and 3 hours of physiology.

3. Biochemistry 4110-20, 5310-20-30, and at least two of the following:

Biochemistry 5110, 5120, 5130, 5220, 5230.

4. At least 9 hours of advanced lecture-seminar courses from the following:

Biochemistry 6410-20-30, 6110, 6120, 6130, 6210, 6220, 6230, 6310, 6320, 6330.

5. Between 9 and 18 hours of Master's research and a thesis.

6. A final comprehensive examination which will cover both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

An incoming student must present an undergraduate major in either chemistry or biology. Departmental requirements for the awarding of the Ph.D. include mastery of the subject matter indicated in the following list of courses. Course content listed in items 1 and 2 are prerequisite to taking preliminary examinations; applicants usually should expect to complete these requirements within the first two years of graduate school.

1. Introductory Organic Chemistry with laboratory (at least one year)*, Inorganic Quantitative Analysis* (e.g., at least one quarter of analytical chemistry), Organic Qualitative Analysis* (e.g., Chemistry 4510), Introductory Physics*, Differential and Integral Calculus* at least three quarters of approved graduate courses in chemistry or physics, for example: Organic Reaction Mechanisms (e.g., Chemistry 5110-20-30-35), Quantum Chemistry (e.g., Chemistry 5340), Advanced Physics (Physics 5210-20-30),

*Though completion of these courses or the equivalent is required, they may not be taken for graduate credit.
Infrared and Raman Spectroscopy (Physics 5440), Radiation Chemistry (Physics 4210), Advanced Thermodynamics and Statistical Mechanics (Physics 5110-20-30); plus minimum of three quarters of approved physical chemistry (e.g., Biochemistry 4210-20-30, Chemistry 3410-20-30) and at least 18 hours of biology beyond the introductory level including at least 3 hours of genetics and 3 hours of physiology. At least 5 hours must be graduate credit in an approved area of specialization which should be identified early so that necessary prerequisites can be taken.

3. Participation in Biochemistry 6410-20-30 and in the advanced biochemistry seminars during the entire period of residence.
4. Preliminary examinations are administered preferably at the beginning of the fall quarter of the student’s third year and are designed to test in comprehensive fashion the mastery of the required formal course work listed in items 1 and 2.
5. A dissertation reporting the results of original research which has been carried out during the term of candidacy.
6. A final examination which will be concerned primarily with the student’s dissertation.

Petitioning for Master’s Degree: Students who have passed the preliminary examination in the Ph.D. program may petition the department for award of a Master’s degree. The additional requirements for such a degree shall be:
(a) the completion of at least 45 hours of approved course work for graduate credit, at least half of which must be at or above the 5000 level;
(b) the preparation of a research manuscript suitable for submission for publication in a major scientific journal;
(c) the oral defense of that manuscript before an examining committee of the faculty members appointed by the head of the department, at least two of whom shall be members of the department.

4110-20 Cellular and Comparative Biochemistry (4, 4) Electrolyte behavior; chemistry and structure of proteins; enzyme behavior and biological function; catalysis and energy capture; synthetic metabolism; nucleic acid function, protein synthesis and biochemical genetics; regulation of biological processes. Must be taken in sequence. Prereq: Chemistry 3211-21, 3219-20-30, and 1 course from Biology 1210-20-30 or Botany 1110-20.

4119 Cellular and Comparative Biochemistry Laboratory (2) Basic biochemical procedures of general application in biochemistry and molecular biology. Prereq: 1 quarter of analytical chemistry. Prereq or coreq: 4110.

4210-20 Introduction to Physical Biochemistry (3) Physical chemistry of macromolecules; polarized light, absorption and fluorescence, sedimentation and transport of hydrodynamics, electrostatic properties, light scattering, and structural x-ray crystallography of proteins and nucleic acids. Prereq: 4220 or Chemistry 3430, or equivalent.

5000 Thesis

5010 Biochemical Techniques (2) Theory and laboratory practice in sedimentation, chromatographic and electrophoretic techniques in isolation and characterization of macromolecules of importance in biochemistry and molecular biology. Prereq: 4119 or equivalent. Open to undergraduates with consent of department.


5120 Membranes, Compartments, and the Regulation of Energy Metabolism (3) Examination of metabolic pathways for electron transport, oxidative phosphorylation, and lipid synthesis, storage and degradation, and of intracellular and interorgan compartmentalization and phenomenon of permeation which make possible biological control of these pathways. Prereq: 4110-20.

5130 Protein Structure and Enzyme Function (3) Physicochemical properties of proteins; primary, secondary, tertiary and quaternary structure; denaturation, renaturation and other conformational change; structure-function correlation; coenzyme-specific models of catalysis; steady-state, transient, relaxation, and allosteric kinetics of catalysis. Prereq: 4110 and either 4220 or Chemistry 3430.

5220 Structures and Functions of the Nucleic Acids (3) Chemistry of nucleic acids; hydrogen bonding and double-stranded structures; coiling, supercoiling, and higher order structure of nucleic acids; biosynthesis of DNAs and RNAs; repair mechanisms; degrading mechanisms; genetics of gene information storage and retrieval. Prereq: 4110-20 or equivalent.

5230 Protein Synthesis and Its Role in Metabolic Regulation (3) Mechanism of assembly of polypeptide chains; ribosome structure and function; deciphering and genetic code; regulation of transcriptional and translational events (induction, repression, etc.). Prereq: 4110-20.

5300 Graduate Research Participation (3-9) May be repeated. Maximum 12 hrs.

5310-20-30 Experimental Techniques (2, 2, 3) Tutorial laboratory course in modern experimental methodology and instrumentation.psons focus on analytical, biochemical, and physiologic methods employed in toxicological investigations, regulation and characterization of macromolecules of importance in biochemistry and molecular biology. Prereq: 4119 or equivalent. Open to undergraduates with consent of department.

5450 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated. Maximum 9 hrs.

5510 Properties of Biomolecules Related to Function (3) Structures, chemical and physical properties of biomolecules developed from theoretical and experimental points of view to examine actions and interactions. Prereq: Chemistry 3211-21-31; Chemistry 2140 recommended. Prereq or coreq: 4210, Chemistry 4910 or equivalent.

5520 Molecular and Cellular Basis of Metabolic Regulation (3) Regulation of metabolic pathways dependent on energy demands of organism and on synthesis of macromolecule precursors. Prereq: 5510 or consent of department. Coreq: 4220 or Chemistry 4920 or equivalent.


5610 Environmental Toxicology (3) Basic concepts in toxicology, interactions at subcellular, cellular, organ, organism, population, and environmental levels, legal aspects. Major emphasis on biochemical toxicology. Prereq: 4110-20, Chemistry 3211-21-31, Chemistry 4910-20-30, or consent of instructor. (Same as Ecology 5610.)

5640 Techniques in Environmental Toxicology (2) Survey of electrochemical, chemical, and biosensor methods employed in toxicological studies. Prereq: Chemistry 2140-2149 and 3211-21-31, 1 yr of physics; or consent of instructor. (Same as Ecology 5640.)

6000 Doctoral Research and Dissertation

6010 Advanced Biochemistry Seminar (1) Topics to be covered in spring quarter for following year. Invited speakers of note will participate. May be repeated. Maximum 9 hrs. S/NC only.

6410-20-30 Current Topics in Biochemistry (2, 2, 2) Seminars and lectures dealing with current advances in field of chemical biology. May be repeated with consent of department. S/NC only.

6450 Advanced Special Topics (1-3) Registration only by prior arrangement with department. For students who have passed Ph.D. preliminary examination or are in advanced state of graduate studies. Topic title posted in advance. May be repeated. Maximum 9 hrs.

Biology

MAJOR

DEGREE

MCAT

The Master of Arts in College Teaching program is administered by an interdepartmental committee composed of one representative from each of the following departments: Biochemistry, Botany, Microbiology and Zoology. Inquiries regarding the program should be addressed to the chairperson of the committee.

Requirements for the degree:
1. Bachelor's degree with satisfactory record.
2. Nine quarter hours of college mathematics.
3. Twelve quarter hours of physical sciences.
4. Twelve quarter hours of general biology, general botany, or general zoology.
5. Eighteen quarter hours of advanced biology courses.

Requirements for the degree:
All candidates for the MACT degree in Biology will meet a minimum distribution of graduate and undergraduate courses as follows:

1. Eight quarter hours in each of the following:
   a. Taxonomy and/or Ecology.
   b. Morphology, Developmental Biology and/or Anatomy.
   c. Physiology and/or Biochemistry.
   d. Genetics, Cytology and/or Cytogenetics.
2. Eighteen quarter hours of graduate credit in each of two of the following four fields: biochemistry, botany, microbiology, zoology or 36 quarter hours of graduate credit in one of the four fields as specified by the interdepartmental committee administering the MACT program in Biology.
3. At least 21 quarter hours of course work in requirement 2 (not including special projects and thesis) numbered at the 5000 or 6000 level.
4. At least 12 quarter hours of Master's research and an acceptable thesis.
5. Total graduate credit in the biological sciences (or appropriate supporting fields) of 57 quarter hours (including that in items 1, 2, 3, and 4).
6. A three-quarter, 1-hour seminar (or seminar series) on the problems and techniques of college teaching.
7. Six quarters of part-time, supervised college-teacher-internship training.
8. A final comprehensive oral examination covering the thesis endeavor and the subject matter of the course requirements.

**Botany**

**MAJOR**

**DEGREES**

M.S., Ph.D.

**Professors:** R. W. Holtan (Head), Ph.D. Michigan; E. E. Ciesla, Ph.D. Duke; H. R. DelSelm, Ph.D. Ohio State; L. A. Benndorf, Ph.D. Vanderbilt; L. W. Jones, Ph.D. Texas; J. F. McCormick, Ph.D. Emory; F. H. Norris, Ph.D. Ohio State; J. S. Olson, Ph.D. Chicago; R. H. Petersen, Ph.D. Columbia; A. J. Sharp (Emeritus), Ph.D. Ohio State; P. L. Malone, Ph.D. Texas.

**Associate Professors:** C. C. Amundsen, Ph.D. Colorado; D. W. Berndt, Ph.D. Texas; J. D. Caponetti, Ph.D. Harvard; A. M. Evans, Ph.D. Michigan; A. S. Heilman, Ph.D. Ohio State; H. H. Shugart, Ph.D. Georgia.

**Assistant Professors:** L. G. Hickok, Ph.D. Massachusetts; K. W. Hughes, Ph.D. Utah; B. Mullin, Ph.D. North Carolina State; O. J. Schwarz, Ph.D. North Carolina State; D. K. Smith, Ph.D. Tennessee; W. C. Smith, Ph.D. Duke.

The Department of Botany offers the Master of Science and Doctor of Philosophy degrees with concentrations in anatomy, bryology, cytology, cyrogenetics, ecology, genetics, lichenedology, mycology, phycology, physiology, phycology, teratology, and taxonomy.

Requirements for admission: In addition to the general Graduate School requirements (see page 11) the botany department also strongly recommends submitting aptitude and advanced scores from the Graduate Record Examinations, at least three letters of recommendation from academic or professional persons, a short statement describing probable areas of interest in botany, and the following specific courses: (1) general botany or biology, 12 quarter hours; (2) advanced botany or closely allied biological sciences, 18 quarter hours; (3) physical sciences; general inorganic chemistry, 12 quarter hours, organic chemistry and physics highly recommended; (4) college mathematics, 9 quarter hours.

General degree requirements are given on pages 19-24. Special departmental requirements include successful completion of the following:

**THE MASTER'S PROGRAM**

**A. Thesis Program**

1. Satisfactory preparation of a written formulation and an oral defense to the student's committee of a research proposal suitable for a thesis problem. Must be completed before enrollment in Botany 5000.
2. Satisfactory performance on an examination in one modern foreign language including German 3030 or German 3030 (can also be applied to the doctoral program).
3. Satisfactory completion of 2 credit hours at the 6000 level.
5. Presentation of a thirty-minute departmental seminar.
6. Educational service is required of each graduate degree candidate and such service will include teaching and/or ancillary services performed in the department related to the instruction of courses.

**B. Non-Thesis Program**

1. Satisfactory completion of 51 quarter hours of approved graduate courses of which 30 quarter hours must be in botany including Botany 5003 and 5004.
2. Satisfactory completion of 2 credit hours at the 6000 level.
3. Educational service is required of each graduate degree candidate and such service will include teaching and/or ancillary services performed in the department related to the instruction of courses.
4. Satisfactory performance on a final written examination on all work offered for the degree. The department may or may not follow this examination with an oral examination.

**THE DOCTORAL PROGRAM**

1. Satisfactory presentation of a written proposal and oral defense to the student's committee of a research proposal suitable for a dissertation problem. Must be completed before enrollment in Botany 6000.
2. Satisfactory performance on a final comprehensive oral examination.
3. Presentation of one or more cognate areas outside of the department totaling 9 graduate credit hours with at least a B average.
4. Satisfactory performance on an examination in one modern foreign language or an A or B in French 3030 or German 3030.
5. Satisfactory completion of 9 credit hours at the 6000 level (excluding dissertation).
7. Presentation of a one-hour departmental seminar near the end of the doctoral program.
8. Educational service is required of each graduate degree candidate and such service will include teaching and/or ancillary services performed in the department related to the instruction of courses.

*Note: Graduate School requirements are denoted by an asterisk. These requirements should be interpreted as minimal requirements and specific stipulations or requirements such as additional foreign languages, additional oral preliminary examinations may be required by the individual student's faculty committee.*

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*Not for graduate credit for botany majors.*

**3910-20 Plants in Evolution (4, 4) Monera to anthozoans, emphasis on evolutionary relationships, morphology and development. Prereq: 6 hrs in biological sciences.**

**3930 Field Botany (4) Study of plants in natural environments. Field identification, plant identification, plant collection, preservation and basic ecological concepts. Prereq: 6 hrs in biological sciences.**

**3031-32 Field Botany (4, 4) Emphasis on fall and winter flora respectively. Prereq: 3030. Need not be taken in sequence.**

**3550 Sociological Impact of Plants (3) Significance of plants in origin and development of human cultures, evolution of cultivated plants, and role of plants in present civilizations. Occasional field trips.**

**3570 Genetics and Society (3) An introduction to genetics, anthropology and evolution with emphasis on their implications for human society. (Same as Anthropology 3070.)**

**3990 Biology and Human Affairs (3) Basic biological principles involved in deterioration and preservation of an environment in which human cultures may survive.**

**3130 Introductory Plant Pathology (4) (Same as Agricultural Biology 3130.)**

**3210 Introductory Plant Physiology (4) Organismal physiology of plants; water relations, mineral nutrition, morphogenesis, elements of metabolic processes, effects of age, light, natural rhythms, temperature and other environmental factors. Lectures and lab. Prereq: 1 yr general chemistry and 1 yr biological science.**

**4039 Mechanisms of Plant Speciation (4) Processes of plant speciation emphasizing population genetics, isolation, drift, hybridization, variation in populations, establishment of population barriers and other aspects of plant speciation. Prereq: 3010-20 and Biology 3110.**

**4120 Plant Anatomy (4) Comparative structure of vascular plants. Prereq: 1110-20.**

**4240 Paleobotany (4) (Same as Geology 4240.)**

**4310 Plant Ecology (4) Interactions between individuals, species, communities and their environments. Calculation of energy and matter in ecosystems. Weekly field trips or laboratory periods, and at least two weekend field trips. Prereq: 3030 or equivalent.**

**5000 Thesis**

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

**5003-04 Non-Thesis Research (3, 3) Library, field or laboratory research under supervision of staff members. Not for thesis candidates.**

**5011 Mycology (4) Intensive survey of fungi, including all major orders of utility, lecture, laboratory and field information. Occasional field trips. Prereq: 3010, 3 hrs and 1 lab.**

**5012 Morphology and Evolution of the Phycomycetes (4) Similar to 5000, but dealing with Phycomycetous fungi. Prereq: 5011 or consent of instructor.**

**5017 Field Mycology (4) Intensive summer course on field techniques and morphology of higher fungi. Frequent field trips. Prereq: Consent of instructor. May be repeated.**
5521 Bryology (4) Taxonomy, phycology, ecol-
ology, physiology, and developmental morphology
of bryophytes with emphasis on field studies and
current research. Prereq: 3020. 1 hr and 3 labs.

5522 Lichenology (4) Taxonomy, phycology, ecol-
ology, economics and symbiosis of lichens with
emphasis on field studies and current research.
Prereq: 3010, 5011 or 5017. Recommended: 5561. 1
hr and 3 labs.

5531 Vascular Plant Taxonomy (4) Family charac-
teristics of vascular plants, including principles
of phycology and classification, based primarily
on plants of local flora. Prereq: 3030 or equiva-
 lent. 2 hrs and 2 labs.

5601 Physiology (4) Intensive, comparative study
of major divisions of algae, both freshwater and
marine. Taxonomical, ecological, morphological,
developmental cycles as applied to evolutionary
aspects. Field and laboratory studies, identification and
classification, introduction to experimental physiology.
Prereq: 3080 or consent of instructor. 2 hrs and
2 labs.

5650 Phytolankton Ecology (4) Interaction be-
tween environment and phytoplankton. Nutrient
uptake, photosynthesis, competition, ecological
theory applied to phytolankton communities, and
physiological adaptations by populations environ-
ment. Prereq: 3010 or consent of instructor.

5700 Principles of Biological Illustration (3) Prin-
ciples and application of photography, including
photomicrography and photomacography, draw-
ing graphics, and other methods for recording and
presentation for research and publication of data in
pictorial or graphic form. 1 hr and 2 labs.

5800 Pteridology (4) Evolutionary study of lower
vascular plants: morphology, cytology, ecology,
life cycles and classification. Biosystematic
studies and recognition of local species. Prereq:
3020-30 or consent of instructor. 2 hrs and 2 labs or
field trips.

5900 Morphology and Evolution of Basidiomy-
cetes (4) Structure and function of asexual and
sexual life cycles as applied to evolution in
group. Cultures and specimens in laboratory.
Prereq: 3010 or equivalent.

5910-20 Agrostology (4) Collection, identification,
classification, and phycology of tribes of grasses.
Prereq: 3030 or consent of instructor. 2 hrs and
2 labs.

5920-21-22-23 Methods and Instrumentation
in Laboratory Investigation (1, 1, 1, 1) Laboratory
course providing project experience and theoreti-
cal background in research methods. Includes:
exchange-resins, adsorption spectroscopy, disease
identification, photosynthesis, plant development,
ultrafiltration, gas chromatography, automatic
analyzer, microscopy, culture methods, use and
detection of radioisotopes, and others.
Prereq: Course in plant physiology, Chemistry
3211-21-31 or equivalent, Physics 2120-20-30 or
equivalent. S/N Only.

5930 Field Methods in Plant Ecology (4) Analysis
of plant communities and environs, including
field experience. Prereq: 4130, 5340, 5350. 2
hrs and 2 periods (field trips).

5960-5961 Advanced Plant Physiology I (3) Plant
cell culture and molecular aspects. Physiological
processing. Prereq: 5510.

5970 Plant Cytology (4) Intensive consideration
of cellular, genetic, structure and function,
with emphasis on correlation where possible of
ultrastructure, biochemistry and function of sub-
cellular organelles. Principles and application of
various analytical and electron microscopic tech-
niques, cell fractionation and isolation of sub-
cellular components; differentiation and analyl-
cal centrifugation; photomicrography and microcinematograph. Intended for graduate
students in the biological sciences. 2 hrs and
2 labs.

5980 Cytogenetics (4) Changes in chromosomes
and genes with relation to mutations, hybridiza-
tion, speciation, and phylogeny. Prereq: Biology
3110; Zoology 4310. 2 hrs and 2 labs.

5982-20-21 Advanced Topics in Ecology (2-4) Needs of
students determine content, such as actions of
photosynthesis, radiation effects, and
ultrastuctural research in selected cytoplasmic
organelles and cellular systems, experimental
cytology, cellular control of nuclear acid biosynthesis. Prereq: 5780 or Zoology 4310; Biology
3110; Biochemistry 4110-20. May be repeated
with consent.

5990 Ecosystems of the World (3) Classification and
characterization of world's regional ecosys-
tems. Interrelations of climate, topography,
soils, vegetation, and fauna. Prereq: 5340.

6210 Analytical Chemistry (4) Laboratory
work using appropriate methods and instrumen-
tation. Topics vary according to needs of stu-
dents. May be repeated with consent.

6320 Advanced Topics in Cryptogamic Botany (2-4)
Advanced studies and current research in
experimental phycology, mycology, biotrophology,
or developmental morphology of cryptogams. May be repeated with consent.

6350 Analysis of Plant Communities (4) Plants as
species and ecosystems components consid-
ered from aspects of genealogy, ordination, and
ecosystem function. Prereq: 4130. 2 hrs and
2 periods (field trips).

6420 Advanced Topics in Genetics (2-4) Literature
survey of selected areas in genetics. Prereq: Biology
3110; Biochemistry 4110-20. May be repeated
with consent.

6540 Seminar in Botany (1) Readings and dis-
cussions of current literature and/or selected
topics in botanical research. May be repeated.

6550-20-30 Systems Ecology (3, 3, 3) 5510—
Nature of ecological systems. System state and
change of state. Elementary network conceptions
of general botany. Supervised teaching in general
labs. Prereq: 5610 or Biochemistry 3510.

6570 Advanced Botanical Morphology (2-4) Cellular
and genetic aspects of morphogenesis-correla-
tions, transformation, cytoplasmic inheritance,
disruption of ecosystems. Statistical models of
community structure. Evolutionary processes and
application of digital computers in simulation and
data-processing. Prereq: 5510.

6760 Developmental Morphology of Plants (2-4)
Developmental objectives in relation to mutations,
hybridization, and disruptions of ecosystems.
Prereq: 5610 or Biochemistry 3510.

6770 Experimental Botany (1) Evolutionary aspects
of phenomena of morphogenesis-correla-
tions, polarity, symmetry, differentiation, regener-
ativity, transformation and evolutionary
factors. Prereq: 5920 or 5101, 5210, or Bioch-
3110; or consent of instructor. May be repeated
with consent of department.

6420 Advanced Topics in Genetics (2-4) Literature
survey of selected areas in genetics. Prereq: Biology
3110; Biochemistry 4110-20. May be repeated
with consent.

6820 Seminar in the History of Botany (2)

6830 Advanced Topics in Plant Physiology (4)
Requirements of student determine content, in-
cluding growth and growth hormones, minor ele-
ment nutrition; photoperiodism; radiation ef-
effects. Prereq: 5210, 1 yr college physics. May be
repeated with consent.

6930 Advanced Topics in Systematics (3-4) Needs of
student determine content, including commu-
ity analysis; biogeochromosystematics; phyllo-
cology; and experimental studies on plant ecosys-
tems. Prereq: 4310, 5340, 5350. May be
repeated with consent of department.

6970 Experimental Plant Genetics (4) Genetics of
plants stressing molecular aspects and includ-
ing mechanisms of gene action, controlling ele-
ments, transduction, and characterization of world's regional ecosys-
tems. Interrelations of climate, topography,
soils, vegetation, and fauna. Prereq: 5340.

Chemistry

MAJOR

DEGREES

Chemistry

M.S., M.A.C.T., Ph.D.

Professors:

D. A. Shirley (Head), Ph.D. Iowa State;

N. S. Bowman, Ph.D. Princeton; C. A. Buehler
(Emirour), Ph.D. Ohio State; W. E. Bull, Ph.D.

Purdue; C. L. Collins, Ph.D. Northwestern;

J. A. Dean, Ph.D. Michigan; J. F. Eastham,
Ph.D. California (Berkeley); W. H. Fletcher,
Ph.D. Minnesota; C. W. Kepner, Ph.D. Texas;

C. K. Kleiientzler, Ph.D. Princeton; J. W. Larsen,
Ph.D. Purdue; M. H. Lietzke, Ph.D. Wisconsin;

A. D. Melaven, Ph.D. Pennsylvania State; W. E. Bull,
Ph.D. Texas; W. E. van Hook, Ph.D. California
(Emirour); W. A. Van Hook, Ph.D. North Carolina;

W. A. Van Hook, Ph.D. North Carolina;

W. A. Van Hook, Ph.D. North Carolina;

M. H. Lietzke, Ph.D. Wisconsin;

A. D. Melaven, Ph.D. Pennsylvania State; W. E. Bull,
Ph.D. Texas; W. E. van Hook, Ph.D. California
(Emirour); W. A. Van Hook, Ph.D. North Carolina;
The requirements for the M.S. degree in Chemistry consist of the satisfactory completion of:

1. Research and a thesis to give 9 to 18 hours of graduate credit (5000).
2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.
3. Sufficient additional graduate course work in chemistry and/or a related field to make an overall total of 45 hours.

These additional hours must include one of the following sequences:
- 4. Participation in seminar (5911-21-31) during the entire period of graduate study. (No more than 3 credit hours of seminar may be applied to the above requirements.)
5. A final oral examination.

The Doctoral Program

The department offers specialization in nine areas for the Ph.D. degree: analytical chemistry, chemical physics, environmental chemistry, energy, inorganic chemistry, organic chemistry, physical chemistry, polymer science, and theoretical chemistry. For the Ph.D. degree in Chemistry with specialization in chemical physics, the satisfactory completion of the following is required:

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).
2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.
3. Participation in seminar (5911-21-31) during the entire period of graduate study.
4. Thirty-nine hours of additional graduate course work in chemistry and/or related fields including at least 6 hours at the 6000 level and one of the following groups: (a) for analytical, 5250-59-60-69-70-79; (b) for inorganic, 5420, 5710-20-30; (c) for organic, 5110-20-29-30-35 and at least 9 hours from the following courses: 5250-60-70, 5340-50-60, 5410-20-30-30, 5710-20-30; (d) for physical, 5340-50, 5410-20-30-30; (e) for theoretical, 5110-20-29-30-35, 5710-20-30-30, 5810, Physics 5210. Graduate course work in related fields may be used for an approved alternate.

The program in chemical physics is conducted jointly with the Physics Department which offers a similar degree. This specialization requires knowledge of one of the following languages: French, German, Russian, or an approved alternate.

A final oral examination.

For the Ph.D. degree in Chemistry with specialization in environmental or energy consist of the satisfactory completion of:

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).
2. Chemistry 4160-70 and one of the following: 5511, 5521, 5531.
3. An examination on the basic principles of mechanics, electricity, and magnetism.
5. The requirements listed in items 3, 5, 6, and 7 above.

The program in chemical physics is conducted jointly with the Physics Department which offers a degree in chemical, metallurgical, and Polymer Engineering, which offer a degree with similar specialization. This specialization
requires satisfactory completion of:
1. Research and a dissertation to give at least 36 credit hours.
2. Chemistry 4150-70, 5531, 5140-50, 5160 or 5170, Polymer Engineering 4910.
3. Participation in Chemistry Seminar (3911-21-31) and the Polymer Seminar (3911-21) for the entire period of graduate study.
4. Thirty hours of additional graduate course work, including at least 6 hours at the 6000 level or 9 hours beyond 3911-21-31 from the Department of Chemistry offerings.
5. A comprehensive advanced examination in polymer science.
6. Demonstration of a reading knowledge of one of the following languages: French, German, Russian, or an approved alternate.
7. A final oral examination.

*3211-21-31 Organic Chemistry (3, 3, 3) Compounds of carbon and their reactions, reaction mechanisms, spectroscopic and other physical properties. Must be taken in sequence. Prereq: 1100 and 1200 or consent of instructor. Coreq: (3211-29- 39) is a coreq for students not having credit for the laboratory.

3219-29-39 Organic Chemistry Laboratory (1, 1, 1) Experiments on topics discussed in 3211-21-31. Corresponding lecture (3211-21-31) is a coreq for students not having credit for the lecture.


3429-39 Physical Chemistry Laboratory (1, 1) Gases, liquids, chemical equilibria, solutions, phase equilibria, reaction kinetics and electrochemistry. Prereq or coreq: 3420-30. 1 lab.

3511-21-31 Principles of Organic Chemistry (3, 3, 3) Structure and reactivity of aliphatic and aromatic compounds emphasizing reactions of synthetic utility. Use of spectroscopic and physical techniques to elucidate reaction mechanisms. Preprereq: recommended for chemistry majors and students planning careers in physical or biological sciences. Must be taken in sequence. Prereq: 3211-21-31 or 3219, 3529-39 as a coreq; latter is recommended.

3539-39 Organic Chemistry Laboratory (1, 1) Experiments in organic chemistry in 3211-21-31, 3219-29-39. Similar to 3229-39 except designed for students who have need for operating knowledge of various spectroscopic and chromatographic techniques. Corresponding lecture (3521-31) or 3221-31 is required for students not having credit for the lecture.

3810 Radioactivity and its Applications (3) Radioactive materials in tracer and therapeutic applications. Radioactive decay, detection apparatus and principles, tracer procedures and precautions in agriculture, biology, medicine, nutrition. Not for credit by chemistry or physics majors or minors. Prereq: 1 yr of general mathematics or equivalent, 1 yr of general chemistry, 2 hrs and 1 lab.


4119 Physical Chemistry Laboratory (1) Solutions, phase equilibria, reaction kinetics and spectroscopy. The corresponding course 4110 is coreq.

4160-70 Intermediate Physical Chemistry (3, 3) (Designed for entering graduate students who have had one year of physical chemistry.) 4160—The three laws of thermodynamics, phase equilibrium. 4170—Gases and kinetic theory, chemical kinetics, molecular spectrophotometry, and introduction to chemical statistical mechanics.

4210 Advanced Analytical Chemistry (3) Chemical separations including chromatography, ion exchange and solvent extraction; spectrophotometric, titrimetric, and gravimetric analyses; analytical chemistry.

4219 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4220. Coreq: 4210.

4220 Advanced Analytical Chemistry (3) Electro-analytical methods of analyses (including potentiometry, coulometry, polarography, and voltammetry); magnetic resonance methods; mass spectrometry; x-ray absorption and fluorescence techniques. Prereq: Analytical chemistry. Recommended: 3420 or 4290.

4229 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4220. Coreq: 4220.

4420 Physical Inorganic Chemistry (3) Theoretical concepts leading to an understanding of inorganic chemistry; quantum theory of the atom, principles of molecular structure, and elements of nuclear physics. 4410—Elements of quantum chemistry.

4430 Intermediate Inorganic Chemistry (3) Application of theoretical concepts to inorganic elements, their chemical states, and their reactions. Prereq: 4420.

4510 Organic Qualitative Analysis (3) Identification of organic compounds and mixtures. Prereq: 3211-21-31, 3219-29-39 or 3219, 3529-39. 3 labs. Open to students who have completed 4510.

4550 Organic Reaction Mechanisms (3) Prereq: 1 yr of organic chemistry.

4610-20 Advanced Chemical Experimentation (2, 2) Laboratory course in applied modern experimental techniques to solution of chemical problems. Synthesis and characterization of organic and inorganic compounds with emphasis on independent study using advanced techniques. Prereq: 3231-39 or 3531-39, 3430-39, 4220, 4610 not open to students who have completed 4510.

4910-20-30 Biophysical Chemistry (3, 3, 3) Physical chemistry of biological systems. Preprereq: 1 yr of physical chemistry. Must be taken in sequence. Not open to students having 3410-20-30, 3419—Quadrant chemistry; electrical, magnetic and thermal analytical methods; on-stream and automatic analysis. Prereq: 1 yr of physical chemistry.

4920—Elementary quantum chemistry; light scattering, coulometry, polarography, and volumetric analysis. 4930—Quantum chemistry. 4940—Elementary quantum chemistry, optical and magnetic spectroscopy; light scattering; molecular and macromolecular techniques. Prereq: 1110-20-30, Mathematics 1540-50 or equivalent.

5000 Thesis


5129 Advanced Organic Chemistry Laboratory (3) Experimental procedures and analytical techniques of modern techniques. Prereq: 1 yr of organic chemistry.

5140 Introductory Polymer Chemistry (3) Fundamental principles of polymer science. Introduction to interdisciplinary field of polymer science; relation of molecular structure to bulk properties of polymers. Prereq: 1 yr each undergraduate organic and physical chemistry.

5150 Kinetics of Polymerization (3) Kinetics of formation and molecular weight distributions of polymers, homogeneous and heterogeneous step growth and chain growth polymerizations. Prereq: 5140 and 4160-70 or equivalent.

5160 Organic Chemistry of Polymers (3) Synthesis and properties of monomers; mechanism, stereochemistry, and sequence distribution of polymerizations. Formation of block, graft, and network polymers. Reactions on polymers, including degradation. Prereq: 5140 and 5531.

5170 Physical Chemistry of Polymers (3) Rubber elasticity; solution properties of macromolecules; structural, configurational, and conformational statistics of polymers. Prereq: 5150.

5220 Analytical Chemistry of Environmental Pollutants (3) Application of modern analytical chemistry to problems in aquatic and atmospheric pollution. Prereq: 5250-60-70 or consent of instructor.

5240 Electronics for Chemists (3) Includes material of Chemistry 4640 plus special project. Prereq: Consent of instructor.

5250-60-70 Advanced Analytical Chemistry Laboratory (3, 3, 3) 5250—Absorption and emission spectroscopy, structure elucidation by IR, NMR, UV, and mass spectra; 5260—Chemical separation methods; solvent extraction, chromatography, electrophoresis; radiochemical methods; fluorescence; x-ray methods; 5270—Electroanalytical, magnetic and thermal analytical methods; on-stream and automatic analysis. Prereq: 1 yr of physical chemistry.

5259-69-79 Advanced Analytical Chemistry Laboratory (3, 3, 3) 5259—Experiments on topics discussed in 5240. Prereq: 5250 for 5259; 5259 for 5260; 5250 for 5259.

5340 Quantum Chemistry (3) Postulate approach to fundamental principles of quantum mechanics. Accurate solutions to Schrodinger equation; approximate (ab initio and semiempirical) molecular orbital methods; calculation of molecular properties.

5350 Quantum Chemistry (3) Electronic excited states; reproduction of group theory; perturbation theory; reactivity of organic molecules. Prereq: 5340.

5410-20-30 Advanced Physical Chemistry (3, 3, 3) Classical thermodynamics. 5420—Molecular spectroscopy and structure. 5430—Chemical kinetics. Prereq: 4110 or 4160-70.


5511 Survey of Inorganic Chemistry (3) Atomic structure, wave mechanical atoms, ionic and covalent bonding, properties of inorganic compounds. Preprereq: 1 yr of physical chemistry, inorganic stereochemistry, coordination chemistry, and descriptive chemistry of the elements.

5521 Survey of Analytical Chemistry (3) Volumetric and gravimetric analysis, acid-base, oxidation-reduction, complexation and precipitation equilibria; spectroscopic, electroanalytical, and separation methods.

5531 Survey of Organic Chemistry (3) Bonding in organic molecules, chemistry of hydrocarbons, alicyclic compounds and conformational analysis, monofunctional and multifunctional derivatives; carboxylic compounds, stereochemistry, aromatics, and spectral analysis of organic molecules by infrared, ultraviolet, nuclear magnetic resonance and mass spectral techniques.

5550 Industrial Chemical Research (3) Practice of modern industrial research taught by case studies and visiting lecturers. Course content varies, selected to illustrate good past and current industrial research practices. Prereq: Completion of a 5000 chemistry course sequence.

5610-20-30 Chemical Basis of Energy Conversion (1, 1, 1) Chemistry of various energy and fuel recovery systems. Introduction to homogeneous and heterogeneous catalysis, thermodynamics of energy conversion systems, fossil fuels chemistry, and electrochemical and
photochemical conversion systems. Prereq: 5410 and one 5000 sequence.

5710-20-30 Theoretical Inorganic Chemistry (3, 3, 3) 5710—Nature of chemical bonding; ionic, covalent, and molecular; 5720—Structure and bonding; coordination compounds, 5730—Investigational methods of structural inorganic chemistry. Prereq: 1 yr of physical chemistry.

5810 Nuclear Chemistry (3) Nuclear properties, radiationless decay processes, nuclear structure and models, nuclear reactions, radiations and matter, radiation detection. Prereq: Coreq: Chemistry 3610.

5911-21-31 Chemistry Seminar (1, 1, 1) Discussion of departmental research, current research literature and general topics. May be repeated. Registration required each quarter except summer resident graduate students. S, NC only.

6000 Doctoral Research and Dissertation

6111 Selected Topics in Organic Chemistry (3) Subject matter varies among important topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6130 Natural Product Chemistry (3) Structure, chemistry, and synthesis of naturally occurring substances of biological or environmental significance. Course content varies with each offering reflecting to areas of current chemical interest. Prereq: Two of 5110-20-30-35.


6165 Orbital Symmetry Control (3) Application of Woodward-Hoffman rules and other theories to mechanism and stereochemistry of concerted organic reactions. Prereq: Two of 5110-20-30-35.

6175 Organic Photochemistry (3) Physical and chemical effects of electron excitation of organic molecules. Experimental and theoretical techniques of photochemical importance. Inter- and intramolecular reactions of alkenes, ketones, dienes, diynes, aromatic compounds, and other photocative species. Prereq: Two of 5110-20-30-35.

6190 Organometallic Chemistry (3) Structure, bonding and synthesis of organometallic reagents and reagents with organometallic synthesis. Prereq: Two of 5110-20-30-35.

6210 Advanced Analytical Spectroscopy (3) Newer methods of spectroscopic analysis, including: transform methods, lasers in spectroscopy, fiber optics, introductory nonlinear optics, and spectroscopic techniques for remote sensing. Prereq: 5250.

6211 Selected Topics in Analytical Chemistry (3) Subject matter varies among important topics of current significance. Prereq: Two of 5140-20-30-60 or consent of instructor. May be repeated.

6320 Natural Polymers (3) Structure, modification, and nonbiochemical utilization of natural polymers, and polymers derived from naturally-occurring monomers. Prereq: 5140 or two of 5110-20-30-35.

6411 Selected Topics in Physical and Theoretical Chemistry (3) Subject matter varies among important topics of current significance. Prereq: Two of 5410-20-30-60, 5340-50. May be repeated.

6420 Nuclear Magnetic Resonance (3) Theory of nuclear magnetic resonance spectroscopy with emphasis on high-resolution methods. Applications to problems in molecular structure and behavior. Prereq: 5110-20-30-35.

6430 Photochemistry and Radiation Chemistry (3) Fundamental physical and chemical processes pursuant to excitation of molecules by photon, electron, multiphoton processes and uses of laser sources; fluorescence and phosphorescence; radiationless transitions as studied by optoacoustic spectroscopy; chemical reactivity of excited states; ion-molecule and free radical reactions; electron capture and electron-transfer processes. Prereq: 5430.

6540 Electrochemistry (3) Electrical double layer; electrode kinetics; transport properties of electrolytes; electroanalytical methods. Prereq: 5430 or 5270.

6475 Electronic Structure of Radicals (3) Application of electron spin resonance to study of molecular conformation, structure, and bonding in organic and inorganic radicals, structure, comparison of experimental results with theoretical predictions based on Walsh rules and on INDO molecular orbital calculations. Prereq: 5340-50 and 6520.

6480 Statistical Thermodynamics (3) Application of statistical mechanical methods to systems of chemical interest such as isolate effects on equilibrium and rate processes, phase equilibria, condensation phenomena. Prereq: 5410, 5450.

6490 Advanced Chemical Kinetics (3) Mechanism of elementary chemical reactions at molecular level including topics such as dynamics of molecular collisions, potential-energy surfaces; reactions cross-sections, direct vs complex modes of reaction, photofragmentation, energy partitioning, chemiluminescence, and chemical lasers. Prereq: 5430.

6510 Thermodynamics of Solutions (3) Theory of regular solutions and of electrolyte solutions; measurement of activity coefficients and other thermodynamic properties; selected topics from literature. Prereq: 5410.

6520 Magnetic Resonance (3) Principles of magnetic resonance spectroscopy underlying nuclear magnetic resonance and electron spin resonance. Chemical applications to solid and liquid systems. Prereq: 5340.

6711 Selected Topics in Inorganic Chemistry (3) Subject matter varies among important topics of current significance: photoelectron spectroscopy, transuranium chemistry, organometallic compounds, inorganic solution kinetics and mechanisms, crystal chemistry, nonaqueous chemistry, chemistry of halogens and compounds. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6730 Topics in Quantum Chemistry (3) Application of newer methods to complex systems including metal complexes, polymers, and molecules of biological significance. Time dependent phenomena. (Effect of external fields and collision processes.) Recent theories of chemical reactivity. Prereq: 5340-50.

6750 Molten Salt Chemistry (3) Structure, spectroscopic properties, solution thermodynamics, electrochemistry and phase equilibria of molten salts. Solutions in molten salts. Prereq: 4110 and 5410 or equivalent.

6810 Vibrational Problems in Molecular Spectra (3) (Same as Physics 6810.)

6811 Selected Topics in Nuclear Chemistry (3) Subject matter varies among important topics of current significance: nuclear decay schemes, nuclear models, nuclear reaction theory, nuclear detection techniques, activation analyses. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6820 Molecular Vibration-Rotation Theory (3) (Same as Physics 6820.)

Classics

Professors: H. G. Rutledge (Head), Ph.D. Ohio State; A. Rapp (Emeritus), Ph.D. Illinois.

Associate Professors: M. Deming, M.A. Arkansas; J. E. Shelton, Ph.D. Vanderbilt.


The graduate courses in the Classics include the wider reading of Greek or Latin authors in a selected field, a more detailed study of one of the great departments of classical literature, and the development of background for the appreciation of Greek or Roman life and literature.

Greek

3000 Plato (3) 3020 Herodotus (3) 3030 Euripides (2) 3040 Aeschylus, Sophocles (3) 3060 Lysias (3) 3040 Aristophanes (3) 3060-90-70 Directed Readings in Greek (3, 3, 3)

Latin

3440 Livy (3) 3450 Pliny and Martial (3) 3460 Elegiac Poets (3) 4120 Horace, Satires and Epistles (3) 4130 Selected Readings From Latin Literature (3) 4230-30 Selected Readings from Latin Literature (3, 3) May be repeated. 4340 Horace, Odes (3) 4350 Tacitus (3) 4360 Lucretius (3) 4370 Readings in Medieval Latin (3) 4510-20-30 The Latin Epic: Lucretius, Vergil, Lucan (3, 3, 3) 5510-20-30 Roman Comedy: Plautus, Terence (3, 3, 3)

GENERAL COURSES

3210 Early Greek Mythology (3) Comprehensive study of Greek myths through readings, lectures, and discussion with emphasis on significance for Greek thought and religion. Studies and tales illustrate influence of Greek myths on art, music, and literature of ancient Greek and later cultures. (Same as Religious Studies 3210.)

3220 Greek Mythology in the Classical Period (3) A study of use of myth in literature, history, religion, philosophy, and art of Classical Age of Greece, and change of attitude toward myth from earlier periods. Familiarity with basic Greek myths is assumed. Readings, lectures, slides, and discussion. (Same as Religious Studies 3220.)

3230 Roman Mythology (3) Study of myths created by Romans, as well as those the Romans borrowed from Greeks, with reference to Roman attitude toward history, religion, and society. Readings, lectures, slides, and discussion. (Same as Religious Studies 3230.)
Computer Science

MAJOR

Degree: M.S.

Professors:
R. T. Gregory (Head), Ph.D. Illinois
F. Donaldson, Ph.D. Pennsylvania State
D. E. Pearson, Ph.D. Florida
G. R. Sherman, Ph.D. (Director of Computing Center).

Associate Professors:
R. M. Acker, Ph.D. Northwestern
T. Feagin, Ph.D. Texas (Aerospace Engineering)
R. C. Walling, Ph.D. Florida (Electrical Engineering)
E. A. Hall, Ph.D. Missouri (Electrical Engineering)
C. G. Hughes, Ph.D. Pennsylvania State
X. C. O'Kane, Ph.D. Pennsylvania State
J. M. Selkow, Ph.D. Pennsylvania State
M. G. Thomsen, Ph.D. Duke.

Assistant Professors:
C. R. Chang, Ph.D. SUNY (Buffalo)
S. R. Jordan, Ph.D. Wisconsin; J. M. McHale, Ph.D. Ohio State
T. P. Pfleeger, Ph.D. Pennsylvania State
D. W. Sifting, Ph.D. Texas.

Instructor:
C. W. Thompson, M.A. Texas.

ENRANCE REQUIREMENTS TO M.S. PROGRAM

Upon admission to the Graduate School, students who wish to enter the Master's degree program in Computer Science should have the following background:

1. Mathematical maturity at least equivalent to that of a student who has completed the calculus sequence through one year of multivariable calculus and matrix algebra.
2. Computer Science 3155 or an equivalent introductory numerical algorithms course.
3. An introduction to probability and statistics at least at the level of Statistics 3450.
4. Computer Science 3715 or an equivalent introductory course in discrete structures and logical foundations of computer science.
5. Computer Science 3510 and 3520 or equivalent courses in advanced FORTRAN programming, machine organization and assembler language programming.

THE MASTER'S PROGRAM

All students must receive departmental credit for or exhibit proficiency in the following courses:

1. Computer Science 4550 and 4510
2. Electrical Engineering 5615-25-35
3. One of the three courses Computer Science 4710, 4035, or 4225.

The student may then select either Plan A or Plan B.

Plan A: Thesis Option
1. Complete 36 hours of courses at the 4000 level or above, including at least 18 hours at the 5000 level, exclusive of Electrical Engineering 5615-25-35.
2. Complete at least 9 additional hours of thesis credit, Computer Science 5000.
3. Pass an oral examination by a committee of at least three faculty members.

Plan B: Non-Thesis Option
1. Complete 45 hours of courses at the 4000 level or above, including at least 27 hours at the 5000 level, exclusive of Electrical Engineering 5615-25-35.
2. Pass written and oral comprehensive examinations.

* UT Space Institute.

Under either plan, courses which are taken from a department other than computer science must have the approval of the Computer Science Department.

3150 Introduction to Numerical Algorithms and Programming (3) Roots of equations, systems of linear equations, least-squares data fitting, numerical integration, numerical differentiation. Prereq: completion of three literature courses in foreign language. Introduction to programming in FORTRAN. 3150 and 3155 may not both be taken for credit. Students with no knowledge of FORTRAN should take 3155. Prereq or coreq: Mathematics 2860. (Same as Mathematics 3150)

3155 Introduction to Numerical Algorithms (3) Roots of equations, systems of linear equations, least-squares data fitting, numerical integration, numerical methods for ordinary differential equations. 3150 and 3155 may not both be taken for credit. Students with no knowledge of FORTRAN should take 3155. Prereq or coreq: Mathematics 2860. (Same as Mathematics 3155).

3510 Computer Organization and Programming I (3) Problem formulation and advanced programming in FORTRAN. Prereq: completion of three literature courses in foreign language. Elementary computer architecture. Interpretation of memory dumps. Prereq: 3510 or equivalent.

3520 Computer Organization and Programming II (3) Machine assembly language programming, elementary computer architecture. Interpretation of memory dumps. Prereq: 3510 or equivalent.

3570 Programming Languages (4) Comparison and analysis of programming languages and their features. Languages to be discussed will include SNOCOL, LISPY, APL, and PASCAL. Prereq: 3510.

3715 Discrete Structures (3) Introduction to discrete structures useful in computer science. Sets, set logic, Relations, functions, Proof techniques, induction, logic. Graphical representations and algorithms. Prereq: 1510 or 1610 or 3150 or equivalents. Prereq or coreq: Mathematics 2860. (Same as Mathematics 3715).


4225 Numerical Solution to Equations and Numerical Approximations (3) (Same as Mathematics 4225).

4235 Numerical Methods for Ordinary Differential Equations (3) (Same as Mathematics 4235).

4245 Numerical Linear Algebra (3) (Same as Mathematics 4245).

4310 Computation in Statistical Analysis (3) Use of digital computer in standard statistical analyses, such as frequency tabulations, percentiles, and data reduction, correlation and regression, analysis of variance. Not for credit for Computer Science majors. Prereq: Statistics 2100 or equivalent. An elementary knowledge of a procedure-oriented language such as FORTRAN is also assumed.

4330 Independent Study in Computer Science (1-3) Special project in area of student's primary interest to be approved by Computer Science faculty, perhaps jointly with student's faculty advisor. Prereq: Consent of instructor. May be repeated. Maximum: 9 credit.

4510 Data Structures and Nonnumeric Programming (3) Data structures and algorithms for their manipulation. Arrays and orthogonal lists; stacks, queues, rings, doubly-linked lists, trees, dynamic storage allocation; organization of files, programming languages for information structures. Prereq: 3520. Prereq or coreq: Knowledge of SNOCOL equivalent to that gained in 3570.
5450 Computer Modeling and Simulation of Physical Systems (3) Techniques for computer modeling and simulation. Inputs, driving functions, errors, outputs, interactive simulations as applied to selected physical systems. Models to represent spatial relationships. Prereq: 3150 or 3155, and 3520 and Statistics 3450.

5210 Artificial Intelligence (3) Simulation of intelligent processes used in a computer. Techniques of representation, search, and manipulation for various areas: problem solving, game playing, pattern perception, theorem proving, semantic information processing. Computer simulation of AI problems. Prereq: 4510 or consent of instructor. (Same as Electrical Engineering 5690.)

5250 Medical Computing (3) Achievements and problems associated with application of computer technology to field of health care. Various areas of medical computing; laboratory data systems, patient monitoring systems, diagnostic assistance, patient records, automatic history taking, and hospital administration systems. Prereq: 4516.

4730 Analysis of Nonnumeric Algorithms (3) Study of efficient algorithms for searching (e.g., binary search, hash coding) and sorting (e.g., heap sort, shell's sort, quick-sort). Algorithms for other non-numeric applications, such as pattern matching, graph path detection, set operations. Precise notions of time and space complexity. Polynomial complete problems. (Same as Computer Science 5830.)

4750 Interactive Computer Graphics (3) Point plotting, vector generation, interactive graphical techniques, two- and three-dimensional transformations, perspectivity, hidden line elimination, shading, software and hardware system design. Discussion of use of these techniques in design, problem solving, mapping, architecture, and many other areas. Prereq: Senior standing in Computer Science, Electrical Engineering or Geography and a knowledge of computer programming, or consent of instructor. (Same as Geography 4750.)


4740 Theory of Compilers (3) Development of major components of compiler using constructs provided by formal language theory. Recognizers, symbol tables, semantic routines, allocation of storage, code optimization. Prereq: 4510, 4550, and 5750.

4545 Finite Difference Methods for Partial Differential Equations (3) (Same as Mathematics 5465.)

4565 Finite Element Methods (3) (Same as Mathematics 5465.)

4575 Advanced Topics in Numerical Partial Differential Equations (3) (Same as Mathematics 5475.)

5565-65-75 Numerical Mathematics (3) (Same as Mathematics 5565-65-75.)

5670-80 Advanced Operating Systems (3, 3) Theory and analysis of operating systems. Synchronization and deadlocks. Analysis of operating systems using mathematical models, simulation, and hardware and software monitors. Comparison of good heuristic scheduling algorithms with best possible schedules; scheduling anomalies. Case studies of virtual memory systems. Analysis of page swapping and placement strategies. Prereq: 4610 or equivalent or consent of instructor.


5730 Computability and Computational Complexity (3) Computability and decidability; Turing machines and halting problem. Register machines. Recursive and recursively enumerable sets; partial and total recursive functions. Time and space bounded computations; the P vs NP problems. Prereq: 4710.

5750 Theory of Formal Languages (3) Phrase-structure languages, their generators and processors. Type 0, 1, 2, and 3 languages; operations on languages and grammars; deterministic context-free languages. Theory of translation. Prereq: 4710.


5840-50 Pattern Recognition (3, 3) Formulation of pattern recognition problem. Role of pattern recognition in artificial intelligence. Vector representation of signals. Introduction to feature extraction problem. Determination of classifier; nearest neighbor, classifier; and statistical pattern recognition. Prereq: 4510 or consent of instructor. (Same as Electrical Engineering 5870.)

5910-20-30 Special Topics in Computer Science (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

5940-50 Advanced Small Computer Systems (3, 3) (Same as Electrical Engineering 5940-50.)

5970 Independent Study in Computer Science (1-3) Special project under faculty guidance. Prereq: Consent of instructor. May be repeated. Maximum 5 hrs.

Cultural Studies

Asian Studies

4010-20-30 Readings in Asian Literature (4, 4, 4) Prereq: Mastery of intermediate level of Japanese, Chinese, or Arabic and consent of instructor.

4012 Selected Topics in Asian Studies (4) Content varies. May be repeated. Maximum 12 hrs.

4531-32-33-34 Advanced Chinese (4, 4, 4, 4) Taped language program. Prereq: 3531-32 or equivalent or consent of instructor. Must be taken in sequence.

Black Studies

3140-50-60 Directed Readings in Black Studies (1, 1, 1) Designed for students who are interested in doing intensive reading in some area of Black Studies which is defined by the student and the instructor. Prereq: 2010 or 2020 and consent of instructor.

4200 Senior Seminar on Pan-Africanism (4) Explores concepts and philosophies of Pan-Africanism and implications of this ideology for various societal institutions.

4300 Resource Materials in Black Studies (4) Introduction to basic references such as bibliographies, indices, and listings of audiovisuals in Afro-American history, African history, and children's literature. Prereq: 2010 or 2020 and consent of instructor.

4310 Research in Black Studies (4) Deals with Black experience and research process.

4550 Current Issues and Topics in Black Studies (3-4) Problems, topics and issues in area of Black Studies. Content and credit determined by the instructor. May be repeated. Maximum 12 hrs.


4880 Afro-American Psychology (4) (Same as Psychology 4880.)

Cultural Studies

5101 Foreign Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5103 Independent Study (1-12) See page 100.

Linguistics

4000 Topics In Linguistics (3) Content varies. May be repeated. Maximum 9 hrs.

4020-30 Historical Linguistics, Neogrammarians, School, and Growth of Structuralism (3, 3) 4020 A course in the development of a scientific approach to Saussure's Cours and growing impact of anthropology and behaviorism on linguistic studies.

4711-81 English as a Second or Foreign Language (3, 3) (Same as English 4471-81.)
**Economics**

*See College of Business Administration.*

**English**

**MAJOR DEGREES**

M.A., M.ACT, Ph.D.

**Professors:**


**Associate Professors:**

L. R. Burghardt, Ph.D. Chicago; D. A. Carroll, Ph.D. North Carolina; B. K. Dumas, Ph.D. Arkansas; A. R. Eaton, Ph.D. Indiana; B. J. Gaines, Ph.D. Wisconsin; J. E. Gill, Ph.D. North Carolina; R. B. Miller, Ph.D. Brown; D. A. Myers, Ph.D. Indiana; A. B. Panter, Ph.D. Colorado; F. K. Robinson, Ph.D. Texas.

**Assistant Professors:**

J. A. Armitstead, Ph.D. Duke; R. D. Cox, Ph.D. Michigan; D. J. Goalen, Ph.D. Yale; N. M. Goalen, Ph.D. Yale; S. A. Hoffmann, Ph.D. University of Maryland; C. J. Maland, Ph.D. Michigan; V. C. Martin, Ph.D. Tennessee; M. L. Pryse, Ph.D. California (Santa Cruz); M. P. Richards, Ph.D. Wisconsin.

**Visiting Lecturers:**

W. Dykesman, B.A. Northwestern; G. Griffiths, Ph.D. Vanderbilt.

**Detailed Information about the Master’s and doctoral programs, and about individual graduate courses, may be obtained by writing the Director of Graduate Studies of English, McClung Tower. For admission forms, write to the Graduate School.**

**THE MASTER’S PROGRAM**

The departmental requirements for the M.A. degree in English include (1) a thesis and 38 quarter hours of courses in the Department of English or 45 quarter hours without a thesis, (2) evidence of proficiency in one foreign language, and (3) a final examination. The courses should include 12 hours at the 6000 level, 12 hours of additional courses at the 5000-6000 level, and 12 hours at any level for graduate credit, including the 3000-4000 level.

For the degree of Master of Arts in College Teaching (MACT) the requirements include (1) 45 quarter hours of courses in English, arranged as for the non-thesis M.A., (2) 2 hours in a special course designed for MACT students, (3) 3 hours of a tutorial in the teaching of freshman composition, (4) a thesis or 9 additional quarter hours of 5000- and/or 6000-level courses in English, (5) evidence of proficiency in one foreign language, (6) a final examination, and (7) a program of supervised teaching approved by the department.

**THE DOCTORAL PROGRAM**

The departmental requirement for the Ph.D. degree in English is completion of a minimum of three academic years of resident graduate study. This includes a balanced program of at least 72 quarter hours (or the equivalent in English: 36 hours at the 6000 level; 24 additional hours at the 5000-6000 level; and 12 hours for graduate credit at any level, including the 3000-4000 level). In addition, 9 (or 8) hours approved by the department must be taken for graduate credit in a subject or subjects other than English. Normally a student with the M.A. from another university may transfer at least 36 quarter hours.

After all, or most, of the course work has been taken and after the two language requirements have been satisfied, the student will take four preliminary comprehensive examinations from several areas divided as the department directs. Successful completion of these examinations will be followed by the writing of the dissertation and by an oral examination in the field of the dissertation.

Any course in the 5000 or 6000 series may be repeated for credit with the permission of the department.

**1211 Written and Oral English for Foreign Students (6)** Rapid review of English grammar structures and pronunciation with intensive oral, aural, and written drill. Required during the first quarter of residence of all foreign students (graduates, undergraduates and transfer students) who are not excused from it on the basis of the English Proficiency Examination required of every foreign student.

**1221 Written and Oral English for Foreign Students (6)** Emphasis on the more advanced structures of English grammar and on paragraph writing. Required during the first quarter of residence of foreign students who on the English Proficiency Examination demonstrate need for work in English structure, but not at the intensive level of English 1211. Required also of foreign students who complete 1211.

**3070 Modern British Poetry (3)** From Housman to Thomas and more recent poets.

**3080 Modern American Poetry (3)** From Robinson to Stevens and more recent poets.


**3135 Tennyson and His Successors (3)** Includes such poetry as that by the Pre-Raphaelites, the later Romantics, and Decadents.

**3136 Browning, Arnold, and Hopkins (3)**

**3150 Melville (3)**

**3210-20 English Literature and Culture of the Nineteenth Century (3, 3)** Survey of literature dealing with leading movements in politics, science, religion, and the arts. 3210—1850 to 1835. 3220—1835 to 1900.

**3241-19-20-30 Modern Drama (3, 3, 3, 3)** 3241—Continental to 1930; 3242—Continental since 1930. 3420—British, 3430—American. (Graduate credit normally limited to students in Speech and Theatre.)

**3510 Sixteenth-century Prose and Poetry (3)** More and Wyatt to Spenser.

**3520 Elizabethan Drama (3)** Marlowe, Jonson, and others.
effects of language upon culture, and vice versa. Prereq: 3330 or consent of instructor.

4450 Dialectology (3) Theories and methodologies of dialect research, fieldwork and analysis. Prereq: 3340 or consent of instructor.

4455 Varieties of English (3) Theories, methodologies, and findings of English and American varieties of English. Prereq: 3330 or consent of instructor.

4460 Special Topics in English Linguistics (3) May be repeated with consent of department.

4471-81 English as a Second or Foreign Language (3, 3) 4471-81—Applied linguistics in teaching and learning of English as second or foreign language. Phonological and grammatical structure of present-day English. Analysis of differences (phonological, grammatical, and lexical) between English and another language. Prereq: Second year of a foreign language. 4481—Materials and methods of language teaching, with emphasis on preparation of materials and structured teaching situations. Theory of testing language competence and performance, with emphasis on construction of tests. Team teaching with an experienced member of the staff. Prereq: 4471. (Same as Linguistics 4471-81.)

4610-20-30 Black Literature (3, 3, 3) Trends and developments.

4651 Southern Literature through the Nineteenth Century (3) Southern writing from colonial period to the nineteen-nineties, including frontier humorists and local color writers.

4652 Southern Literature in the Twentieth Century (3) Modern Southern literary renaissance, the Southern novel and Agrarians, Faulkner and more recent writers such as Welty, O'Connor, and Porter.

4660 Emerson and Thoreau (3)

4680 American Humor through Mark Twain (3)

4721-31-41 Ballad and Folktales (3, 3, 3) 4721—Study of traditional English and Scottish popular ballads and their North American variants; 4731—Study of native American ballad and folklore; 4741—The folk narrative: functions, categories, and patterns of storytelling.

4850 Milton (3) Emphasis on major poems.

4860 Seventeenth-century Prose and Poetry (3) Bacon and Donne to Marvell.

4910-20 Chaucer (3, 3) 4916—Early poems and Troilus and Criseyde; 4920—The Canterbury Tales.

5000 Thesis

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

5101 Foreign Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5103 Independent Study (1-12) See page 100.

5110 Teaching Expository Writing (1) Using essays and personal experience as bases for Freshman Composition. Weekly sessions on how to prepare and teach such a course. Grading of sample papers; supervised teaching; observation of other sections. Requirement of all first-year Teaching Assistants. S/NC only.

5120 Teaching Writing about Literature (1) Variety of literary works as subjects for student research and analysis. Same format as 5110. S/NC only.

5130 Teaching Business and Technical Writing (1) Forms and strategies appropriate to memo, letters, articles, reports, and proposals. Same format as 5110. S/NC only.

5150 Old English Prose (3)

5170-80 History of the English Language (3, 3) 5170—Phonetic transcription, Old English, development of inflection and syntax. 5180—Middle and Early Modern English, developments in pronunciation and vocabulary.

5210-20-30 Readings in American Literature from Colonial Period to the Present (3, 3, 3)

5240 Readings in Black American Literature (3) Critical analysis of poetry, prose, drama, criticism; historical and cultural background; discussion of relevance or irrelevance of race as influence on text and reader.

5310 Rhetoric and Composition: Theory and Practice (3) Concentration on stylistics and types of expository writing.

5410-20 Readings in Middle English Literature (3, 3)

5510-20 Readings in Literary Criticism from Plato and Aristotle to the Present Day (3, 3)

5610-20-30 Readings in English Literature of the Nineteenth Century (3, 3, 3)

5710-20-30 Readings in English Literature of the Eighteenth Century (3, 3, 3)

5810-20-30 Readings in English Literature of the Renaissance (3, 3, 3)

5860 Introduction to Literary Research (3) Critical examination of aims of English studies, profession of English teacher, scope of literary history, and methods of research, including collecting of information, evaluation of materials, and transmitting results of scholarly developments.

5910-20-30 Readings in English and American Literature of the Twentieth Century (3, 3, 3)

6000 Doctoral Research and Dissertation

6110-20-30 Studies in Elizabethan Literature (3, 3, 3)

6140 Studies in Old English Language and Literature (3) For students who know Old English well and who wish to do research in literature, structure of language, paleography, Anglo-Latin backgrounds and sources, and related topics.

6150 Old English Poetry (3) Prereq: 5150.

6160 Beowulf (3) Prereq: 5150.

6170 Studies in Middle English (3)

6181-82-83 Studies in the English Language (3, 3, 3)

6210-20-30 Studies in American Literature (3, 3, 3)

6241-42 Studies in Colonial American Literature (3, 3) 6241—From Thomas Hariot through Increase and Cotton Mather. 6242—From Jonathan Edwards to adoption of Constitution.

6270-80 Studies in American Fiction (3, 3)

6310-20-30 Studies in Victorian Literature (3, 3, 3)

6410-20-30 Studies in Chaucer (3, 3, 3)

6510-20-30 Studies in Spenser and Milton (3, 3, 3)

6550 Studies in Mode and Genre (3) Content varies. May treat drama, novel, short story, poetry, or satire, the comic, the tragic, etc., depending on professor.

6590 Special Topics (3) Content varies. Humor, history of ideas, biography, autobiography, literature of travel, literature and extra-literary disciplines, etc.

6610-20-30 Studies in English Romanticism (3, 3, 3)

6710-20-30 Studies in Eighteenth-century Literature (3, 3, 3)

6810-20-30 Studies in Drama and Theatre (3, 3, 3)

6860 Textual Bibliography and Criticism (3) Study of evidence gathered from printing process to make critical judgments about text of literary work. Prereq: 5680 or consent of instructor.

6910-20-30 Studies in Twentieth-century Literature (3, 3, 3)

French

See Romance Languages

Geography

MAJOR

DEGREES

M.S., Ph.D.

Geography

Professors: S. R. Jumper (Head), Ph.D. Tennessee; C. S. Aiken, Ph.D. Georgia; E. H. Hammond, Ph.D. California (Berkeley); A. G. L. Line, Ph.D. Northwestern; T. H. Schnidde, Ph.D. Wisconsin.

Associate Professors: T. L. Beif, Ph.D. Iowa; L. W. Brikman, Jr., Ph.D. Wisconsin; J. B. Reeder, Ph.D. Louisiana State.

Assistant Professors: J. R. Carter, Ph.D. Georgia; W. N. Cherry, M.S. Tennessee; B. Ralston, Ph.D. Northwestern.

The Department of Geography offers the degrees of Master of Science and Doctor of Philosophy with concentrations in cartography and remote sensing (M.S. only), physical geography and human systems, urban geography, geography of Anglo-America, and rural and nonmetropolitan geography.

THE MASTER'S PROGRAM

The department requires a minimum of 45 quarter hours beyond completion of a sound undergraduate major program. Of these, half must be in courses numbered above 5000, in addition to thesis, and must include Geography 5150-60 and (at each offering during residency) 5100 Thesis and comprehensive examination required.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those persons who demonstrate productivity in conducting independent research. Students must have achieved the equivalent of a comprehensive Master's program before they will be admitted to the doctoral program. All Ph.D. programs must include Geography 5170 and (at each offering during residency) 5100. Other course requirements will be determined by the student's committee in accordance with specific interests and needs. A normal program contains 75 hours in courses for graduate credit and includes a minimum of 15 hours in the 6000 series. A minimum of 15 hours of graduate credit must be earned in related fields outside the department. Registration in any course in the 6000 series may be repeated for credit with the permission of the department.

Competence in one foreign language and pertinent quantitative techniques are required. The language will be French or German unless otherwise approved by the student's faculty committee. Written and oral qualifying examinations are required.

3410 Intermediate Economic Geography (4) Concepts, theories, and practices in location planning, locational patterns in agriculture, manufacturing, and service activities.
3430 Urban Geography (4) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities.

3450 Rural Geography (4) Geographical appraisal of rural areas of the United States, including small towns and urban fringes. Problems and potentialities of rural areas.

3460 Geography of Resources (4) Study of factors related to variations in resource availability from time to time and from place to place, with particular emphasis upon energy and metal resources.

3520 The Atmospheric System and Man (4) Overview of general circulation system leading to world pattern of climates. Role of climate in agriculture, human comfort and economic activity.

3530 The Land-Surface System and Man (4) Nature and regional variations in relationships among surface form, water, vegetation, and surface materials. Man as evaluator and agent of change.

3510 Political Geography (4) Importance of geographic factors for understanding political relationships within and between nations; spatial implications of political decision-making process; geographic of administrative units.

3600 Cultural Geography (4) Basic concepts of culture; methods and background of cultural geography; world patterns of cultural phenomena.

3790 Geography of Middle America (4) Covers Mexico, Central America, and the West Indies.

3800 Geography of South America (4)

3870 Geography of Asia (4) A survey of the physical geography and culture of the countries of Asia, excluding the Soviet Union.

3910 Regional Geography of the United States and Canada (4) Major physical, economic, and social distributions as they interrelate to give distinctive character to regions of the United States and Canada.

3920 Geography of the American South (4) Geographical appraisal of southeastern United States, including physical environment and human resources. Origin and development of contemporary economic and cultural traits of area.

3940 Geography of Appalachia (4) Interrelation of physical, economic, and social patterns to give distinctive character to the region and its parts, especially Southern Appalachia. Appalachia in perspective in the current American scene.

4075 Geography of Transportation (4) Geographical examination of transportation systems, emphasizing transport of people on highways and by public facilities. Relationship of these systems to changing geography of cities and urban hinterlands.

4100 Quantitative Methods in Geography (4) Quantitative applications of statistical techniques, point pattern analysis and analysis of areal units. Prereq: Mathematics 3000 or consent of instructor.


4240 Historical Geography of the United States (4) Survey of changing human geography of United States during four centuries of settlement and development. Emphasis upon changing population patterns, development of agricultural regions and patterns of urban development.

4510 Principles of Geomorphology (4) (Same as Geology 4510.)

4550 Geography of Soils (4) Soils as physical systems and their relationship to environments. Investigation of specific cases of the role of soil in management of environmental systems.

4610 Industrial Geography (4) Factors affecting location of manufacturing activities, with emphasis on the United States. Prereq: 3410 or consent of instructor.

4650 Geography of Agriculture (4)

4710 Cartography (4) Map construction, reproduction, and use in map reading.

4720 Data Mapping (4) Methods for representing spatial distributions by maps and graphs. Mapable data may include phenomena as diverse as birth rates, voting patterns, and air pollution levels. Prereq: Consent of instructor.

4740 Remote Sensing: Types and Applications (4) Basic principles and uses of aerial photography and other remote sensing techniques. Emphasis upon value of various types of imagery for geographic interpretation and simple mapping. Prereq: Consent of instructor.

4750 Interactive Computer Graphics (3) (Same as Computer Science 4750.)

5000 Thesis

5100 Colloquium in Geography (1) Discussion of departmental research literature, and general topics. Registration at each offering required of resident graduate students. May be repeated. Maximum 8 hrs. S/N only.

5101 Foreign Study (1-2) See page 100.

5102 Off-campus Study (1-12) See page 100.

5150 Introduction to Geographical Research (3) Aims of geographical research; survey of printed source materials; practices in effective presentation of research findings.

5160 Research Design and Field Problems (4-4) Development of research problems, preparation of appropriate study designs, and practical field application. Normally offered as 4-week summer course for 6 hrs credit. Students may not take other courses or have other assignments during this 4-week period.

5170 Geographical Concept and Method (3) Traditional and modern thought regarding nature, scope, problems, and methods of geography.

5200 Special Problems in Geography (2-6) Reading and research on problems or topics of interest to individual students. Student must define topic and receive instructor's approval of study plan before registering for course. May be repeated with consent of instructor.

5250 Topics in Historical Geography (3) Examination of trends, problems, and methods in historical geography. Prereq: 4510 or consent of instructor. May be repeated with consent of instructor. Maximum 9 hrs.

5260 Advanced Cultural Geography (3) Geographic analysis of rural settlement in Eastern United States, with emphasis upon New England, Tidewater East, and Upland South, and specific application to Southern Appalachians. Includes field work and final paper. Prereq: 3660 or consent of instructor.

5310 Topics in Regional Geography of the United States (3) Intensive analysis of problems and trends in one or more regions of United States, excepting American South. May be repeated with consent of instructor. Maximum 9 hrs.

5320 Topics in the Geography of the American South (3) Geographic perspective on economic and cultural aspects of southeastern United States. Topics vary. May be repeated with consent of instructor.

5410 Advanced Topics in Economic Geography (3) Examination of trends, problems, and methods in modern economic geography. Prereq: 3410 or consent of instructor. May be repeated. Maximum 9 hrs.

5520 Advanced Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems, and urban spatial behavior. Prereq: 3400 or consent of instructor.

5550 Topics in Geography of Land-Surface System (3) Examination of trends, problems, and methods in geography of land-surface system. Prereq: 3530 or consent of instructor. May be repeated with consent of instructor.

5560 Topics in Climatology (3) Examination of trends, problems, and methods in modern climatology. Prereq: 3520 or consent of instructor. May be repeated with consent of instructor.

5710 Seminar in Geography (3)

5720 Topics in Quantitative Geography (3) Multivariate analysis applied to problems in geography; research problems utilizing appropriate packaged computer programs; usefulness to geographic research of techniques developed by other disciplines. Prereq: 4100 or consent of instructor.

5740 Advanced Topics in Remote Sensing (3) Advanced research using remote sensing and aerial photographic imagery for interpretation and mapping of geographic data. Prereq: 4740 or consent of instructor.

5915 Regional Geomorphology (4) (Same as Geology 5915.)

6000 Doctoral Research and Dissertation

6110-20 Seminar in Economic Geography (3, 3)

6220-30 Seminar in Urban Geography (3, 3)

6240-50 Seminar in Historical Geography (3, 3)

6260-70 Seminar in Cultural Geography (3, 3)

6310-20 Seminar in Rural Geography (3, 3)

6410-20 Seminar in Regional Geography of the United States, (3, 3)

6510-20 Seminar in Regional Geography of Latin America (3, 3)

6710-20 Seminar in Physical Geography (3, 3)

Geological Sciences

MAJOR

DEGREES

Geology

M.S., Ph.D.

Professors: J. C. Walker (Acting Head), Ph.D. Yale; B. Briggs (Associate Dean), Ph.D. Wisconsin; H. K. McKerrow (Emeritus), Ph.D. Ohio State; J. T. Dunton, Ph.D. Berkeley; E. L. Swanson, Ph.D. Illinois; Ph.D. Tennessee; D. H. Roeder, Ph.D. Goethe University; L. A. Taylor, Ph.D. Lehigh; J. G. Wallis (Emeritus), Ph.D. North Carolina.

Associate Professors: G. M. Clark, Ph.D. Pennsylvania State; K. M. Misra, Ph.D. Western Ontario.

Assistant Professors: T. W. Brodhead, Ph.D. Iowa; D. W. Byrner, Ph.D. Pennsylvania; J. B. Higgins, Ph.D. Virginia Polytechnic Institute; F. B. Keller, M.Phil. Yale; H. Y. McClellan Jr., Ph.D. Harvard.

THE MASTER'S PROGRAM

The department requires a minimum of 45 quarter hours including at least 18 hours in courses (other than thesis) numbered above 5000. A minimum of 24 hours in geology courses, in addition to thesis, is required. Students who enter with equivalent or consent of instructor. May be taken as an undergraduate. Orientation examinations will be given to determine course program, which must be approved by the student's committee.
THE DOCTORAL PROGRAM

Specific course program and thesis topic determined by candidate's faculty committee.

1. Problem to be determined by faculty committee. Requirements include a minimum of 84 quarter hours in courses for graduate credit, in addition to dissertation. These courses must include a minimum of 3000 or 6000 series, of which at least 15 hours must be in the 6000 series. Up to one-third of the required hours may be taken in related fields. A Master's degree is recommended. Registration in any course in the 6000 series may be repeated for credit with the permission of the department.

2. Preliminary examination will be both written and oral.

3. Each Ph.D. student must satisfy a research tool requirement which will be determined by his/her faculty committee and which will consist of one of the following:

a. Demonstration by examination of a reading knowledge in one modern foreign language in which there is a significant body of Geological literature.

b. Completion of course 3030 in an appropriate foreign language with a B or better.

c. Courses (minimum of 6 hours) at 3000 level or higher taken for undergraduate credit and completed with a B average in appropriate mathematics, statistics, or computer science courses. The courses must be taken during a student's graduate program and must be approved by the student's entire committee.

In no case will option c above be available unless the student has had reading training as a college undergraduate in an appropriate foreign language.

*3160 Introduction to Earth Materials (4) Study of minerals and rocks. Laboratory includes both hand specimen and analytical methods of identification. Prereq: 1410. 2 hrs and 2 labs.

*3180 Mineralogy (4) Introduction to crystallography and study of minerals. Laboratory includes hand specimen, chemical and x-ray methods of identification. Prereq: 1410, Chemistry 1110-20 or equivalent. 3 hrs and 1 lab.

*3210-20 Invertebrate Paleontology (4, 4) Systematic review of important invertebrate fossil groups. 3210—Proterozoic to Brachiopoda, including sponges, coelenterates and brachiopods. 3220—Phoronida to Hemichordata, including an-nelids, molluscans, arthropods and echinoderms. May be taken separately or in any order. Prereq: 3260. Recommended 3210-20 or consent of instructor. 3 hrs and 1 lab or field period.

3250 Micropaleontology (4) Microscopic remains of animals and plants with special emphasis on stratigraphically important groups. Prereq: 3210 or consent of instructor. 3 hrs and 1 lab.

3260 Paleobiology (4) Introduction to principles and materials of paleontology as applied to interpretation of earth history. Prereq: 1420, 1425. 3 hrs and 1 lab, field period.

3270 Geological History of Land Organisms (4) Geological history and development of terrestrial biota and ecosystem with special emphasis on fossil record of land plants and vertebrates. Prereq: Biology 1210-20 or consent of instructor. 3 hrs and 1 lab or field period.

*3310 Introductory Petrology (4) Introduction to classification and properties of igneous and metamorphic rocks, processes which produce them, and tectonic environments in which they form. Laboratory emphasizes both hand specimen and microscopic study of important rock types. Prereq: 3180. 3 hrs and 1 lab.

*3330 Geology of East Tennessee (4) Lectures and field excursions. Prereq: 12 hrs of geology and consent of instructor.

*3360 Stratigraphy-Sedimentation (4) Introduction to stratigraphic principles and practices and of sedimentary processes and interpretation of depositional environments. Prereq: 1420 and 3180. 3 hrs and 1 lab or field period.

3370 Structural Geology (4) Introductory discussion of structures such as faults, joints, cleavage, and primary structures. Laboratory work includes depth and thickness problems, structure sections, structure contour maps. Prereq: 1420, Mathematics 1840-50 or equivalent. 3 hrs and 1 lab.

*3410 Principles of Ground Water Geology (3) Geological processes affecting the occurrence and behavior of water. (Same as Water Resources Development 3410.) 2 hrs and 1 lab.

*3510 Introductory Environmental Geology (4) Geologic problems involving earth environment and resources, and geologic parameters associated with their control and misuse. Prereq: 1420 or consent of instructor. 2 hrs and 2 labs or field periods.

3610 Quaternary Geology for Engineers (3) Erosional and depositional processes, landforms, ground water. Prereq: 2510 or equivalent. 2 hrs and 1 lab or field period.

3710 Origin and Evolution of the Continents and Ocean Basins (4) Introductory study of origin and evolution of the earth's crust with emphasis on modern concepts of continental drift and plate tectonics. Prereq: 1420.

4110 Principles of Economic Geology (4) Formation of mineral deposits. Prereq: 3180, 3370, or equivalent.

4115 Elementary Applied Geophysics (4) Basic principles of electrical, seismic, gravity and magnetic methods and interpretation. Prereq: 3180 or 2210. 3 hrs and 1 lab.

4130 Sedimentology (4) Introduction to physical processes of sedimentation: transport of sediments and formation of sedimentary structures. River flows, waves, tides, and ocean circulation. Prereq: 3180. 3 hrs and 1 lab.

4230 Paleocoeology (4) Principles of environmental analysis applied to fossil assemblages and associated lithologies. Prereq: 3260 or consent of instructor. 3 hrs and 1 lab.

4240 Paleobotany (4) Survey of fossil record of plants with particular emphasis on comparative morphology and evolutionary trends in major plant groups, and chronological succession and geographic distribution of past floras on earth. Prereq: 1420 or 2210; Botany 3010-20 or consent of instructor. (Same as Botany 4240.) 3 hrs and 1 lab or field period.

4310 Geologic Mapping (4) Interpretation of geologic maps and aerial photographs. Prereq: 12 hrs geology. 3 hrs and 1 lab or field period.

4370 Tectonic Styles (4) Elements, habitats, and geotectonic causes of basic styles of tectonic deformation are presented on maps, sections, aerial photographs and laboratory. Prereq: 3370 or consent of instructor. 3 hrs and 1 seminar or lab.

4440 Field Geology (8) Five-week field course, first term summer quarter. Advanced undergraduates or first-year graduates in geology. Emphasizes writing skills. Prereq: 12 hrs geology and consent of instructor.

4460 Geologic Photography and Photogrammetry (4) Principles of terrestrial and aerial geologic photography, including photographic principles and practice, geometry of terrestrial and aerial photographs, and image interpretation. Prereq: 3370 or consent of instructor. 3 hrs and 1 lab.

4510 Principles of Geomorphology (4) Geomorphic processes acting on earth's surface and landforms produced. Prereq: 1410 or consent of instructor. (Same as Geography 4510.) 3 hrs and 1 lab.

4550 Optical Mineralogy (4) Identification of opaque substances by immersion methods, using petrographic microscope.

4610 Principles of Geochemistry (4) Application of chemical principles to geologic problems. Emphasis on crystal chemistry and relation between basic atomic structure and distribution and behavior of elements in the earth's crust. Prereq: Chemistry 1110-20 or equivalent. Recommended: 3310.

4650 Mineral Phase Equilibria (3) Principles of phase chemistry and application of phase equilibria in rocks and minerals as aids to understanding conditions of formation and modification of rocks. Prereq: 4610 or consent of instructor.

4810 Special Problems in Geology (1-4) Prereq: Consent of instructor. May be repeated. Maximum 4 hrs.

5000 Thesis

5050 Geochemistry of Ore Mineral Deposits (3) Study of ore deposits based on experimental, empirical, and theoretical geochemical considerations. Prereq: 4650 and 4110 or consent of instructor.

5069 Experimental Geochemistry Laboratory (1-3) Independent lab study of problem in geochemistry using lab techniques. Prereq: Consent of instructor.

5120 Geophysics—Gravity and Magnetic Methods (4) Potential methods, introduction to geodesy and paleomagnetism, integration of empirical and theoretical geochemical information, differential and integral calculus or consent of instructor. Advanced engineering mathematics desirable. 3 hrs and 1 lab.

5310 Geoscientific Exploration Methods (4) Seismic reflection methods, interpretation of reflection data, interpretation of surface and subsurface geophysical data, petrography of igneous rocks, processes which produce them, and tectonic environments in which they form. Prereq: 3180 or consent of instructor. 3 hrs and 1 lab.

5210-20 Special Problems in Geology (1-4, 1-4, 1-4)

5290 Quaternary Problems (4) Interdisciplinary approach to interpretation of physical and biological phenomena directly or indirectly influenced by Quaternary glaciations. Prereq: Elements of geology (3 quarters) or consent of instructor. (Same as Botany 5290 and Zoology 5290.)

5310 Advanced Stratigraphy and Sedimentation (4) Integrated field-oriented study of sedimentary rocks, analysis of depositional environments, paleocurrents, and paleoecographic-paleotectonic setting. Prereq: 3360 or equivalent, 4130.

5340 Seminar in Local Stratigraphy (1) Stratigraphy of Knoxville area.

5350 Selected Topics in Geology (1) Presentation of graduate research, topics from current literature, and subjects of general interest. Registration required each quarter except summer for resident full-time graduate students. S/NC only.

* Not available for graduate credit for geology majors.
5460 Electron Microprobe and X-Ray Spectrographic Analysis (3) Theory and application of electron microprobe and x-ray spectrographic analysis to chemical analysis, emphasis on earth sciences. Prereq: 3360 or equivalent. 2 hrs and 2 labs.

5620 X-Ray Diffraction: Theory and Application (4) Production and use of x-rays in identifying crystalline substance; powder camera, diffractometer, Gandolfi camera, and single crystal methods. Prereq: 3180 or consent of instructor. Recommended: 4550. 5 hrs and 1 lab.

5640 Clay Mineralogy (4) Origin of clay minerals; structures and properties; application of mineralogical techniques in clay mineral studies. Prereq: 3180 and 5630 or equivalent. 2 hrs and 2 labs.

5650 Thermodynamics for Geologists (3) Principles of chemical thermodynamics related to geologic processes. Prereq: Chemistry 1110-20-30 and Mathematics 1630 and calculus of a single variable or equivalents. 3 hrs and 1 lab.

5670 Geochemical Prospecting (3) Theory and practice of geochemical prospecting for metallic ore deposits, i.e., use of chemical analyses of rock, soil, plants, water, and stream sediment for locating ore. Prereq: 4110 and Chemistry 1110-20-30 or equivalents.

5710 Advanced Palentology (4) Fossil invertebrates.

5810 Ore Microscopy (4) Study of ore mineral assemblages by reflected light microscopy. Techniques such as x-ray diffraction and electron microprobe are used, as necessary. Prereq: 4110, 4550, and consent of instructor. 2-2 hr labs.

5850 Regional Geology in Economic Geology (3) Origin, occurrences, and impregnations of specific mining districts and deposits, followed by trip between quarters to study in field. Prereq: 4110 and consent of instructor. May be repeated. Maximum 9 hrs. 2 hrs and 1 field trip.

5915 Regional Geophysics (4) Selected geophysically-related areas, which have common elements such as history or development, related processes which have produced geologically-similar assemblages of landforms. May be repeated with consent of department. (Same as Geography 5915.)

6000 Doctoral Research and Dissertation

6110 Seminar in Stratigraphic Geology (3)

6210 Seminar in Paleontology (3)

6310 Seminar in Structural Geology (3)

6410 Seminar in Mineralogy (3)

6510 Seminar in Petrology (3)

6610 Seminar in Economic Geology (3)

6710 Seminar in Geochemistry (3) Prereq: 4610 or consent of instructor.

6810 Seminar in Geomorphology (3) Prereq: 4510 or consent of instructor.

GERMANIC AND SLAVIC LANGUAGES

MAJORS

German

MA. M.A.

GERMAN LANGUAGE AND LITERATURE

Ph.D.

Emeritus Professors:

E. T. Henkamer, Ph.D. Bonn (Germany);

R. L. W. Nordlie, Ph.D. Ohio State.

Professors:

H. Krazt (Head), Ph.D. Ohio State; J. E. Felen, Ph.D. Pennsylvania; H. W. Fuller, Ph.D. Wisconsin; R. L. Miller, Ph.D. Cornell; J. C. Osborne, Ph.D. Northwestern.

Associate Professors:

N. A. Lauckner, Ph.D. Wisconsin; D. E. Lee, Ph.D. Stanford; M. P. Rice, Ph.D. Vanderbilt.

Assistant Professors:

J. L. Elliott, Ph.D. Michigan; D. M. Flene, Ph.D. Indiana; C. J. Melaitor, Ph.D. Chicago; U. Richterhoff, Ph.D. Germany.

The Department of Germanic and Slavic Languages offers three advanced degrees. They are the Master of Arts (M.A.) in German, the Master of Arts in College Teaching (M.A.T.) in German, and the Doctor of Philosophy (Ph.D.) in German Language and Literature.

THE MASTER'S PROGRAM

In addition to the general Graduate School requirements as stated on page 19, the department requires 36 quarter hours in approved courses, including at least 18 hours in courses numbered above 5000. In addition to coursework, the student is required to write a thesis, for which he/she may get a maximum of 9 hours credit. The maximum number of credit hours for the M.A. is 45 quarter hours.
5000 Thesis
5010 Foreign Study (1-12) See page 100.
5012 Off-campus Study (1-12) See page 100.
5013 Independent Study (1-12) See page 100.
5200 Proseminar (3) Bibliography; methods; illus-

trative problems; preparation of papers.
5210-20-30 College Teaching of German (1, 1, 1) Required of all M.A., MACT, or Ph.D. candi-
dates, except those whose previous teaching experience warrants excuse from this require-
ment or who wish to pursue vocations other than teaching.
5410-20-30 Medieval German Language and Litera-
ture (3, 3, 3) 5410—Introduction to Middle High
German; 5420-30—Readings in Medieval German
Language.
5500 Studies in German Literature (3) Content
varies. May be repeated. Maximum 9 hrs.
5510 German Humanism and the Reformation (3)
5520 German Baroque Literature (3)
5530 The Enlightenment and the Rococo (3)
5540 German Classicism (3)
5550 Goethe’s Faust (3)
5560 German Romanticism (3)
5570 German Realism and Naturalism (3)
5580 Modern German Literature (1889-1945) (3)
5590 Modern German Literature (1945-Present) (3)
5600 German Literary Theory and Criticism (3)
5610-20-30-40-50-60 Directed Readings in Ger-
man Language and Literature (3, 3, 3, 3, 3, 3)
5710 Introduction to Old Norse (3) Phonology,
morphology, and syntax of Old Norse. Represen-
tative readings in Old Norse.
5720 Readings in Old Norse Prose (3) Intensive
readings of Old Norse prose works. Icelandic
sagas as literary genre.
5730 Readings in Old Norse Poetry (3) Intensive
reading of Eddic poems as a literary genre and
repository of ancient Germanic customs, leg-
ends, and mythology.
6000 Doctoral Research and Dissertation
6100 Gothic (3) Phonology, morphology, and syn-
tax of Gothic language, Relationship to Indo-
European languages and other Germanic lan-
guages. Readings from Gothic Bible.
6120-30 Old High German (3, 3) 6120—Introduct-
ion: phonology, morphology, and syntax of Old
High German of eighth and ninth centuries.
Dialects. Representative prose readings. 6130—
Literature and Linguistics; prose and poetry of
period from linguistic and literary point of view.
6140 Old Saxon (3) Phonology, morphology, and
syntactic of Old Saxon. Representative readings.
6210-20-30-40-50-60 Seminar in German Litera-
ture (3, 3, 3, 3, 3, 3) May be repeated.
6310-30 Seminar in German and Germanic
Philo
gy (3, 3, 3) May be repeated.

Russian
3010-20-30 Elements of Russian for Graduate
Students and Seniors (3, 3, 3) For graduate stu-
dents preparing for language examinations and
seniors desiring reading knowledge of a second
foreign language. Prereq: 2 years of some for-
eign language in college or consent of depart-
ment. Undergraduate credit only. No credit for
students having completed 1 yr of Elementary
Russian.
3210 Nineteenth-century Russian Literature
in English Translation (3-4) Realism and the novel;
selections from works of Pushkin, etc.
3220 Works of Leo Tolstoy in English Translation
(3-4) War and Peace, Anna Karenina, and other
works.
3221 Works of F. M. Dostoevsky in English
Translation (3-4) Crime and Punishment, Brot-
thers Karamazov and other works.
3230 Twentieth-century Russian Literature
in English Translation (3-4) Russian modernism
and literature under the soviets.
3240 The Russian Drama in English Translation
(3-4) Selections from works of Fontoviz, Grib-
edov, Pushkin, Gogol, Ostrovsky, Turgenev,
Chekhov, and others.
3250 The Works of Ivan Turgenev and Anton
Chekhov in English Translation (3-4)
3260 Russian Folklore in English Translation (3-4)
3270 Russian Philosophical and Theological
Thought (3) A study of the development of phi-
losophical and theological thought in Russia
from the Middle Ages to the Revolution. Special
emphasis on the expression of this thought in
Russian literature and literary criticism. No
knowledge of Russian required. (Same as Philos-
ophy 3270 and Religious Studies 3270.)
4010 Selected Topics in Russian and East Euro-
pean Studies (3) Interdisciplinary seminar on
selected topic using comparative approach.
4110-20-30 Studies in Major Russian Writers
(3, 3, 3) Content varies. Pushkin, Lermontov, Gogol,
Turgenev, Tolstoy, Dostoevsky, Chekhov and
others. Prereq: 9 hrs of 3000 courses (exclusive of
3010-20-30, 3210-20-30-40-50-60-70, 3310) or
equivalent. May be repeated.
4120-20-30 Studies in Russian Literary Periods
(3, 3, 3) 4120—Russian Romanticism. 4220—Ru-
ssian Realism. 4230—Russian Modernism. Prereq:
9 hrs of 3000 courses (exclusive of 3010-20-30,
3210-20-30-40-50-60-70, 3310) or equivalent.
4250 Introduction to Descriptive Linguistics
(3, 3) (Same as French, German, and Spanish
4260.)
4260 Introduction to Historical and Compari-

tive Linguistics (3, 3) (Same as German, French,
and Spanish 4260.)
4270 Introduction to Slavic Linguistics (3)
3410-20-30 Advanced Studies in Russian Lan-
guage and Literature (3, 3, 3, 3) For students
majoring or minoring in Russian who are inter-
ested in language and linguistics. Includes prob-
lems in morphology and syntax, stylistics and
translation techniques, and history of Russian
language as well as other special problems for
advanced students of Russian. May be repeated.
Maximum 9 hrs each.
4410-20-30 Directed Readings in Russian (3, 3, 3)
Intended primarily for students participating in
program in Russian and East European Area
Studies, course will involve individual study relat-
ing to student’s major field. Prereq: 9 hrs of
3000 courses in Russian (exclusive of 3010-
30-30, 3210-20-30-40-50-60-70, 3310) or equivalent.

Greek
See Classics

DEGREES
MA, MACT, Ph.D.

Major History

MA, MACT, Ph.D.

Directors

P. L. Grafl (Head), Ph.D. Harvard; G. Broeker
(Emiratisa), Ph.D. Dunedin; E. A. A. J. Legrand,
Ph.D. Harvard; J. D. C. Daniel, Ph.D. Maryland;
R. E. Dunn, Ph.D. California (Berkeley),
S. F. Pink (Emeritus), Ph.D. Princeton;
A. G. Haas, Ph.D. Chicago; Y. P. Hao, Ph.D.
Harvard; N. A. Hasinn, Ph.D. California (Berkeley);
C. O. Jackson, Ph.D. Emory;
M. A. Klein, Jr., Ph.D. Columbia; R. A. Landen,
Ph.D. Princeton; J. R. Sheeler (Visiting), Ph.D.
West Virginia.

Assistant Directors

S. D. Becker, Ph.D. Case-Western Reserve;
N. L. Bann, Ph.D. Stanford; S. J. Kleinberg,
Ph.D. Pittsburgh; R. B. Rice, Ph.D. Harvard.

THE MASTER’S PROGRAM

Major of Arts—Plan I: Course
requirements include History 5240, and
either 5250 or 5260; one M.A. reading
course, one M.A. thesis, or 3000 credit
hours for Master’s Program. Total hours
including thesis—45.

* Distinguished Service Professor.

* Alumni Distinguished Service Professor.
Plan II: History 5240, and either 5250 or 5260; two M.A. reading courses; 12 additional hours 5300 or above, at least 2 of which must be completed in 5020 and 5110. Total hours—45. Plan I and Plan II require evidence of proficiency in one foreign language before the M.A. degree is granted.

Master of Arts in College Teaching—Course requirements include History 5240-50-60, 5271-72-73, and Continuing and Higher Education 5110. Students must spend one year as a graduate assistant and one year as a teaching assistant. Total hours, including thesis—60. Students seeking the M.A.C.T degree may substitute 9 quarter hours of courses numbered 6300 or above for the Master's thesis.

THE DOCTORAL PROGRAM

1. Admission: (a) Acceptable scores on the Graduate Record Examination (General Aptitude and History Achievement).
   (b) Students successfully completing the M.A. degree at The University of Tennessee must be recommended by the Department of History.
   (c) Students from other institutions should have an M.A. degree and must be recommended and approved by the Graduate Awards and Review Committee after their first year of work at The University of Tennessee.

2. Residence and Course Work: Beyond the Bachelor's degree, the University of Tennessee requires the candidate to reside under the supervision of the staff of The University of Tennessee.

3. Language Requirements: Candidates shall be required to possess a reading knowledge of one language and such additional language or languages as may be determined by the student's graduate committee. Under normal circumstances, students specializing in European history will need two languages. The committee may also specify any other research tools, such as statistics, which it regards as essential for the student's preparation.

The foreign language requirements may be satisfied in one of two ways:
(a) By examination. When the student is ready to take a language examination he/she should consult with an advisor. The appropriate forms and the time of the examination may be obtained from the Graduate School.
(b) By course work. Upon consultation with the advisor, a student may elect to complete an appropriate 3010-20-30 sequence in a language department (or an intermediate sequence in a language in which no 3010-20-30 sequence is available). Satisfactory completion requires that a student must have at least a B in the final quarter.

4. Preliminary Examinations and Committee: Incoming students will be advised by the department head. The preliminary examinations must be taken after all course work is completed, language requirements fulfilled, and at least nine months before the degree is expected. These exams should normally be taken before beginning the ninth quarter of work toward the doctorate. The candidate must present four fields, distributed as follows: one major field (history) with minor fields (history); and one minor field which may be either in history or outside the department. In any case, the student is required to have 9 hours of graduate work outside the History Department. Three of the four areas listed below must be represented by a major or a minor field, or both.

I. Ancient and Medieval
   (1) Ancient Near East
   (2) Greece
   (3) Rome
   (4) Early Middle Ages, 375-1122
   (5) Late Middle Ages, 1095-1450

II. Early Modern
   (1) Renaissance and Reformation
   (2) Europe, 1559-1815
   (3) American History to 1815
   (4) Latin America, 1492-1825

III. Modern
   (1) Europe, 1815-1914
   (2) European World Since 1914
   (3) United States, 1815-present
   (4) Latin America, 1789-present
   (5) East Asia, 1841-present
   (6) Middle East, 1798-present

IV. National, Sectional and Topical
   (1) England, 1485-1763
   (2) Great Britain, 1760-present
   (3) France, 1559-1815
   (4) France, 1789-present
   (5) Germany, 1555-1806
   (6) Germany, 1806-present
   (7) Russia, 1800-1900
   (8) Russia, 1900-present
   (9) Colonialism and Imperialism
   (10) Diplomatic History of the United States

V. Social and Cultural History of the United States
   (1) The South
   (2) Frontier and Westward Movement
   (3) Afro-American

6. Dissertation and Final Examination:
   (a) Preliminary examinations will be written and oral.
   (b) Dissertation and Final Examination:
      Original research forms the basis for the dissertation. After the dissertation has been completed, a final oral examination will be given on the dissertation in its historical context.

3060-70-80 History of Western Religious Thought and Institutions (3, 3, 3) Same as Religious Studies 3060-70-80.
3140-50-60 History of England (3, 3, 3) 3140—To 1688, 3150—1689 through the Reform Bill of 1832, 3160—1832 to the present.
3311-21 History of Tennessee (3, 3) 3311—Eighteenth Century to Civil War Era. 3321—1865 to present.
3411-12-13-14 Renaissance and Reformation (3, 3, 3) 3411—Renaissance; 3412—Reformation; 3413—Catholic Reformation and Wars of Religion. (Same as Religious Studies 3411-12-13-14.)
3445-46 History of France (4, 4) 3445—To 1875. 3446—Since 1871.
3470-80-90 History of Russia (3, 3, 3) 3470—To 1801. 3480—1901-Nineteenth Century. 3490—Twentieth Century.
3510-20 The American Colonies and the American Revolution (3, 3) 3510—Settlements to 1754. 3520—1754-1789.
3710-20-30 History of Germany (3, 3, 3) 3710—First Reich to 1713. 3720—Habsburg and Hohenzollern and Formation of Second Reich, 1713-1890. 3730—From a unified to a divided Germany, 1890 to present.
3740 The City in Europe, ca. 1200-1900 (3) Survey of European urban growth, with comparative analysis of the major periods of urbanization of the thirteenth and fourteenth centuries. Emphasis on the relationship between demographic, economic and social development of cities and cultural development.
3751-52 Ancient Near Eastern Civilization (3, 3) 3751—Egypt and Mesopotamian Bronze Ages. 3752—Late Bronze and Iron Ages.
3760-70 The Ancient World (3, 3) 3760—Greece. 3770—Rome.
3780-90 History of the Middle East (3, 3) 3780—Hiss and spread of Islamic Civilization to the 16th century. 3790—The impact of the West on the Middle East from the sixteenth century to World War I.
3795 Contemporary Middle East (4) Background of current problems in the area, from World War I to present.
3800 North Africa Since 1830 (3) Morocco, Algeria, Tunisia, and Libya in the nineteenth and twentieth centuries.
3810-20-30 History of East Asia (3, 3, 3) 3810—Traditional China and Japan, ancient to mid-nineteenth century. 3820—Modern China, Japan and Korea, mid-nineteenth century to 1920s. 3830—Contemporary China, Japan, and Korea, 1920s to present.
3850-60-90 History of Latin America (3, 3, 3) 3870—Exploration, conquest, settlement and Colonial life to 1800. 3880—Major countries of South America, 1800 to present. 3890—Mexico, Central America and the Caribbean. 1800 to present.
4015 Studies in History (3-4) Variable content course affording opportunity to offer subject matter not covered in an existing course. May be repeated.
4120-30 History of Colonialism and Imperialism (3, 3) 4120—Background; age of discovery and exploration to nineteenth century. 4130—Nineteenth century to present.
4250-60-70 European Intellectual and Cultural History (3, 3, 3) 4250—From Reformation to the Enlightenment. 4260—Enlightenment to 1800. 4270—From the Enlightenment to the Age of Realism, 1700-1870. 4280—From Realism to the Age of Revolution, 1870-1918. 4290—From Subjectivism to Relativism, 1870-present.
4280 Women in European History (4) Comparative analysis of role and image of women in Medieval, Renaissance, and Victorian periods. Attention given to parallel changes in structure and relations as well as in Western culture and women's protest movements.
4290 Women in American History (4) Approaches of 4290 applied to American Society.
4310-20-30 History of American Foreign Relations (3, 3, 3) 4315—Revolution to 1901. 4320—1901-1941. 4330—1941 to present.

4360 The United States in World War II (4) Military, diplomatic, and domestic experience.

4370 U.S. Military History, 1754 to the Present (4) Examination of nation's broad strategic aims and means used to attain them, shifting strategy, tactics and weaponry involved in our wars, and relationship between American society and its armed forces.

4380 Civilian-Military Relationships in the Modern World (4) From 1865 to present, civilian-military affairs from about 1900 to 1960 in Western Europe, Russia, and America; emphasis on Western Europe: e.g., Dreyfus Affair, Army in Nazi Germany, and Truman-MacArthur controversy.

4410-20-30 Europe in the Twentieth Century (3, 3, 3) 4410—1880-1919. 4420—1919-1939. 4430 to present.

4470 Poland and Its Neighbors (3) A survey of Polish history from its beginnings to present with some emphasis on the Polish question within the context of modern international affairs.

4480 Russian Intellectual History (3) From eighteenth century to present, emphasizing problems of Westernization, nationalism, and revolutionary tradition.

4490 Soviet Foreign Policy (3)

4500 History of Medieval England (3)

4519-20 Tudor-Stuart England (3, 3) 4510—1485-1603. 4520—1603-1714.

4551 Great Britain from Burke to Bright (1780-1848) (3)

4570 Twentieth-century Britain (3)

4580 Revolution and Reform: Ireland in the Nineteenth and Twentieth Centuries (4)

4590 History of Canada, 1775—Present (3)

4610-20-30 The American Frontier and Westward Movement I, II, III (3, 3, 3) Settlement and development of the “West” throughout American history, 4610—From the Atlantic to the Mississippi. 4620-30—The Trans-Mississippi West.

4640-50-60 Social and Cultural History of the United States (3, 3, 3) 4640—Colonial society and Early Nation to 1825. 4650—1825-1890. 4660—1890-present.

4670 Cities and Urbanization in American History (4) Origins, growth and influence of American cities in development of the nation, from colonial era to present.


4741 Italian City-States, 1250-1550 (3) Evolution of urban civilization in northern and central Italy in medieval and Renaissance periods. Architectural-historical topics and forms studied in sociocultural and cultural contexts. Florence is primary focus, but other major city-states also included.

4770-80 Austria and Central Europe (3, 3) 4770—To 1607. 4780—Since 1607.

4791 Modernization of the Middle East (3) Advanced reading and discussion course which examines key facets of political, economic, and social change in contemporary Middle East with emphasis on institution building, elites, and ideology. Prereq: 3795 or consent of instructor.

4792 Historical Writers in Islamic History (3) Advanced reading course which introduces the student to the major historical writers of the Middle East from Ibn Khaldun to modern times. Prereq: 6210 Middle East History or consent of instructor.

4811-21 History of Japan (4, 4)

4840 History of Mexico (3)

4850 History of the Caribbean (3) Caribbean region from discovery and colonization to contemporary times.

4870-80-90 China (3, 3, 3) 4870—Cultural history of China. 4880—History of contemporary China.


5000 Thesis

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

5015 Periods in European History (3) May be repeated. Maximum 9 hrs.

5016 Periods in American History (3) May be repeated. Maximum 9 hrs.

5011 Foreign Study (1-12) See page 100.

5021-5225 A. M. Reading Courses (3 hrs each) Directed reading courses in preparation for fields required for Master's oral examination. 5211, Ancient; 5212, Medieval; 5213, Early Modern Europe; 5214, Europe Since 1789; 5215, American History to 1815; 5216, American History Since 1789; 5217, Latin America; 5218, Far East; 5219, Colonialism and Imperialism; 5221, England; 5222, Russia; 5223, Germany; 5224, France; 5225, Middle East. Open only to Master's candidates in history. S/NC only.

5240 Introduction to Historical Research (3) Principles and techniques of research in the study of history. Required of all candidates for advanced degrees who do not present evidence of similar training elsewhere.

5250 European Historiography (3) Introduces the student to the historical literature of leading European nations.

5260 American Historiography (3) Like 5250 in the American field.

5271-72-73 The Teaching of College History (0, 0, 3) Introduction to problems of teaching at college level. Emphasis in curriculum, types and levels of courses, and techniques of teaching. Prereq: Consent of instructor. Required of all candidates for the MACT. Credit will be withheld until the completion of 5273, with grades of "S" or "NC" submitted at end of each of first two quarters.

5280 Philosophy and Methodology (3) Philosophies of history and their relationship to milieux from which they emerge; modern trends in historical methodology.

5290 Quantitative Analysis of Historical Data (3) Prereq: Sociology 5320 and 5330, or consent of instructor.

5300 Topics in History (3)

5310 Topics in Women's History (3)

5320 Topics in Historical Editing (3) Principles and practice of editing documents.

5360 Topics in American Foreign Relations (3)

5410 Topics in Early Modern European History (3)

5440 Revolution and Restoration in Central Europe, 1780-1850 (3) Reform, resistance, and the advent of Liberalism and Nationalism.

5444 Topics in French History (3)

5445 Topics in Nineteenth-century European History (3)

5450 Topics in Twentieth-century European History (3)

5480 Topics in Russian History (3)

5510 Topics in Tudor-Stuart England (3)

5520 Topics in Modern English History (3)

5550 Reaction and Reform in England, 1789-1848 (3)

5560 Anglo-Irish Relations (3)

5640 Topics in American Social and Cultural History (3)

5645 Topics in American Urban History (3)

5650 Topics in the American Westward Movement (3)

5660 Topics in Negro History (3)

5670 Topics in American Colonial History (3)

5675 Topics in the Early National Period of American History (3)

5680 Topics in Nineteenth-century American History (3)

5690 Topics in Twentieth-century American History (3)

5720 Topics in Medieval History (3)

5740 Topics in European Urban History (3)

5750 Topics in Ancient History (3)

5780 Topics in German National Socialism (3)

5790 Topics in Middle Eastern History (3)

5810 Topics in Andean History (3)

5820 Topics in Mexican History (3)

5850 Topics in Chinese History (3)

5860 Topics in Japanese History (3)

5910-20 Topics in Southern History (3, 3) 5910—Old South, 5920—New South.

6000 Doctoral Research and Dissertation

6210-20-30-40 Directed Readings (3, 3, 3, 3) Individual readings directed toward preparation for preliminary examination fields. Open only to candidates for Ph.D. degree who are in residence and who have been in residence at least two quarters. Only one course may be taken in preparation for each of four fields. Depending on field in which he/she is reading, student will be assigned to appropriate member of department. S/NC only.

6300 Seminar in Special Studies (3)

6310 Seminar in Tennessee History (3)

6350 Seminar in American Diplomatic History (3)

6410 Seminar in Western Europe (3)

6444 Seminar in French History (3)

6480 Seminar in Russian History (3)

6510 Seminar in English History (3)

6610 Seminar in American Colonial History (3)

6620 Seminar in the Era of the American Revolution (3)

6830 Seminar in Early National Period of American History (3)

6835 Seminar in Jacksonian Period (3)

6840 Seminar in Social and Cultural History of the United States (3)

6850 Seminar in the American Westward Movement (3)

6710 Seminar in Medieval Institutions (3)
subject to the approval of the department.

Courses may be offered upon the initiative of the department whose course number ends in 31 or 32, and on the student's transcript. Honors courses listed in the Graduate Catalog are permitted only with the word "Honors" both in the timetable and on the student's transcript.

Any 3000 or 4000 course in the Department of Mathematics and Statistics is intended primarily for teachers of high school mathematics.

Before admission to this program, the applicant must have taken (a) a certification for teaching secondary mathematics in at least one of the states of the United States, or (b) three years of successful elementary or secondary school teaching experience. Evidence of the requirement being met must be supplied by the student.

Applicants for admission to this program must take the Graduate Record Examination (aptitude portion), and have had at least one year of college mathematics including analytic geometry. The following requirements must be met:

1. Completing 45 hours of course work, of which at least 9 must be at the 5000 level. The course work must include:
   a. 36 hours of mathematics courses numbered above 4000 and approved by both the major and the departmental requirements:
   b. 9 hours of additional work from mathematics courses numbered above 5000. Of the 45 hours, 15 in courses approved by the student whose supervisory committee gives its approval may choose the field in which they wish to work in acceptable courses numbered above 4000. Of the additional hours, 9 may be in an area outside the department and 18 must be in courses in mathematics numbered above 5000.

After two quarters of graduate study, a student whose supervisory committee gives its approval may choose the non-thesis option, for which 45 hours of work in courses numbered above 4000 are required. Of these, 27 hours must be earned along with 36 additional hours of work in acceptable courses numbered above 4000. Of the additional hours, 9 may be in an area outside the department and 18 must be in courses in mathematics numbered above 5000.

The Master of Arts degree and the Master of Science degree are designed to prepare students for industrial employment and for teaching at the high school and junior college level.

The department offers two options for these degrees. The first option requires a thesis for which 9 credit hours must be earned along with 36 additional hours of work in acceptable courses numbered above 4000. Of the additional hours, 9 may be in an area outside the department and 18 must be in courses in mathematics numbered above 5000.

After two quarters of graduate study, a student whose supervisory committee gives its approval may choose the non-thesis option, for which 45 hours of work in courses numbered above 4000 are required. Of these, 27 hours (at least 24 of which are in mathematics) must be in courses numbered above 5000. Of the 45 hours, 15 in courses approved by the supervisory committee may be taken in fields other than mathematics. For this option it is also required that a written comprehensive examination be passed, and that credit be received for a 3-hour seminar or reading course (6990-9995) in which a term paper or project is required. A student offering mathematics as a minor for the Master's degree is required to obtain at least 9 hours of resident graduate credit in courses numbered above 4000 and approved by both the major department and the Department of Mathematics and Statistics.

THE DOCTORAL PROGRAM

The Master of Mathematics degree is intended primarily for teachers of high school mathematics.

Before admission to this program, the applicant must have taken (a) a certification for teaching secondary mathematics in at least one of the states of the United States, or (b) three years of successful elementary or secondary school teaching experience. Evidence of the requirement being met must be supplied by the student.

Applicants for admission to this program must take the Graduate Record Examination (aptitude portion), and have had at least one year of college mathematics including analytic geometry. The following requirements must be met:

1. Passing written examinations covering four of the following subjects to the extent indicated by the accompanying course numbers and such other topics as the graduate faculty may prescribe:
   - Algebra 5510-20-30, Functions of a Complex Variable 5110-20-30, Topology 5910-20-30;

The student must pass at least two examinations from Group a; anyone passing two examinations from Group b will be required to take an approved one-year graduate course (numbered 5000 or above), in which mathematics is extensively used, outside of the mathematics department, and not cross-listed as a mathematics course.

2. Pass an intensive examination in the student's area of specialization.

3. Demonstrate a reading knowledge of two of the following languages: French, German, Russian, an approved alternative. At least one language requirement must be met before taking a written exam in the student's third area and the second language requirement must be met before taking the exam in the student's area of specialization.

4. Complete an approved one-year 6000-level course in mathematics outside the area of specialization.

5. Complete a dissertation consisting of original and significant research.

6. Pass a final oral examination. Study in a cognate field is not required by the mathematics department.

Registration in any course in the 6000 series may be repeated for credit with the permission of the department.

*3050 Elementary Probability and Statistical Analysis (3) Combinatorial problems; sample spaces, sets, and events; statistical independence; axiomatic probability theory; random variables and their distributions; simple random processes. Prereq: 1550-60 or equivalent.

*3060 Elementary Statistical Analysis (3) Elementary probability distributions used in statistics: binomial, Poisson, and normal and their properties; sampling theory; confidence intervals and statistical tests of hypotheses; least squares and linear regression. Prereq: 3050 or consent of instructor.

3099 Polynomials and Rings (3) An introduction to abstract algebra, beginning with study of integers followed by more general notion of rings, integral domains, and fields. Emphasis is given to certain ring theoretic properties shared by integers and polynomial rings over certain fields. Prereq or coreq: 3100 or consent of Instructor.

1. Logic and Sets (3) Elements of mathematical logic; elementary algebra of sets. Primarily for students in the College of Education. Prereq: 1 yr of college mathematics.

*3110 Real Number System (3) Laws of arithmetic; rational and irrational numbers; fields. Prereq: 1 yr of college mathematics. Primarily for students in the College of Education.

3156 Introduction to Numerical Algorithms and Programming (3) (Same as Computer Science 3156).

3134 Introduction to Numerical Algorithms (3) (Same as Computer Science 3155).*

* These courses are sometimes offered in special summer institutes for an 8-week period with 4 hr. credit. Such special courses are designated 3051, 3061, etc.
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3220 History of Mathematics (3) Survey of development of mathematics from prehistoric times to modern times. Prereq: 1860 or 2560 or equivalent.

3310 Advanced Euclidean Geometry (3) Triangles and circles, constructions, modern concepts. Prereq: 1 yr of college mathematics.

3320 Non-Euclidean Geometry (3) Foundations of hyperbolic and elliptic geometries, the theory of parallels, hyperbolic trigonometry, classification of isometries and similarities; symmetries of a polygon; inversions. Prereq: 1 yr of college mathematics.

3350 Intermediate Analysis (3) Primarily for students in secondary mathematics education. Course covers, elementary calculus from an advanced viewpoint with emphasis on proofs of basic theorems. Topics covered include limits of sequences and series, completeness, continuous functions, differentiation and maxima and minima for functions of several variables, integration. Functions of several variables, implicit function theory. Multiple integrals, infinite series, sequences and series of functions, uniform convergence. Taylor series. Should be taken in sequence. Prereq: 2860.

4225 Numerical Solution to Equations and Numerical Approximations (3) Numerical solution to equations and approximations; difference equations, introduction to computation, instabilities, rounding errors. Solution of a single nonlinear equation; introduction to numerical methods for linear and nonlinear systems. Polynomial equations; power and inverse power methods for eigenvalues. Approximations of polynomials, least squares, orthogonal polynomials, trigonometric and rational functions. Prereq: 3150 or 3155. (Same as Computer Science 4225.)

4225 Numerical Methods for Ordinary Differential Equations (3) Interpolation by polynomials and piecewise polynomials; quadrature; single-step and multi-step methods for differential equations. Stability, consistency and convergence. Current algorithms, variable step and order; stiff systems. Boundary value problems. Prereq: 3150 or 3155 and 4610 or 4225. (Same as Computer Science 4235.)


4250 Elementary Complex Variables (3) Complex numbers, Cauchy-RIemann equations, elementary functions. Cauchy's theorem and formula, Taylor and Laurent series, residues and their applications. Prereq: 2860; one 4000-level mathematics course other than Mathematics 2860.


4640 Calculus of Finite Differences (3) Real-valued functions; the vibrating string; solution by series; heat flow. Bessel functions. Prereq: 2860. Recommended: 4610.

4610-20-30 Ordinary Differential Equations (3, 3, 3) 4610—Linear first- and second-order equations. Power series solutions and Legendre polynomials; Frobenius method, and Bessel equations. Systems of linear differential equations and the matrix exponential. 4620—Numerical methods for ordinary differential equations including one-step methods (Euler, Runge-Kutta) for initial value problems, multistep methods, A-stability, and two point boundary value problems. 4630—Special topics which may include existence and uniqueness, oscillation theory, Liapunov stability, singular perturbations, and asymptotic solutions. Prereq: 4610. 4620 or 4640; 4620: 4050 or 2860; and 3150 or 3155, 4630: 4610 or consent of instructor.

4640 Calculus of Finite Differences (3) Real differential equations, application to problems in engineering and physics. Prereq or coreq: 4610.

4650-60-70 Introduction to Mathematical Statistics (3, 3, 3) Introduction to probability; discrete and continuous distributions; correlation, regression, and statistical independence; foundations of sampling theory, significance tests. Must be taken in sequence. Prereq: 4610.

4710 Vector Analysis (3) Fundamental operations, basis vectors, dot and cross products, directional derivatives, divergence and curl of vector fields, line integrals, divergence theorem of Gauss, and Stokes's theorem. Prereq: 2860.

4750-50-60 Introductory Probability Theory (3, 3, 3) 4750—Elementary combinatorial analysis, probability on discrete models, conditional probability and stochastic independence, binomial, Poisson, hypergeometric and normal distributions; random variables, expectation and variance; expectation and characteristic function of random variables, infinite sequences of random variables, laws of large numbers, and the central limit theorem. 4770—Markov chains: limiting probabilities; steady-state and stationary distributions; Stochastic processes: Poisson, birth and death processes; Kolmogorov equations. Prereq: 2840-50-60.

5012 Differential Geometry for Teachers (3-4) Advanced techniques applied to graphing functions. Curves, surfaces, parametrizations, singular points, tangent lines and tangent planes, osculating planes, arclength of curves in plane and curves on surface, curvature, torsion, asymptotic lines, local coordinates, Frenet formulas. Prereq: 1 yr of calculus, or consent of instructor.

5013 Geometry for Teachers (3-4) Primarily for high school teachers of geometry. Historical and modern presentations of topics encountered in a high school geometry class: axioms, synthetic and metric; models; betweenness; congruence of segments and triangles; parallelism; similarity; area; ruler and compass constructions; Klein's Erlangen Program. Prereq: Consent of instructor.

5014 Analysis for Teachers (3-4) Functions of several variables, vectors, limits and continuity, partial derivatives, directional derivatives and gradient, implicit function theorem, maxima and minima, transformations. Prereq: 3510 or consent of instructor.

5015 Probability and Statistical Inference for Teachers (3-4) Probability distributions including binomial, hypergeometric, and Poisson; moment generating functions; expectation of continuous random variables; moment generating functions of uniform and normal distributions. Sampling including Chi-square, F, and t distributions; interpretation of results; confidence intervals; point estimation and hypothesis testing. Prereq: 1 yr of calculus and 3050 or consent of instructor.

5050-60-70 Mathematical Logic (3, 3, 3) Truth functions; syntax and semantics of some propositional theory, Gentzen's sequence-calculus

* This course is intended for student in the Master of Mathematics program and for students in Graduate programs in education. It may not be applied as graduate credit toward the M.A. or M.S. degree in Mathematics.
and systems of natural deduction; algebraic logic, axiomatics of first-order theories; elementary model and recursion theory; consistency, completeness, decidability.

5110-20-30 Theory of Functions of a Complex Variable (3, 3, 3) Complex numbers; infinite series; analytic functions; complex integration; conformal mapping; analytic continuation; special functions: Riemann surfaces. Prereq: 4510-20 for 5110; 4530 for 5120. Must be taken in sequence.


5210-20-30 Theory of Functions of a Real Variable (3, 3, 3) Sets and real valued functions in Euclidean spaces; abstraction of these concepts, Lebesgue measure and integration; abstract measure and integration. Classical function spaces, such as Lp spaces. Generalized Fourier series theory. Special topics. Prereq: 4510-20-30. Must be taken in sequence.

5240-50-60 Linear Algebra (3, 3, 3) Metric spaces; finite and infinite dimensional Banach and Hilbert spaces, linear operators, vector and operator norms, spectral theory. Examples to be chosen from relevant applied areas. Prereq: 4510-20-30.


5310-20-30 Introduction to Higher Geometry (3, 3, 3) Projective spaces; coordinates and transformations; conics and quadrics. Elliptic and hyperbolic geometry from viewpoint of projective geometry. Prereq: 4510-60. Must be taken in sequence.


5465 Finite Element Methods (3) Finite element techniques for solution of ordinary and partial differential equations; basic principles; local bases, rates of convergence, and computer implementation. Prereq: 3150 or 3155, and 4225 or consent of instructor. (Same as Computer Science 5465.)

5475 Advanced Topics in Numerical Partial Differential Equations (3) Advanced topics in numerical solution of partial differential equations. FEM for eigenvalue problems, boundary value problems with singularities. Other topics, such as special methods, further study of FDM etc., at discretion of instructor. Prereq: 4545-65. (Same as Computer Science 5475.)

5490-90 Mathematical Programming (3) Optimization of functions or variables subject to constraints. Prereq: 3150, 4600 and 4530.

5510-20-30 Introduction to Higher Algebra (3, 3, 3) Algebraic systems: groups, rings, integral domains, fields. Must be taken in sequence.

5540 Galois Theory (3) Fields and their extensions, separable and normal extensions, algebraic closure, groups of automorphisms, fundamental theorem, solvability of equations, by radicals. Prereq or coreq: 5520.

5560-70-80 Theory of Matrices in Numerical Analysis (3, 3, 3) Matrix identities and inequalities; factorization theorems, generalized reciprocals, Hadamard inequalities, Lanzos algorithm, 5570 iterative matrix and matrix norms, convergence, domains of inclusion and exclusion of roots of matrices; the field of values; majorized eigenvalues, maximal theorems for Hermitian matrices; Kantorovic inequalities. 5580—Computational methods for inverting matrices, direct and by successive approximations; methods of reduction to normal form; successive approximations to roots of matrices; measures of error. Prereq: 4530-60.

5590 Theory of Rings (3) Direct and subdirect sums of rings, prime and maximal ideals, prime ideals, radicals and endomorphisms of rings; radicals; Wedderburn-Artin structure theorem. Prereq: 5520.


5640 Numerical Methods in Physics (3) (Same as Physics 5640.)

5655-65-75 Numerical Mathematics (3, 3, 3) Numerical solution of large systems of linear algebraic equations, systems of nonlinear equations and algebraic eigenvalue problems. Prereq: 4545 or 4235. (Same as Computer Science 5655-65-75.)

5710-20-30 Tensor Analysis (3, 3, 3) Absolute differential calculus, Euclidean space; differential geometry of curves and surfaces; applications to physics; extension to n-dimensional space. Prereq: 5720. Must be taken in sequence.


5830-40-50 Advanced Topics in Topological Semigroups (3, 3, 3) Theorems of Liouville, Picard, and Poincaré; elementary model and recursion theory; probability spaces, linear operators, vector and matrix spaces, finite and infinite dimensional Banach and Hilbert spaces. Prereq: 4750 or consent of instructor; prereq for 5840-50 : 4750 or 4650 or consent of instructor.


5970-80 Mathematical Systems Theory (3, 3) Analytical approach to discrete and continuous dynamical systems, fundamentals of control theory, linear problems, linear perturbation theory, stability, nonlinear analysis, sensitivity and stability aspects, applications to ecological systems, role of control in evolutionary theory, nonlinear optimization problems. Prereq: 4610, 4505 or consent of instructor.

5990 Graduate Reading in Mathematics (1-3) Reading on graduate level, with consent of department head. Independent study with faculty guidance. May be repeated. Maximum 9 hrs.

5991 Seminar Analysis (1-3)

5992 Seminar Topology (1-3)

5993 Seminar Algebra (1-3)

5994 Seminar Foundations (1-3)

5995 Seminar Applied Mathematics (1-3)

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6210-20-30 Linear Analysis (3, 3, 3) Algebraic and topological properties of linear spaces, emphasis on normed linear spaces, and dual spaces; linear transformations; special topics (spectral theory, ergodic theory, semi-groups of transformations); applications to problems in analysis. Prereq: 4510-60 and 5210-20-30. Must be taken in sequence.

6450-60-70 Partial Differential Equations (3, 3, 3) Advanced topics in classical and modern theoretical partial differential equations. Prereq or coreq: 5110-20-30 and 5210-20-30 or consent of instructor.

6510-20-30 Modern Algebra (3, 3, 3) Intensive study of some major branch of algebraic theory. Subject matter will vary according to interests and preparations of students. Prereq: 5110-20-30.

6540-50-60 Theory of Semigroups (3, 3, 3) Constructions and constructions; ideals theory; representations, decompositions, and extensions; free, regular, inverse, simple, and completely simple semigroups. Prereq: 5520.

6570 Theory of Groups (3) Structure of groups, free groups, nilpotence and solvability, extensions and products, permutation groups, abelian groups. Prereq: 5520.

6590-20-30 Advanced Ordinary Differential Equations (3, 3, 3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature. Subject matter varies according to interests of instructor. Prereq or coreq: 2610 or 4610, 4510-60, and 5110-20-30 or 5210-20-30 or consent of instructor.


6810-20-30 Topological Algebra (3, 3, 3) Topics chosen from topological semigroups, topological semigroups.
groups, Lie groups; transformation groups; topological lattices; relations in topological spaces; topological rings, fields, algebras. Prereq or coreq: 5910-20-30.

6910-20-30 Modern Topology (3, 3, 3) Technical background to current literature in topology. Topics vary from year to year.

6840-50-60 Introduction to Algebraic Topology (3, 3, 3) Homology, cohomology, and homotopy theories. Homology and cohomology groups, the Eilenberg-Steenrod axioms, cup and cap product, duality theorems, homotopy equivalence, higher homotopy groups, fiber spaces, spectral sequences. Prereq: 4160 and 5920.

6991 Seminar Analysis (1-3)
6992 Seminar Topology (1-3)
6993 Seminar Algebra (1-3)
6994 Seminar Foundations (1-3)
6995 Seminar Applied Mathematics (1-3)

Registration for seminars may be repeated with consent of department.

**Microbiology**

**MAJOR**

**DEGREES**

Microbiology

M.S., Ph.D.

Professors:

A. Brown (Head), Ph.D. Chicago; R. W. Beck, Ph.D. Wisconsin; J. M. Becker, Ph.D. Cincinnati; T. C. Monge, Ph.D. Maryland; J. O. Mudder, Ph.D. Michigan State; J. M. Woodward, Ph.D. Kansas; C. J. West, Ph.D. Indiana.

Associate Professors:

J. A. Bemis, Ph.D. Cornell; B. Bellomy, M.D. Buenos Aires; C. J. Wust, Ph.D. Idaho.

Assistant Professors:

R. J. Courtney, Ph.D. Wisconsin; R. V. Miller, Ph.D. Illinois; W. S. Riggboy, Ph.D. Yale; B. T. Rothe, Ph.D. Guelp (Canada).

Lecturers:


Students planning to major in Microbiology are expected to present, as undergraduates prerequisites, a minimum of one year of biology, one year of mathematics including calculus, two years of chemistry and one year of physics.

The student’s dissertation committee determines whether a foreign language is required for the doctoral degree.

3810 Food Bacteriology (4) Standards for examination, cultivation, and identification of bacteria associated with food fermentation and food spoilage. Prereq: 2910 and Chemistry 2230 or 3211. 2 hrs and 2 labs.

3820 Yeast and Molds (4) Morphology, taxonomy, and physiology of yeasts, actinomycetes, and fungi of industrial importance. Prereq: 2910 and Chemistry 2230 or 3211 or consent of instructor. 2 hrs and 2 labs.

4110 Physiology of Bacteria (2) Modern concepts of bacterial physiology and metabolism including cell structure and function. Prereq: 3510 and 12 hrs of organic chemistry.

4119 Bacterial Physiological Laboratory (2) Prereq: 3519. Coreq: 4110.

4120 Taxonomy of Bacteria (3) Bacterial classification. Prereq: 3510-19.

4140 Molecular Genetics of Prokaryotes (2) Transmission and expression of genetic information at the molecular level. Emphasis is on bacterial and viral systems, but unique features of eukaryotic genetic systems are included. Prereq: 3510 or consent of instructor.

4150 Microbial Ecology (3) Application of ecological principles to study of microbial communities. Emphasis on fundamental role of microorganisms in natural environments. Prereq: 3510, 1 yr of organic chemistry, Biology 3130, or consent of instructor.

4270 Advanced Immunology (2) Chemistry of antigens and haptenes, theories of antibody formation, cell cooperation in immune mechanisms, transplantation, abnormalities of the immune system, and autoimmune diseases. Prereq: 3520 or consent of instructor. (Same as Zoology 4270.)

4279 Advanced Immunology Laboratory (2) Laboratory exercises designed to accompany 4270. Prereq or coreq: 4270.

4320 Pathogenic Bacteriology (2) Disease producing microorganisms including bacteria, rickettsia, and chlamydia. Prereq: 3530.


4330 Medical Mycology (2) Disease-causing fungi, cytology, ultrastructure, and parasitism and immunity; emphasis on methodology of isolation and identification. Prereq: 3530 and 3829.

4339 Medical Mycology Laboratory (2) Prereq: 3619. Coreq: 4330.


4439 Medical Virology Laboratory (2) Laboratory procedures for isolation, handling and culturing of animal viruses. Prereq: 3539. Coreq: 4430.

5000 Thesis

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

5011-12-13-14-15-16 Mini-course in Microbiology (1, 1, 1, 1, 1, 1) Selected, advanced topics in microbiology, concentrated in time and subject matter. Consult departmental listing for topics offered. Prereq: as posted. May be repeated. Maximum 9 hrs. S/NC only.

5130 Topics in Taxonomy (3) Isolation, cultivation and taxonomic relationships of bacteria: emphasis upon less frequently encountered organisms. Prereq: 4130. 3 labs.

5310 Selected Topics in Microbiological Research (3) Literature surveys and laboratory methods for development and interpretation of microbiological research. May be repeated.

5360 Topics in Immunology and Immunocochemistry (4) Molecular and genetic aspects of immunoglobulin synthesis. Theoretical and practical exercise in immunocochemistry. Prereq: 4270, Biochemistry 4110-20 or equivalent.

5441-42-43-44-45-46 Clinical Microbiology (6, 6, 6, 6, 6, 6) Six quarters, 6 quarter hrs each consisting of lectures and clinical laboratory experience. Enrollment by consent of department head.

5510-20-30 Research Problems (3, 3, 3)

5720 Microbial Physiology (3) Lectures and seminars dealing with current advances in bacterial physiology in general and cell structure. Prereq: 4110; Biochemistry 4110-20.

5730 Pathogenesis of Infectious Disease (3) Host response to infection. Derangement of host-metabolism initiated by microbial invasion, exotoxins, endotoxins and other factors related to virulence. Alteration of genetic and hormonal controls resulting from progressive infection. Prereq: 4320.

5750 The Oncogenic Viruses (3) Lectures and special laboratory exercises dealing with known tumor-inducing viruses. Prereq: 4430 or consent of instructor. 2 hrs and 1 lab.

5760 The Bacterial Viruses (3) Lectures and discussions dealing with bacterial viruses with emphasis on the biological and chemical consequences of bacteriophage infection. Text supplemented by readings from literature. Prereq: 4420; Biochemistry 4110-20 or consent of instructor.

5819 Molecular Genetics Laboratory (3) Principles and methods of research in molecular genetics. Fundamental genetics concepts (mutation, complementation, recombination) at molecular level. Studies of lactose operon of Escherichia coli. Prereq: 4140 and Biochemistry 4110-20 or consent of instructor.

5820 Microbiology of Foods (3) Lectures and seminars dealing with current advances and selected topics in food microbiology with emphasis on analytical methods, safety and preservation. Prereq: 3810 and Biochemistry 4110-20. Recommended: Food Technology 4920.

5829 Experimental Microbial Ecology (3) Survey of techniques for assessment of microbial forms, functions, activities, and interactions in a variety of habitats. Prereq: 3519. Coreq: 4150 or consent of instructor. 1 hr and 2 labs.

5850 Seminar in History of Microbiology (1) Microbiologists and their achievements from Pasteur to present. S/NC only.

5910-20-30 General Seminar (1, 1, 1) Reviews of current literature. May be repeated with consent of department. S/NC only.

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6310 Seminar in Immunology (1) Readings and discussions based on current literature. May be repeated. S/NC only.

6320 Seminar in Microbial Pathogenesis (1) Readings and discussions based on current literature. May be repeated. S/NC only.

6330 Seminar in Microbial Physiology (1) Readings and discussions based on current literature. May be repeated. S/NC only.

6340 Seminar in Microbial Genetics (1) Readings and discussions based on current literature. May be repeated. S/NC only.

6350 Seminar in Virology (1) Readings and discussions of current literature. May be repeated with consent of department. S/NC only.

6360 Seminar in Filamentous Fungi (1) Readings and discussions based on current literature. May be repeated. Maximum 9 hrs. S/NC only.

6370 Current Topics in Environmental Microbiology (2) Reading, discussions, and critical evaluation of current literature. May be repeated. Maximum 9 hrs. S/NC only.

6410 Concepts of Immunity (3) Discussion and readings of recent advances in immunobiology and immunopathology.

6720 Advanced Topics in Microbial Physiology (3) Prereq: 5720. May be repeated with consent of department. S/NC only.

6730 Advanced Topics in Microbial Pathogenesis (3) Prereq: 5730. May be repeated with consent of department.

6740 Advanced Topics in Virology (3) Prereq: 4420 or 4430. May be repeated with consent of department.

6760 Advanced Topics in Microbial Genetics (3) Prereq: 6340. May be repeated with consent of department.
Music

MAJOR

Music

DEGREES

M.M., M.M.A.

Professors:

W. J. Stark, (Acting Head), M. M. Eastman;
A. G. Holford, M.M. Northwestern; C. R. Huber, Ph.D. North Carolina; J. L. Meacham, M.M. Northwestern;

Associate Professors:

G. C. Bitzas, M.M., Converse; W. Bommeje, M.M. Tulsa; J. P. Brock, M.M. Alabama;
L. W. Mischakoff, M.A. Columbia; W. P. Scarlett, M.M. Louisiana State;
S. E. Young, Ph.D. North Carolina.

Assistant Professors:

K. L. Micklestadt, M.A. Columbia; E. E. Niedens, M.M. Cleveland Institute of Music;

The Department of Music offers the degrees of Master of Music with concentrations in performance, composition, choral conducting, Suzuki string techniques, and piano literature, and the Master of Arts with a major in Music with concentrations in theory and musicology.

Applicants for these degree programs must have completed an undergraduate degree approximately equivalent in music requirements to those required in degrees conferred by The University of Tennessee, Knoxville, appropriate to the prospective area of concentration on the Master's level.

Applicants who plan to pursue the degree in performance (applied music) are required to audition before the appropriate area committee. Applicants for admission to the program in composition must submit scores and tape recordings of representative works. All applicants are required to take the Diagnostic Examinations in music theory and music history and literature.

General requirements for the Master's degree begin on page 19 of this catalog.

THE MASTER OF MUSIC PROGRAM

Voice: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 9 hours in music history/literature or music theory, (c) 6 hours in vocal pedagogy, and (d) 3 hours in recital or lecture-recital, (e) 3 hours in ensemble, and (f) 12 hours in elective (excluding applied music and ensemble).

Piano: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 9 hours in piano literature and/or pedagogy, (c) 3 hours in music theory, (d) 6 hours in music history/literature, and (e) 3 hours in ensemble or accompanying, (f) 6 hours in music history/literature, (g) 3 hours in recital, and (h) 3 hours in music electives.

Piano Literature: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 12 hours in piano literature and/or pedagogy, (c) 3 hours in music research, (d) 6 hours in music theory, (e) 3 hours in ensemble or accompanying, (f) 6 hours in music history/literature, and (g) 3 hours in recital.

Organ: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 6 hours in organ literature and/or pedagogy, (c) 3 hours in music research, (d) 9 hours in music theory, (e) 3 hours in recital, (f) 6 hours in music history/literature, and (g) 6 hours in music electives.

Strings: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 6 hours in area literature and/or pedagogy, (c) 3 hours in research techniques, (d) 6 hours in ensemble, (e) 3 hours in theory, (f) 3 hours in recital, and (g) 12 hours in music electives.

Wind and Percussion Instruments: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 6 hours in area literature, (c) 3 hours in music research, (d) 3 hours in advanced conducting, (e) 3 hours in music research, (f) 6 hours in ensemble, (g) 3 hours in recital, and (h) 9-12 hours in music electives.

Composition: 45 hours distributed as follows: (a) 9 hours in applied composition, (b) 3 hours in music research, (c) 15 hours in music theory, (d) 6 hours in music history/literature, (e) 9 hours in thesis, and (f) 3 hours in electives.

Music Theory: 45 hours distributed as follows: (a) 18 hours in music theory, (b) 3 hours in music research, (c) 6 hours in music history/literature, (d) 9 hours in thesis, and (e) 9 hours in electives.

Choral Conducting: 45 hours distributed as follows: (a) 6 hours in conducting, (b) 6 hours in choral literature/techniques, (c) 3 hours in music research, (d) 9 hours in theory, (e) 6 hours in choral conducting performance or document, and (g) 12 hours in electives.

Suzuki String Techniques: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 6 hours in Suzuki literature/techniques, (c) 3 hours in music research, (d) 3 hours in music theory, (e) 3 hours in recital, (f) 6 hours in ensemble, and (g) 12 hours in electives.

THE MASTER OF ARTS PROGRAM

Music Theory: 45 hours distributed as follows: (a) 18 hours in theory, (b) 3 hours in music research, (c) 9 hours in music history/literature, (d) 9 hours in thesis, and (e) 6 hours in electives.

Musicology: 45 hours distributed as follows: (a) 21 hours in music history/literature, (b) 3 hours in music research, (c) 6 hours in theory, (d) 9 hours in thesis, and (e) 6 hours in electives.

A reading knowledge of French or German is must be demonstrated by candidates for the Master of Arts degree.

Specific course requirements will be prescribed by the department for all degree programs and elective courses must have the approval of the student's advisor.

3041 Keyboard Harmony (2) Melody harmonization, figured bass realization, and improvisation.
4210 Music in the Romantic Period (3) Survey of music from Beethoven through post-Romantic instrumental and vocal styles.

4230 Contemporary Music: 1945 to Present (3) Survey of new and avant-garde music in Europe and America since World War II.

4241 American Music (3) American music from colonial times to present. Emphasis on twentieth-century. Includes both folk and cultivated traditions. Prereq: 1210-20 or equivalent.


4290 Gregorian Chant (3) Chants of Latin rite. Masses and Offices examined as functional music as well as by type.

4310 History of Art Song (3) Survey of art song from fifteenth century to 1930.

4315 Wind Chamber Music (3) Study of wind chamber music from eighteenth through twentieth century. Emphasis placed on style interpretation, rehearsal techniques, programming and musical significance, both historical and theoretical.

4340-50 Works of Bach (3, 3) Detailed examination of sonatas, chamber, keyboard, and orchestral works; cantatas, motets, passions and oratorios. 4340—instrumental works; 4350—vocal works.

4400 Jazz Directing (1) Rehearsal techniques for jazz ensembles; special conducting techniques. Rehearsal and recording procedures. May not be repeated. Supervised laboratory experience in rehearsing university jazz ensembles. Prereq: Enrollment in Applied Music with jazz emphasis or consent of instructor.

4840 Jazz Pedagogy (1) Methods and materials relating to teaching of jazz and administering of jazz program. Prereq: Consent of instructor.

4850 Jazz Composition (3) Prereq: Music 4114 and consent of instructor.

4860 Advanced Improvisation (2) Emphasis on further development of individual skills and solving individual problems in jazz improvisation. Prereq: 3932-53.

5000 Thesis


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

5010 Organ Literature Seminar (3) Topics vary. Prereq: Organ literature.

5012-22-32 Pedagogy of Voice (2, 2, 2) 5012—Survey of voice production processes in singing including: voice classification, quality, diction registration, breath control, and control. 5022—Examination of teaching materials, preparation of programs for various vocal categories and levels of study. Observation of studio teaching. 5032—Analysis of the vocal problems of a selected group of students. Supervised teaching. Prereq: 4012-22-32 or consent of instructor.


5030 Choral Literature Seminar (3) Topics vary.

5040 Vocal Literature Seminar (3) Topics vary.

5050 Graduate Recital (3)

5051 Opera Performance (3)

5052 Vocal Chamber Music Performance (3)

5053 Choral Conducting Performance (3)

5055-56 Practicum for Instrumental Conductors (1, 1) Internship experience in choral music and in an instrumental field other than the area of major interest. S/N only.

5057 Instrumental Conducting Seminar (3) Rehearsal and performance problems and techniques allied to score reading and preparation. Particular attention to individual problems. Prereq: 4050 or equivalent.

5060 Seminar in Choral Performance (3) Rehearsal and performance problems and techniques allied to score reading and preparation. Particular attention to individual problems. Prereq: 4050 or equivalent.

5070 Opera Production (1-3) Prereq: Consent of instructor.

5080 Instrumental Conducting Performance (1) Jury performance; conducting band or orchestra in public.

5080 Special Topics in Performance (1-3) Prereq: Consent of department head.

5100 Independent Study in Music Theory (1) Prereq: Consent of department head.

5111 Advanced Harmony (3) Analytic survey of harmonic trends in compositions from 1700 to present. Exercises employing and illustrating these techniques. Prereq: Consent of instructor.

5114 History of Music Theory (3) Work and contributions of theorists from ancient Greece to present. Emphasis on 1600 to present. Prereq: Consent of instructor.

5116 Musical Styles (3) Elements of design and their role in definition of musical styles. Exercises in aural and visual identification. Prereq: Consent of instructor.

5121 Analytical Techniques (3) Analytical techniques with emphasis on contemporary approaches. Tonal and neotonal music. Prereq: Consent of instructor.

5125 Practicum in Computers and Music Research (3) Programming languages, design, and implementation of projects in musical analysis, composition and indexing. Prereq: Consent of instructor.

5150 Seminar in Music Theory (3) Topics vary. Prereq: Consent of instructor.

5200 Independent Study in Music History and Literature (1-3) Prereq: Consent of department head.

5210 Introduction to Music Research (3)

5220 Proseminar (3) Research techniques in music emphasizing bibliography, writing of research papers and presentation of oral reports. Prereq: Consent of instructor.

5270 Seminar in Musicology (3) Topics vary. Prereq: Consent of instructor.

5315 Band Literature (3) Band literature and origins of band emphasizing its important, existential, and musical experience, sense perception and emotions, value in music, and role of artist in society. Aesthetic viewpoint of individuals and historical eras through selected writings.

5500 Flute (1-4)

5505 Oboe (1-4)

5510 Bassoon (1-4)

5515 Clarinet (1-4)

5520 Saxophone (1-4)

5525 Horn (1-4)

5530 Trumpet (1-4)

5535 Trombone (1-4)

5540 Baritone (1-4)

5545 Tuba (1-4)

5550 Percussion (1-4)

5555 Voice (1-4)

5560 Violin (1-4)

5565 Viola (1-4)

5570 Cello (1-4)

5575 String Bass (1-4)

5580 Piano (1-4)

5585 Harpsichord (1-4)

5590 Organ (1-4)

5595 Guitar (1-4)

5597 Composition with Electronic Media (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5599 Composition (1-3) Prereq: Consent of instructor.

5600 Small Ensemble (1)

5602 Brass Choir (1)

5604 Jazz Ensemble (1)

5605 Trombone Choir (1)

5610 Percussion Ensemble (1)

5612 Baroque Ensemble (1)

5620 UT Singers (1)

5630 Chamber Singers (1)

5632 Collegium (1)

5634 Saxophone Choir (1)

5640 Opera Theatre (1)

5642 Opera Workshop (1)

5650 Concert Band (1)

5652 Campus Band (1)

5654 Varsity Band (1)

5656 Laboratory Band (1)

5657 Marching Band (1)

5670 Symphony Orchestra (1)

5680 Concert Choir (1)

5352 Music in the Renaissance (3) From 1400 to 1600. Mass, motet, chansons, madrigal, and other vocal and instrumental forms and genre.

5353 Music in the Baroque Period (3) From 1600 to 1750; rise of opera and oratorio, church and secular cantata, instrumental forms, performance practice.

5355 Music in the Classic Period (3) Preclassical music (Rococo) and music of Haydn, Mozart and early Beethoven. Includes background of other cultural and artistic activities.

5400 Musical Aesthetics (3) Nature of music and musical experience, sense perception and emotions, value in music, and role of artist in society. Aesthetic viewpoint of individuals and historical eras through selected writings.

May be repeated.
**Philosophy**

**MAJOR Philosophy**

**DEGREES Philosophy**

**M.A., Ph.D.**

**Professors:**
- J. W. Davis (Head), Ph.D. Emory
- R. B. Edwards, Ph.D. Emory; M. H. Moore (Emeritus), Ph.D. Chicago; D. Van de Velde, Jr., Ph.D.

**Associate Professors:**
- R. E. Aguila, Ph.D. Northwestern
- G. G. Brannett, Ph.D. Michigan; L. B. Gabik

**Assistant Professors:**
- J. O. Bennett, Ph.D. Tulane; S. M. Cohen, Ph.D. Northwestern
- K. A. Emmett, Ph.D. Ohio State
- H. P. Hamlin, Ph.D. Georgia; R. Jones, Ph.D. Chicago; S. Reaven, Ph.D. California.

**THE MASTER'S PROGRAM**

See general requirements on page 19. Courses below 4000 may not be taken for graduate credit by philosophy majors except with special permission.

**THE DOCTORAL PROGRAM**

Specific requirements for doctoral students in Philosophy include a minimum of three academic years of graduate study involving at least 72 quarter hours credit in course work (normally 24 quarter courses or their equivalent, exclusive of credit for the thesis and dissertation) of which at least 45 shall be in courses numbered over 5000, and of which at least 9 shall be in a subject other than philosophy. The specific number and distribution of courses will be determined by the student's faculty committee.

Two foreign languages, normally French and German, are required. As an alternative to the two-language requirement, candidates for the Ph.D. may elect to demonstrate a substantially more advanced proficiency in reading knowledge of one language. Requirements for this option may be obtained in the department office.

Registration in any course in the 5000 or 6000 series (except 5050 and 5910-20-30) may be repeated for credit with the consent of the department. That is, courses having the same number, but with different subject matter, may be taken with each separate subject description.

**MEDICAL ETHICS**

The department has an M.A. and Ph.D. program of graduate study with a concentration in medical ethics. Details concerning the program can be obtained from the department.

**RELIGIOUS STUDIES**

The department has an M.A. program of graduate study with a concentration in philosophy of religion and other religious studies. Details concerning the program can be obtained either from the Department of Philosophy or Religious Studies.

**College of Liberal Arts 129**

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**Courses Below 4000**

- 6000 series (except 5050 and 5910-20-30) may be taken for graduate credit by philosophy majors except with special permission.

**Philosophy**

**MAJOR Philosophy**

**DEGREES Philosophy**

**M.A., Ph.D.**

**Professors:**
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- R. B. Edwards, Ph.D. Emory; M. H. Moore (Emeritus), Ph.D. Chicago; D. Van de Velde, Jr., Ph.D.

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- K. A. Emmett, Ph.D. Ohio State
- H. P. Hamlin, Ph.D. Georgia; R. Jones, Ph.D. Chicago; S. Reaven, Ph.D. California.

**THE MASTER'S PROGRAM**

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**THE DOCTORAL PROGRAM**

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**MEDICAL ETHICS**

The department has an M.A. and Ph.D. program of graduate study with a concentration in medical ethics. Details concerning the program can be obtained from the department.

**RELIGIOUS STUDIES**

The department has an M.A. program of graduate study with a concentration in philosophy of religion and other religious studies. Details concerning the program can be obtained either from the


5610 Recent Developments in Philosophy of Religion (4)

5710 Studies in Metaphysics (4) Metaphysics of philosopher or systematic philosophical tradition.

5810 Social and Political Philosophy (4)

5910-20-30 Research (4, 4, 4) Independent study under direction of member of department.

5950 Clinical Practicum in Medical Ethics (4-12) Prereq: Consent of Medical Ethics Committee. Open only to students concentrating in medical ethics. S/NC only.

6000 Doctoral Research and Dissertation

6110-20-30 Seminars in the History of European Philosophy (4, 4, 4)

6150 Seminars in the History of American Philosophy (4)

6250 Seminar in the Philosophy of Religion (4)

6310 Seminar in Axiology (4)

6370 Advanced Topics in Medical Ethics (4) Prereq: 5570 or consent of Medical Ethics Committee.

6510 Seminar in Epistemology (4)

6550 Seminar in Philosophy of Science (4)

6950 Advanced Residence in Medical Ethics (4-12) Prereq: Consent of Medical Ethics Committee. Open only to students concentrating in medical ethics. S/NC only.

Physiology and Anatomy

MAJOR DEGREES

Physics


Assist Professors: M. F. Fair, M.S., Michigan; M. W. Guidry, Ph.D. Tennessee; T. H. Handler, Ph.D. Rutgers; R. H. Kohl, Ph.D. Ohio State; D. L. McCorkle, Ph.D. Tennessee; R. S. Thoe, Ph.D. Connecticut.

Lecturers: R. L. Becker, Ph.D. Yale.

1 Alumni Distinguished Professor.
2 Space Institute, Tullahoma, Tennessee.
3 Presently on leave of absence.
4 Chancellor's Research Scholar.
5 Visiting.
6 Research Associate Professor.
7 Presently on leave of absence.
8 Research Associate Professor.
9 Visiting.
10 Presently on leave of absence.

A student who enrolls in the Graduate School with the intention of attaining an advanced degree in Physics shall, in general, have completed an undergraduate major in physics or its equivalent. Physics 3210-20-30, 3710-20-30 or 4110-20-30, 4210-20, 4230 or 4240 constitute the minimum courses prerequisite to graduate study.

A student who enrolls in the Graduate School with the intention of attaining an advanced degree in Physics shall, in general, have completed an undergraduate minor in Physics or its equivalent. Physics 3210-20-30, 4210-20 constitute the minimum courses prerequisite to graduate study.

Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy are offered in a number of specialized fields including chemical physics, elementary particle physics, atomic and low temperature physics, health physics, molecular spectroscopy, nuclear physics, plasma physics, solid state physics, theoretical physics, ultrasonics, heavy ion atomic physics, biophysics, and liquid state physics.

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

All first-year graduate students are required to take a comprehensive examination in undergraduate physics during the fall quarter registration period.

THE MASTER’S PROGRAM

The Physics Department has two Master's degree programs—thesis and non-thesis.

The thesis program is primarily designed for students intending to go into industrial or governmental laboratories as physicists. The course requirements include 36 quarter hours in such courses as Physics 4510-20-30, 4610-20-30, 5110-20-30, 5210-20-30, 5310-20-30, 6110-20-30 and 6310. Physics 6210-20-30 and 6310 are normally required of students specializing in nuclear physics, Physics 6500-10 of students in plasma physics, Physics 6610-20-30 of students in health physics, Physics 6710-20-30 of students in solid state physics, and Physics 6810-20 of students specializing in molecular spectra. (The Master's degree is not required.)

A reading knowledge of one foreign language is recommended. A significant body of literature is required. German or French 3030 with a grade of A or B may be substituted for the corresponding language examination.

The thesis topic will be chosen with reference to one of the fields in which research facilities can be made available either at the University laboratory or at the Oak Ridge National Laboratory, Oak Ridge, Tennessee.

A program leading to the Ph.D. in chemical physics is conducted jointly with the Chemistry Department, which offers a similar degree program. The requirements for the degree in chemical physics include the successful completion of: Physics 4510, 4610-20-30, 5210-20-30, 5310-20-30, 6110-20-30, 6120-20-30, and either 6310 or 5720; Chemistry 4160-70, 5430, and any two quarters from 5340-50, 5460, 5860, 6730 or 6810-20.
Astronomy

Physics

3230 Heat and Thermodynamics (3) Concepts of temperature and heat; laws of thermodynamics; applications of laws to simple physical and chemical problems. Prereq: 2320 or 2330 and calculus, 3910-20 or consent of instructor.


3510-20-30 Physical Measurements (3, 3, 3) Laboratory measurement of some physical quantities. S/NC only. Prereq: 2310-20 or 2320-20-30, and calculus; 3510 for 3520 and 3530. 3 labs.

3610-20 Electronics (3, 3) Electronic components and circuits of interest to physicists. Prereq: 2320 or 2330 and mathematics 3. Calculus 3. 3 labs.

3630 Nuclear Electronics Laboratory (3) Elementary circuits of interest in nuclear instrumentation are designed and built, and their characteristics are tested as a function of various parameters. Prereq: 3610-20.


4040 Foundations of Physics (3) Selected topics from history and philosophy of classical and modern physics. Prereq: 1 yr general physics and consent of instructor. Required of MACT calculus majors.

4110-20-30 Introduction to Quantum Mechanics (3, 3, 3) Introduction to fundamental principles of quantum mechanics and methods of calculation. Applications to atomic, molecular, and nuclear physics. Prereq: 2330 or equivalent, Mathematics 4550.

4140 Elementary Nuclear Physics (3) General properties of nuclei, two-nucleon systems, nuclear forces, nuclear models, nuclear reactions, nuclear disintegrations and beta-decay, nuclear spin and magnetism. Prereq: 3730 or 4120.

4180 Physical Acoustics (4) Considerations fundamental to detailed investigation of any branch of acoustics; propagation of acoustic waves in the infrasonic, the audible, the ultrasonic, and the hypersonic ranges of frequencies. Prereq: 3210-20, 3230. 3 hrs and 1 lab.

4210-20 Electricity and Magnetism (3, 3, 3) Intermediate level: electrostatics; steady and alternating currents; laws of magnetism; Maxwell's equations; radiation of electromagnetic waves; reflection and refraction; electromagnetic fields, polarization of light, scattering of light. Prereq: 2220 and Mathematics 2830.

4240-40 Modern Optics (4, 4) 4230—Geometrical Optics: Reflection and refraction of light at a dielectric interface; paraxial theory of interfaces, lenses, and mirrors: thick lenses, lens systems, ray tracing, aberrations, imaging, imagery. 4240—Physical Optics: Mathematics of wave motion, superposition of waves; interference; Fraunhofer and Fresnel diffraction; Fourier optics; holography. Prereq: 4210 or consent of instructor. 3 hrs and 3 hrs lab.

4510-20-30 Atomic Physics Laboratory (3, 3, 3) Experiments in: fundamental particle properties, photoelectricity, conduction of electricity through gases, scattering of atomic and molecular spectroscopy, x-ray. Prereq or coreq: 3910-20-30. 3 labs.

4540-50 Experimental Nuclear and Radiation Physics (4, 4) Interaction of charged particles and electromagnetic radiation with matter; theory and characteristics of various detectors: statistics of counting, nuclear properties. Experiments illustrate recent techniques for investigating the nucleus and nuclear radiation. Prereq: 3230. 1 hr and 6 hrs lab.

4580 Principles of Nondestructive Testing (3) Detection and characterization of discontinuities in materials by nondestructive testing measurements. Ultrasonic, electromagnetic, holographic and penetrating radiation techniques are discussed. Prereq: 2310-20 or consent of instructor.


4710-20 Introduction to Health Physics (3, 3, 3) Radioactivity, interaction of electromagnetic radiation with matter, radiation quantities and units, protection, radiation hazards, x-rays and gamma rays, neutron activation, interaction of charged particles with matter, stopping power, range-energy relations, counting statistics, shielding, dosimetry, waste disposal, critical prevention, radiation biology and ecology. Prereq: 3720.

5000 Thesis
5002 Non-Thesis Graduation Completion (3-19) Experiments in : fundamental particle properties, photoelectricity, conduction of electricity through gases, scattering of atomic and molecular spectroscopy; special nuclear models; theory of beta-decay. Prereq: 3210-20 or equivalent, Mathematics 3. Calculus 3. 3 labs.

5080 Graduate Research Participation (3) Advanced research techniques under supervision of staff research. Research area coincides with interests of students. Open to all graduate students with consent of department and research director. May be repeated. S/NC only.

5110-20-30 Introduction to Theoretical Physics (3, 3, 3) Classical theoretical physics, with limitations; special relativity and Einstein, and Fermi-Dirac statistics. Ensemble; relation of statistical mechanics to thermodynamics; distribution functions and functional integrals; application to gases, liquids, and solids, including cluster theory of imperfect gases. Prereq: 3230. Prereq or coreq: 5130-20, 5160-20.

5160-20 Mathematical Methods in Physics (3, 3, 3) Vector and tensor analysis; lineal algebra, matrices, vector spaces; Fourier series and integrals; linear operators and matrices, vector spaces; Fourier series and integrals; linear second-order partial differential equations and their associated boundary value problems. Vector calculus and transform methods. Special attention to problems arising in physics. Prereq: Advanced calculus and differential equations. (Same as Mathematics 5610-20.)

5640 Numerical Methods in Physics (3) Numerical methods available for solution of physical problems, point forward use of automatic computing machinery; analysis of errors. Prereq: 5610-20, or consent of instructor. (Same as Mathematics 5640.)

5720 Physics of Polytomolous Molecules (3) Introduction to electromagnetic and physical processes of luminescence of these molecules; theoretical and experimental aspects of intramolecular and intramolecular electron excitation energy transfer and charge transfer; application of excitation energy transfer and charge transfer in such fields as organic molecular reactivity and organic scintillation. Prereq: 5210-20 or consent of instructor.

5910-20-30 Special Problems (3, 3, 3) Specially assigned theoretical or experimental work on problems not covered in other courses.

5911-31 Special Problems in the Teaching of Physics (1, 3) Design of physics experiments and apparatus, preparation of physics tests and examinations, techniques in presentation of physics topics, and related problems. Prereq: Consent of instructor. Required of MACT candidates.


6000 Doctoral Research and Dissertation

6110-20-30 Quantum Mechanics (3, 3, 3) Fundamental principles of quantum mechanics and principal approximation methods. Applications to atomic and molecular physics, nuclear physics, and quantum electrodynamics. Prereq: 4130 or 5210. 5210-30 or 5410-20. Which ever of the latter series is used as prerequisite is considered corequisite.

6210-20 Nuclear Structure (3, 3, 3) General properties of nuclei; two-body scattering problems; saturation and symmetry properties of nuclear forces; theory of light nuclei; nuclear spectroscopy; special nuclear models: theory of nuclear reactions; theory of beta-decay. Prereq: 6110-20.

6310 Electromagnetic Theory of Light (3) Classical electron theory including theories of line breadth, dispersion and absorption; scattering of light and X-rays; dielectric and magnetic properties.

8320 Special Relativity (3) Lorentz transformation; Einstein postulates; relativistic tensors; relativistic kinematics, relativistic dynamics. Prereq: Phys 5310-20-30, 5410-20-30, 5310.

8330 General Relativity (3) Tensor calculus; general theory of relativity; gravitational field equations. Prereq: Phys 5320.

8420 Advanced Topics in Classical Theory (3) To meet special needs of students. Possible fields: advanced dynamics and hydrodynamics; electromagnetism, statistical mechanics; solutions to non-equilibrium processes. Prereq: Phys 5310-20-30, 5410-20-30, 5510-20-30. May be repeated with consent of department.

8430 Advanced Topics in Quantum Theory (3) To meet special needs of students. Possible topics: angular-momentum theory, beta-ray theory, theory of atomic spectra, molecular structure and valence, electron structure, electronic excitations, electric and magnetic susceptibilities, high energy processes, scattering and collision processes, theory of Fermi gases. Prereq: Phys 5100-20-30. May be repeated with consent of department.

6500-10 Electrical Conduction in Gases and Plasma Physics (3, 3) Electrical conduction in gases and plasmas. Characteristics of spark, arc and glow discharges. Flame phenomena in a plasma; plasma oscillation; magnetic stability of plasmas; instabilities. Topics of current interest in astrophysics, geophysics and thermonuclear research. Prereq: Phys 3710-20-30 and either Phys 3220-30 or Electrical Engineering 5310-20-30. (Same as Electrical Engineering 6500-10.)

8610 Interaction of Radiation with Gases (3) Interaction of electromagnetic radiation with atomic molecules. Collision strength, ionization of charged particles with atoms and molecules; ionization; transmutation and light emission. Ionization in solution, transport and capture; electron swarm and electron beam experiments. Prereq or coreq: 6110-20-30.

8620 Interaction of Electrons with Solids (3) Collisions with free electrons; stopping power; electron slowing down spectra; energy straggling; nuclear scattering; electron diffusion; plasmon excitations; stopping power; energy distribution in electronic lemons, Cherenkov radiation, electron transport in gases and solids. Prereq or coreq: 6110-20-30.


6810 Vibrational Problems in Molecular Spectra (3) Normal coordinates and potential functions; group theoretical methods and selection rules in gases and condensed phases. Laserampec proportion and nonlinear electrooptical phenomena. Prereq: Phys 5420 or equivalent. (Same as Chemistry 6810.)

8820 Molecular Vibration-Rotation Theory (3) Molecules as vibrating and rotating systems possessing molecular properties; quantum mechanical theory of symmetric and asymmetric molecular vibrators including vibration-rotation interactions; selection rules and energies of molecular transitions; methods of analysis used in high resolution molecular spectroscopy. (Same as Chemistry 6820.)

Political Science

MAJORS

Political Science
Public Administration

Professors:
T. D. Ungs (Head), Ph.D. Iowa; R. S. Avery, (Emeritus), Ph.D. North Carolina; T. H. Garlese, Ph.D. North Carolina; R. S. Graeme* (Emeritus), Ph.D. Wisconsin; V. R. Iredel, Ph.D. Chicago; D. D. Nimmo, Ph.D. Vanderbilt; H. Psas, Ph.D. Utah; N. M. Robinson, Ph.D. Syracuse; O. H. Stephens, Ph.D. Johns Hopkins; D. M. Welborn (On leave), Ph.D. Texas.

Associate Professors:
R. B. Cunningham, Ph.D. Indians; J. Dodd, Ph.D. Tulane; A. Ellick, Ph.D. Columbia; G. Evans, Ph.D. Columbia; A. H. Hopkins, Ph.D. Syracuse; W. Lyons, Ph.D. Oklahoma; S. Oofsky, Ph.D. Columbia; R. L. Peterson, Ph.D. Yale; G. J. Rathin, Ph.D. Michigan State; T. McK. Simpson, Ph.D. Johns Hopkins; T. A. Smith, Ph.D. Ohio State.

Assistant Professors:

Registration in any courses in the 5000-5000 series may be repeated for credit with consent of the department.

THE BUREAU OF PUBLIC ADMINISTRATION

The University maintains in the College of Liberal Arts a Bureau of Public Administration for the purpose of promoting sound government administration through research, publication, and consultation. The staff is as follows: Professor Ungs (director); Professors Lyons (associate director), Fitzgerald, Freeman (assistant professors); Research Associates Brown, Duran, Mauney, Thomas.

THE MASTER'S PROGRAM

See general requirements on page 19.

MASTER'S IN PUBLIC ADMINISTRATION

Specific requirements for graduation include:
1. The completion of 45 quarter hours of approved graduate courses including 9 hours of thesis work. In lieu of this, candidates may complete a total of 48 quarter hours of course work.
2. At least 80% of the credit hours including thesis must be in approved courses numbered 5000 and above.
3. Demonstration of command of the material covered in course work in an oral comprehensive examination. A non-thesis student must have written examination which may be followed by an oral.

Inquiries concerning all programs include: 2510-20. (Same as Political Science 2510-20.}


3555 Minority Group Politics in the United States (3) Content varies from quarter to quarter. May be repeated with consent of department. Maximum 8 hrs.

3565 Introduction to Public Administrative Organization and Management (4) Organization and decision-making theory, line and staff services, politics of organization, leadership, personnel and fiscal management, administrative responsibility. Recommended prereq: 2510-20. (Same as Water Resource Development 3565.)


3605 Political Change in Developing Areas (4) Characteristics and problems of political changes with primary focus on developing areas.

3615-16 Dynamics of Black African Politics (4, 4)

3621-22 Politics of Asian States (4, 4)

3625-26 Latin American Government and Politics (4, 4)

3631-32 Government and Politics of the Soviet Union (4, 4)

3635-36 Politics in Western Democracies (4, 4) Political culture, patterns, and institutions of Western democratic systems.

3641 Government and Politics of Middle East and North Africa (4)

3710 State Politics (4) Focus on form and informal setting of state government: governors, courts, legislative process, and state administrators. Attention will be paid to state government's role in formulating, enacting, and implementing state policy.

3720 State Government and Policy Making (4) Nature and functions of the institutions of state government: governors, courts, legislatures, and state administrators. Attention will be paid to state government's role in formulating, enacting, and implementing state policy.
3750 The Urban Polity (4) Analysis of political institutions and processes in metropolitan areas.
3760 Urban Policy Process (4) Analysis of urban problems and policies in metropolitan areas.
3790 Contemporary Problems of Soviet Foreign Policy (4)

3610 Studies in Ancient Political Thought (4) Classical Greek and Roman political thought.
3802 Studies in Medieval Political Thought (4) From Augustine to Luther; emphasis on problems and theories of religion and politics.
3803 Studies in Early Modern Political Thought (4) Machiavelli through the Enlightenment.
3804 Studies in Nineteenth- and Twentieth-century Political Thought (4) Political theories of industrial and technological societies; nineteenth and twentieth century.

3880 American Political Thought (4) Examination of role of selected political ideas, doctrines, and themes in America, emphasizing their development and relationships to diverse political interests.
4410 Law and the Administrative Process (4) Problems, procedures, controls over administrators.
4535-36 Political Attitudes, Opinions and Communication (4, 4) Nature, development, formation and distribution of politically relevant attitudes and the role of leadership, persuasion, and communication in opinion-policy process.
4540-50 Presidency, Congress and Public Policy (4, 4) The Presidency and Congress within framework of policy-making process.
4573 Special Topics in United States Government and Politics (4) May be repeated with consent of department. Maximum 8 hrs.
4610 Budgetary Process (4) Fiscal planning, budget and expenditure processes in government, their policy and administrative implications.
4620 Public Personnel Administration (3) Development of the merit system in government, career systems, public personnel management functions, organization for personnel management.
4665-66 Policy Making in Democracies (4, 4) Comparative approach to theory and process of making public policies.
4675 Special Topics in Comparative Government and Politics (4) May be repeated with consent of department. Maximum 8 hrs.
4711 International Law (4)
4727 Politics of Inter-American Relations (4) Analysis of selected theoretical and policy issues concerning international relations in the Americas with emphasis upon imperialism, intervention, and the Cuban Revolution, nationalism, foreign assistance, trade and economic integration.
4740-55 Political Parties and Elections (3, 3, 3) 4740—Nature and function of party system; nominations and campaigns. 4760—Voting behavior of the electorate.
4815 Contemporary Soviet Marxism-Leninism (4) Soviet applications of Marxist-Leninist theory.
4831-32-33 The Systematic Study of Politics (4, 4, 4) Scope, methods and procedures of analysis in political science; intended primarily for seniors intending to pursue graduate work and entering graduate students who have not had such a course.
4875 Special Topics in Political Thought (4) May be repeated with consent of department. Maximum 8 hrs.
4940 Politics and the Environment (4) Examination of formulation and implementation of public policies relating to physical environment with emphasis upon water and air pollution control.
4975 Proseminar in Political Science (4) Selected research for seniors; primarily for majors. May be repeated with consent of department. Maximum 8 hrs.
5000 Thesis
5002 Non-Thesis Graduation Completion (3, 15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5101 Foreign Study (1-12) See page 100.
5102 Off-campus Study (1-12) See page 100.
5103 Independent Study (1-12) See page 100.
5110-20 Seminar in Political Theory (3, 3) Selected political thinkers, schools, historical periods.
5140 Politics, Administration and Community in Nonmetropolitan Areas (3) Analysis of problems and processes associated with community development.
5150 Internship in Political Science (3-9) Open to students participating in approved internship programs. May be repeated with consent of instructor. Maximum 9 hrs.
5210-20-30 Seminar in World Politics (3, 3, 3) Research in world problems and organization.
5211 Directed Readings in Political Science (3, 3) May be taken with consent of instructor and student's advisor. Maximum 9 hrs. May be taken for letter grade or S/NC.
5250 Seminar in African Politics (3) Selected topics in African politics.
5270 Seminar in the Politics of Development (3) Selected topics with political problems of less developed countries.
5310-20 Seminar in Comparative Government (3, 3) Selected topics in modern governments.
5340-50 Seminar in Latin American Government (3, 3)
5370-80 Seminar in Soviet Politics and Government (3, 3)
5410-20 Seminar in Public Law (3, 3) Special problems in constitutional and administrative law.
5440-50 Theory and Analysis of U.S. Foreign Policy (3, 3) Theoretical approaches to decision making in foreign policy area and analysis of policy-making process.
5510-20 Seminar in International Organization (3, 3) 5510—Introduction to regional international organizations; political integration at international level. 5550—Functional international organizations.
5540 Seminar in Comparative Public Administration (3) Approaches to and methods used in comparative analysis.
5550 Seminar in Administration in Developing Countries (3)
5600 Public Administration (3) Public administration theory and functions, approaches to public management, contemporary problems in public administration.
5605 Research and Methodology in Public Administration (3) Basic assumptions and techniques of research in public administration; measurement, analysis, and reporting of data.
5610-20 Seminar in Organization Theory (3, 3) Appraisal of major theories of organization and their applicability to public sector.
5611-21-31 Seminar in State-Local Administration (3, 3, 3)
5630 Seminar in Technology and Public Policy (3) Technological change and policy process; government interactions with scientific community, political characteristics of scientific enterprise.
5635-45 Operations Research for Public Administrators (3, 3) Operations research methodology; applications and limitations in public sector; linear programming, transportation and assignment problems, network analysis, PERT, dynamic programming and other methods.
5840-50-60 Seminar in Metropolitan Areas (3, 3, 3)
5841 Seminar in Contemporary Public Policies (3) Problems in one or more public policy areas from political and administrative perspectives. Topics selected by instructor.
5870-80 Seminar in Policy Analysis (3, 3) Role of administrators in policy analysis and decision making with special attention to historical and current issues.
5710 Seminar in the Politics of Administration (3) Examination of organization theory applications in context of American political system with emphasis upon policy making and political roles of public administrators and agencies.
5740 Seminar in Organizational Analysis (3) Organization theory applications in public management; field analysis of public organizations.
5750-55 Seminar in Public Management (3, 3) Selected problems.
5760 Seminar in TVA Public Personnel Management Practices (3) Exploration of public personnel management through in-depth examination of one of national government's foremost personnel systems—TVA. TVA staff and employee organization representatives serve as discussion leaders.
5765-75 Law and the Administrative Process (3, 3) Constitutional position; decisional processes, regulation and management; limitations on governmental action; questions of structure, role, and administrative choice.
5770 Practicum in Public Administration (3)
5780 Seminar in Fiscal Management (3) Fiscal role of government in mixed economy, sources of public revenue and credit, financial planning and control.
5785-95 Seminar in Staff Functions (3, 3) Functions of administrative staff personnel serving political executives, public bureaucracies, legislative bodies, and advisory and community groups in public sector. Selected topics include budgeting, personnel, evaluation, and other staff functions.
5810 The American Political Process (4) Principal patterns of political activity linking citizens and political institutions.
5820 The American Political Process (4) Selected problems in American political process.
5850 Seminar in Comparative State Politics (3) Intensive readings in comparative state politics focusing on environment of state politics, institutions and policy making.
5910-20-30 Methodology and Bibliography (3, 3, 3) 5910—Behavioral and mathematical approaches to research. 5930—Philosophical problems in research, traditional literature, and nonbehavioral projects.
6000 Doctoral Research and Dissertation
THE PSYCHOLOGICAL CLINIC

The Psychological Clinic supports graduate training in clinical psychology. Psychological diagnosis and psychotherapy are offered on an outpatient basis, with medical consultants, to the general public as well as to University students, on referral by a physician.

4107 Experience in Individualized Instruction (3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

4120 Topics in Social Psychology (4) Intensive analysis of selected research topics. Prereq: 3120 or Sociology 3130. (Same as Sociology 4120.)


4239 Laboratory in Sensory Processes and Perception (2) Prereq or coreq: 4230.

4400 Organizational-Industrial Psychology (3)

4510 Personality Theories (4) Prereq: 3650.

4520 Personality and Social Systems (4) Prereq: 2520.

4610 Group Processes (3) Study and experience of theory and techniques of group processing and facilitation. Those participating in 4610 are expected to continue into 4630 and 4650. Prereq: 3616-26 and consent of instructor.

4620-30 Seminar in Group Processes (3, 3) Didactic and laboratory experience for those qualified for further training as group facilitators. Prereq: 4610 and consent of instructor.

4640 Psychological Tests and Measures (4) Theory and construction of individual and group measures; survey of various methods of assessment of intelligence, personality, special abilities, and educational achievement. Prereq: 3150.

4650 Symbolic Processes (4) Logic of signs and symbols; directed and associative thinking; memory, problem solving, and concept formation; nature, use, and development of language. Prereq: 3210 or consent of instructor.

4660 The Psychology of Language (4) Theories and descriptions of phonology, syntax, and semantics as applied to psychology and related disciplines. Recommended: 4650 or linguistics background.

4710 Physiological Psychology (4) Nervous system and physiological correlates of behavior. Prereq: 1 yr of biology or zoology and 2520.

4719 Physiological Psychology Laboratory (4) Laboratory studies of nervous system and physiological correlates of behavior. Coreq: 4710.

4720 Comparative Animal Behavior (4) Methods and principles. (Same as Zoology 4720.)

4729 Comparative Animal Behavior Laboratory (4) Laboratory and field studies. Coreq: 4720 (Same as Zoology 4729.)

4750 Evolution and Ontogeny of Social Behavior (4) Genetic, evolutionary, ecological, and developmental processes as they apply to social organization and dynamics of vertebrates. Prereq: Consent of instructor.

4830 History and Systems of Psychology (4) Prereq: 8 hrs of upper division psychology.

4850 Learning Theories (4) Historical and theoretical development of learning models. Prereq: 3210.

4860 Programmed Learning (3) (Same as Curriculum and Instruction 4860.)

4870 Contemporary Research in Behavior of Women (4) Study of interaction of cultural and biological factors in determining the behavior of women, with emphasis on physiological mechanisms involved.

4880 Afro-American Psychology (4) Review and analysis of psychological literature on Afro-American. Prereq: Consent of instructor. (Same as Black Studies 4880.)

4900 Aspects of Urban Environment (4) Interdisciplinary course in urban problems. Prereq: Consent of instructor. (Same as Architecture 4900, Real Estate 4900.) S/NC only.

5000 Thesis

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

5017 Colloquium in Experimental Psychology (1) Coreq: 5019. S/NC only.

5019-29-39 Laboratory Techniques in Experimental Psychology (3, 3, 3) Required of all first-year students in experimental, physiological, and comparative psychology. Coreq: 5017. S/NC only.

5050 Methods of Research in Applied Psychology (3) Techniques and principles for designing and conducting psychological research in natural settings.

5070 Seminar in College Teaching (2) Concepts, methods, and materials in introduction of psychology at college level. Emphasis on research. Required of all Ph.D. candidates. S/NC only.

5079 Practicum in College Teaching (2) Supervised participation in college teaching. S/NC only.

5100 Developmental Psychology (3) Prereq: 3550 or Educational Psychology 2430. (Same as Educational Psychology 5100.)

5105 Developmental Assessment (3) Techniques for assessing development in infants and children. Does not include practicum. Prereq: 5100 or equivalent and consent of instructor.

5110 Clinical Aspects of Human Sexuality (3) Nature of sexuality: societal perspectives, personal identity, application, intimacy and isolation including psychosocial and psychosexual identification and models for intervention. Intended for graduate students in clinical psychology, social work, counseling, and related health professions. Prereq: Consent of instructor.

5111-12-13 Seminar in Current Issues in School Psychology (1, 1, 1) Historical, legal, ethical, and technological issues in practice of school psychology. Multiple instructors. (Same as Educational Psychology 5111-12-13.) S/NC only.

5140-50-80 Psychoeducational Assessment (3, 3, 3) Naturalistic, psychometric, and sociometric assessment methods in school learning environments. Must be taken in sequence. Prereq: Admission to School Psychology program or consent of instructor. (Same as Educational Psychology 5140-50-80.)


5170-80-90 Proseminars in Industrial and Organizational Psychology (3, 3, 3) (Same as Management 5170-80-90.)

5200 Topics in Developmental Psychology (3) Prereq: 5100 or equivalent and consent of instructor. May be repeated. Maximum 6 hrs.

*5210 Readings in Psychology (1) S/NC only.

*5220 Readings in Psychology (2) S/NC only.
Radiation Biology

(Interdepartmental)

MAJOR

Radiation Biology

M.S.; Ph.D.

Daniel Billen, Director

A graduate major in the field of Radiation Biology is offered through the Institute of Radiation Biology. This is a program crossing both departmental and institutional boundaries. Included in the Institute staff are certain scientists from the Departments of Biochemistry, Botany, Chemistry, Microbiology, Physics, Zoology and the Memorial Research Center and the Comparative Animal Research Laboratory of The University of Tennessee, the Biology and Environmental Sciences Divisions of the Oak Ridge National Laboratory, and the Medical Division of Oak Ridge Associated Universities.

Formal courses in this program are offered mainly on the Knoxville campus. Thesis research may be carried on either at the University or at one of the Oak Ridge laboratories. Problems selected for thesis research shall involve the interaction of radiations or long-lived fission products and radionuclide chemicals with biological systems, at the molecular, cellular, organismal, or ecological level of complexity. Areas of radiation specialization currently include photochemistry, environmental, microbial, botanical, and biochemical and biophysical radiobiology.

ADMISSION REQUIREMENTS

The minimum academic requirements for admission to the Institute are: (1) a Bachelor's degree from an accredited college or university, (2) a biological science, chemistry, or physics major, (3) 30 quarter hours in one and 12 in each of the others, (3) college mathematics: potential candidates for the Master's degree, 9 quarter hours, potential candidates for the doctoral degree, 12 additional and integral calculus, (4) for the Ph.D. program, Graduate Record Examination scores.

THE MASTER'S PROGRAM

Course requirements include:

(1) Zoology 5610, (2) Zoology 5620 or 5770 or 5780, (3) Zoology 5350 or Plant and Soil Science 3610, (4) Chemistry 3810, (5) Biochemistry 4110-20 or 5610-20-30. (At least one-half of the student's program must be at the 5000 level.) A thesis is required of all students.

THE DOCTORAL PROGRAM

(1) Courses: In addition to those required for the Master's degree, Chemistry 4910-20-30; Physics 3710-20-30 (Chemistry 3810 may be substituted for Physics 3730); Radiation Biology 5620, 5780. Additional course requirements are determined by the student's faculty committee. The student's special field of interest and plans for a career determine these requirements. The more important courses from which selection may be made are advanced courses in biochemistry, botany, chemistry, electrical engineering, mathematics, microbiology, physics, and zoology. Courses are available in the University of Tennessee Graduate School of Biomedical Sciences at Oak Ridge. (2) The preliminary examination will consist of oral and written portions in radiation biology and in allied fields in which the candidate has received training. (3) The student's dissertation committee determines whether a foreign language is required for the doctoral degree. (4) The final examination will be an oral examination covering the candidate's dissertation and such other fields as the candidate's faculty committee may specify.

Regular attendance at the weekly Radiation Biology Seminar or an appropriate Departmental Seminar is expected of all students.

5000 Thesis

5300 Graduate Research Participation (3-9) May be repeated. Maximum 12 hrs.

5610-20 Foundations of Radiation Biology (4, 4) (Same as Zoology 5610-20).

5780 Radiation Physiology (4) (Same as Zoology 5780).

6000 Doctoral Research and Dissertation

6910 Seminar in Radiation Biology (2) (Same as Zoology 6910).

Religious Studies

Professors: J. L. Fitzgerald, Ph.D. Chicago.

Associate Professors: H. L. Daniels, Ph.D. Duke; W. L. Humphreys, Ph.D. Union; D. E. Linge, Ph.D. Vanderbilt; C. H. Reynolds, Ph.D. Harvard.

Assistant Professors: R. R. Eurl, Ph.D. Vancorbert; J. Kim, Ph.D. Chicago.

Instructor: J. L. Fitzgerald, Ph.D. Chicago.

An M.A. in Philosophy with a concentration in religious studies is available for graduate work in these related fields. (Details of this program are available in the office of either department.) Graduate courses in religious studies further provide opportunity for students in a variety of disciplines to pursue work in religious studies as a graduate concentration.

3060-70-80 History of Western Religious Thought and Institutions (3, 3, 3) 3060—First Century to Fifth Century, 3070—Sixth Century to Fifteenth Century, 3080—Sixteenth Century to 1900. (Same as History 3060-70-80.)

3210 Early Greek Mythology (3) (Same as Classics 3210.)

3220 Greek Mythology in the Classical Period (3) (Same as Classics 3220.)

3230 Roman Mythology (3) (Same as Classics 3230.)

3270 Russian Philosophical and Theological Thought (4) (Same as Philosophy 3270 and Russian 3270.)

3411-12-13 Renaissance and Reformation (3, 3, 3) (Same as History 3411-12-13.)

3440 Religion of Primitive Peoples (3) (Same as Anthropology 3440.)
Romance Languages

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Professors:

Associate Professors:

Assistant Professors:
- F. R. Armstrong, Ph.D. Kentucky; E. J. Campion, Ph.D. Yale; M. Henshaw, Ph.D. Florida; K. D. Levy, Ph.D. Kentucky.

The Department of Romance Languages offers three advanced degrees: the Master of Arts in College Teaching (M.A.C.T.) in Romance Languages only; the Master of Arts (M.A.) in French and Spanish; and the Doctor of Philosophy (Ph.D.) in Spanish.

THE MASTER OF ARTS IN COLLEGE TEACHING PROGRAM

This program requires a minimum of 60 hours of graduate work. Students must participate in the graduate seminar in college teaching during their first year of residence (3 credits). They must also complete 6 hours in supervised instructional work. French or Spanish must be selected as the major subject, and at least 36 hours of graduate work, including 9 hours of thesis and 9 hours of linguistics and philosophy, and 3 hours of courses in language teaching, must be completed. In addition, civilization courses are strongly recommended. Spanish or French must be selected as the minor subject, in which at least 18 hours of graduate work must be completed.

THE MASTER OF ARTS PROGRAM

The student may select either Plan A or Plan B:

**Plan A**
1. Completion of a minimum of 36 quarter hours of which 24 must be taken in courses numbered above 5000, including 5011 (French or Spanish, as appropriate).
3. A written examination covering the course work and selected items from a master reading list.
4. A final oral examination covering the thesis.

**Plan B**
1. Completion of 45 quarter credits of which 33 must be in courses beyond 5000, including 5011 (French or Spanish, as appropriate).
2. Two term papers that have been accepted as satisfactory by the Advisory Committee.
3. A written examination covering the course work and selected items from a master reading list.

THE DOCTORAL PROGRAM

Residence and Course Work:
Completion of a minimum of 36 quarter hours in courses numbered above 5000, including 5011 (French or Spanish, as appropriate), and a dissertation (36 credit hours).

No less than 24 quarter hours should be taken in courses pertaining to the student's major field; of these a minimum of 18 hours must be taken in courses above 5000, and 12 hours may be taken in courses of the 4000 level and the rest in courses above 5000. All students must complete the series in methods of research (5151-61-71) for a total of 3 credits. The minor shall consist of at least 18 hours of which at least 12 hours must be numbered above 5000 and the rest above 4000, and should represent a meaningful complement to the student's area of concentration. In addition 9 hours of courses above 4000 in a related discipline are required. In special cases the latter requirement may be waived in favor of additional course work in the major field.

Language Requirements:
Students are expected to demonstrate written and oral fluency in Spanish as well as knowledge of two other foreign languages. One of these must be French; the second one should be chosen from such languages as German, Italian, Portuguese, Arabic or Hebrew in accordance with the student's field of concentration. Proficiency in Latin shall be required of all students specializing in an area related to philology or the medieval period.

Examinations:
A preliminary comprehensive examination, both written and oral, covering the major and minor fields must be passed before the candidate can become an official candidate for the degree. This preliminary examination is to be held at the time deemed most appropriate by the student's major advisor and committee. The candidate is expected to defend the dissertation in a final oral examination. For additional information on the program, consult pages 21-22.

Arabic

3510-20 Intermediate Modern Standard (4, 4)
3610 Islamic Literature in English Translation (4) Survey from origins to modern period of major Islamic literatures, especially Arabic, Persian, and Turkish. Recommended readings include *The Arabian Nights*, *The Rubaiyat of Omar Khayyam* and Gibran's *The Prophet.*
5070-80-90 Hispano-Arabic Literature and Culture (3, 3, 3) (Same as Spanish 5070-80-90.)
5101 Foreign Study (1-12) See page 100.
5102 Off-campus Study (1-12) See page 100.
5103 Independent Study (1-12) See page 100.

French

3010-20-29 Elements of French for Upper Division and Graduate Students (3, 3, 3) Elements of language, elementary and advanced readings. Open to graduate students preparing for language examination. Open to upper division students desiring reading knowledge of the language. Undergraduate credit only. No credit for those having had Elementary French. No auditors.
5212 College Teaching of Romance Languages (3) Seminars, demonstrations, and practical applications of techniques and procedures for teaching and evaluating basic language skills, cultural aspects, and beginning literature. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships except those whose previous training or experience warrants their being excused by department.

5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as Italian and Spanish 5151-61-71) S/NC only.

5210-20-30 French Literature of the Sixteenth Century (3, 3, 3)

5230-60-70 The Philosophes (3, 3, 3) Textual analysis of the works of Voltaire, Diderot, Rousseau, and other eighteenth-century writers.

5140-20-30 The French Novel (3, 3, 3)

5450-60 Lyric Poetry of the Nineteenth Century (3, 3) 5450-German and English Influences on French Romanticism and generation of the poets of "le mal du siecle." 5460-Victor Hugo; the Parnassians.

5470 Bauledaire and the Symbolists (3) Les Fleurs du mal and Petits poemes en prose with emphasis on the theories of color and "correspondances" and their influence on Symbolist school.

5610-20-30 Trends in Contemporary French Literature (3, 3, 3)

5650-60 Advanced Syntax and Stylistics (3, 3) Readings and written imitations of modern literary styles in form of compositions, sketches, and original stories.

5670 Problems in Romance Linguistics (3) Topics vary. May be repeated with consent of department. Prereq: 4270 or equivalent. (Same as Spanish 5670.)

5710-20-30 Seminar in French Literature (3, 3, 3) Topics vary. May be repeated with consent of department.

5810 Literary Criticism: The Foundations of Romance Criticism (3) (Same as Spanish 5910.)

Italian

3210-20-30 Civilization and Culture (3, 3, 3) Prereq: Intermediate Italian or equivalent.

3310-30-30 Italian Literature in English Translation (3, 3, 3) Italian School, the Florentine School, Dante, Petrarach, Boccaccio, Machiavelli, Ariosto, Tasso. 3320-From the Baroque through nineteenth century, commedia dell'arte, Vico, Leopardi 3330-Twentieth century, Carducci, Pirandello, Quasimodo, D'Annunzio, Moravia. No change in credit hours after add deadline. Option of 4 hrs credit must present appropriate amount of extra work above that required for 3 hrs.

3510-20 Aspects of Italian Literature (4, 4) Prereq: Intermediate Italian or equivalent. Recommended for literature majors.

4010-20-30 Italian Drama in English Translation (3, 4, 4) 4010-La commedia dellarte and major works of Machiavelli, Metastasio, Goldoni, Goldoni. 4020-Twentieth-century theater: operatic drama, the Grottesco, Pirandello, De Filippo, Frati. No change in credit hours after add deadline. Option of 4 hrs credit must present appropriate amount of extra work above that required for 3 hrs.

4050-60-70 Dante and Medieval Culture (3, 3, 3) Readings and lectures in English for students majoring or minoring in Italian. (Same as Comparative Literature 4050-60-70.)

4220 Petrarach (3) Prereq: 3130, 3520 or equivalent.

4230 Boccaccio (3) Prereq: 3130, 3520 or equivalent.

4330 History of Italian Language (3) Prereq: 3130, 3520 or equivalent.

4140-20-30 Literature of the Rinascimento (3, 3, 3) From Pulci to Tasso, the Quattrocento and the Cinquecento. Prereq: 3130, 3520 or equivalent.

4330 The Modern Novel (3) Prereq: Intermediate Italian or equivalent.

4540 The Modern Theatre (3) Prereq: Intermediate Italian or equivalent.

4610 Contemporary Theatre (3) Prereq: Intermediate Italian or equivalent.

4620 Contemporary Poetry (3) Prereq: Intermediate Italian or equivalent.

4630 Contemporary Prose (3) Prereq: Intermediate Italian or equivalent.

5011 Techniques in Literary Analysis (2) Intensive course in explication de texte.

5101 Foreign Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5103 Independent Study (1-12) See page 100.

5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as French and Spanish 5151-61-71) S/NC only.

5610-20-30 Readings in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of department.

5710-20 Seminar in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of department.

Portuguese

3510-20 Aspects of Portuguese Literature (4, 4) Prereq: Intermediate Portuguese or equivalent. Recommended for literature majors.

4210-20-30 Directed Readings in Brazilian and Portuguese Literature (3, 3, 3) May be repeated with consent of instructor.

5101 Foreign Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5103 Independent Study (1-12) See page 100.

Spanish

4030 Masterpieces of Spanish Literature in English Translation (3) No foreign language credit.

4050-60-70 Hispanic-Arabic Literature and Culture (3, 3, 3)

4110-20-30 Spanish Literature of the Golden Age (3, 3, 3) The picassque novel: Cervantes; the Comedia.

4160-70-80 Advanced Conversation (2, 2, 2) Intensive training in prepared and spontaneous conversations. Subjects range from travel and current events to literature and aspects of national culture. Prereq: Completion of 9 hrs of courses on 3000 level.

4210 Phonetics (3) Prereq: 2130, 2520, or equivalent.

4220-30 Advanced Grammar (3, 3) Prereq: 2130, 2520, or equivalent.

4250 Introduction to Descriptive Linguistics (3) Phonetics and phonology, morphology and syntax. Types of languages, linguistic groups, dialects and dialect geography. Application of descriptive linguistics-field linguistics, dialect study-its practical use in learning languages and in language teaching. Introduction to transformational grammars. Prereq: 9 hrs of upper division English or 9 hrs of upper division courses in a modern or ancient language (exclusive of German and French 3010-20). Prerequisites in literature and original stories. Subjects range from travel and current events to literature and aspects of national culture. Prereq: Intermediate French or equivalent. May be repeated with consent of department.

4260 Introduction to Historical and Comparative Linguistics (3) (Same as German, Russian, and Spanish 4260.)

4270 Romance Linguistics (3) Development of the Romance languages, or consent of department. (Same as French, German, and Russian 4270.)


4410-20 French Civilization (3, 3, 3) Prereq: Intermediate French or equivalent.

4510-20-30 French Literature of the Nineteenth Century (3, 3, 3) Prereq: Intermediate French or equivalent.


4710-20-30 French Literature of the Twentieth Century (3, 3, 3) Prereq: Intermediate French or equivalent.

5000 Thesis

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

5011 Techniques in Literary Analysis (3) Required for either Plan A or Plan B of M.A. program. Intensive course in explication de texte.

5101 Foreign Study (1-12) See page 100.

5102 Off-campus Study (1-12) See page 100.

5103 Independent Study (1-12) See page 100.
5450-70 Studies in Modern Spanish Style (3, 3) Prereq: Consent of instructor.
5410-20-30 Spanish Literature of Nineteenth Century (3, 3, 3) Prereq: Intermediate Spanish or equivalent.
4710-20-30 Spanish Literature of the Twentieth Century (3, 3, 3) 4710—Non-dramatic prose fiction; 4720—prose poetry; 4730—dramatic poetry. Prereq: Intermediate Spanish or equivalent.
5000 Thesis
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5011 Techniques in Literary Analysis (3) Required for either Plan A or Plan B of M.A. program. An intensive course in explication de texte.
5070-80-90 Hispano-Arabic Language and Literature (3, 3, 3) 5070—General culture history, philosophy in Arab Spain. 5080—Development of traditional Arabic poetry and popular narrative, into modern novel of character after invention of printing. 5090—Mutual influence of traditional Arabic poetry and popular narrative, Spanish literature, choral lyric; development of classical muwashshah, the colloquial zajal, and the later villancico. Readings in Arabic and Spanish. (Same as Arabic 5070-80-90.)
5101 Foreign Study (1-12) See page 100.
5102 Off-Campus Study (1-12) See page 100.
5110-20-30 Old Spanish (3, 3, 3) Medieval Spanish language and literature; authorized only during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
5121 College Teaching of Romance Languages (3) Seminars, demonstrations, and practical applications of techniques and procedures for teaching and evaluating basic language skills, cultural aspects, and beginning literature. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships except those whose previous training or experience warrants their being excused by department.
5151-15-71 Bibliography and Methods of Research (1, 1, 1) (Same as French and Italian 5151-15-71) S/NC only.
5211-21 Don Quijote (3, 3) Must be taken in sequence.
5212-22-23 Goldene Age Prose (3, 3, 3, 3) 5212—La Celestina; critical study of Fernando de Rojas' life and work. 5213—Celestinae genre; Feliciano de Silva's Segunda Celestina. 5214—Spanish philological thought; mystical prose; satirical works. 5215—Guzman de Alfaroche and Spanish picarosse genre.
5231 The Exemplary Novels, Pierses y Siglosmunda (3)
5250-60 The Generation of '98 (3, 3) Angel Ganivet, Giner de los Rios, Baroja, Unamuno, Valle Inclán, Beravente, Azorín, Perez de Ayala.
5270 The Contemporary Novel (3) Civil War and post-Civil War period.
5310-20 Directed Readings (3, 3)
5311-21 Special Topics in Spanish or Spanish American Literature (3) May be repeated.
5340 Problems in Hispanic Culture (3) Prevailing social, political, artistic, literary and ideological conditions and patterns of any area or period within Spanish or Latin American culture. May be repeated with consent of department. Maximum 6 hrs.
5510-20-30 The Spanish Theatre after the Golden Age (3, 3, 3) 5510—From eighteenth century through Romanticism. 5520—From Realism through Generation of 1898. 5530—Contemporary theatre.
5610 Spanish American Prose to 1900 (3) Novel, chronicle, essay.
5611-21 Spanish American Lyric Poetry (3, 3)
5620-30 The Modern Novel in Spanish America (3, 3)
5631 Spanish American Essay (3)
5632 The Spanish American Short Story (3) Short story as major literary genre in Spanish America. Reading and criticism of works of authors such as Dario, Quiroga, Borges, Arreola, and Rufio.
5633 Twentieth-century Latin American Theatre and Film (3) Readings from works of Carlos Solzurosa, Rodolfo Usigli, Conrado Naile Rosio, Roberto Cossa, Rene Marques and Sebastian Salazar Bondy. Presentation of films as adaptations of classical tales such as Dona Barbara, Los de abajo and Don Segundo Sombra as well as exponents of experimental cinema of today.
5640 Latin American Women Women's Literature (3) Feminine point of view, modern image of woman, male-female relationships and society as context for woman's destiny. Readings from poetry and fiction, including such authors as Alfonsina Storni, Delmira Agustini, Gabriela Mistral, Silvina Burilich, Silvina Ocampo, and Rosario Castellanos.
5650-60 Advanced Syntax and Stylistics (3, 3) Readings and written imitations of modern literary styles in compositions, sketches, and original stories.
5670 Problems In Romance Linguistics (3) (Same as French 5670.)
5810-20-30 Spanish Lyric Poetry (3, 3, 3)
5910 Literary Criticism: The Foundations of Romance Criticism (3) (Same as French 5910.)
6000 Doctoral Research and Dissertation
6210-20-30 Seminar in Spanish Literature (3, 3, 3) Topics vary. May be repeated with consent of department.
6310-30 Seminar in Latin American Literature (3, 3, 3) Topics vary. May be repeated with consent of department.

For a full statement of departmental requirements, students are referred to the Departmental Manual. All registration for 3000- and 4000-level courses require the consent of the instructor.

THE MASTER'S PROGRAM

The department offers both a thesis and non-thesis option for a Master's degree. For information on the Master's degree with thesis, see the General Requirements on page 19. Those interested in the non-thesis option should obtain details from the department.

THE DOCTORAL PROGRAM

General requirements for the degree of Doctor of Philosophy are described on page 21. Additional specific requirements for the degree of Doctor of Philosophy in Sociology include:

1. A minimum of 108 credit hours following the Bachelor's degree, exclusive of credits for the Master's thesis, is required. Of this number, 36 hours shall be allocated to doctoral research and dissertation. A maximum of 12 hours credit outside the major may be taken in related fields, with the approval of the student's committee. Exclusive of doctoral research and dissertation at least one-half of all credits shall be in courses numbered 5000 or 6000.
2. A written preliminary examination covering sociological theory, research methodology, and two other areas in sociology shall be passed prior to admission to candidacy. This examination must be passed not later than one academic year before the date on which the degree is granted.
3. No later than one month before granting of the degree, the candidate will be required to pass an oral examination on the doctoral dissertation. At the oral examination the candidate will be expected to show a thorough knowledge of sociological theory and methodology related to the research.

4030 Society and Law (4) General treatment of social origins and consequences of law and legal process. Particular emphasis is placed on problems of law and social change, and on structure and functioning of legal sanctions. Some attention is paid to law and law-like phenomena in formal organizations and primitive societies.
4110 Population Problems (4) Demographic factors and social structure; trends in fertility, mortality, population growth, migration, distribution, and composition; population policy.
4120 Topics In Social Psychology (4) (Same as Psychology 4120.)
4130 Sociology of Punishment and Corrections (4) Traces development of correctional movement, develops a critical sociological perspective on contemporary correctional programs, and provides overview of evaluative research in corrections.
4310 Criminology (4)
4330 Urban Ecology (4) Examination of public, private, collective, individual, and individual phenomena. Classical school of ecology, its neoclassical revisers, social area analysis, and cognitive symbolic ecological geography.
4410 Educational Sociology (3) (Same as Curriculum and Instruction 4410.)
4530 Community Organization (4) Structure; function; linkages; change and development and
important community studies are reviewed and discussed. Emphasis on sociological analysis, not on the implementation of change.

4540 Social and Religious Change (4) Critical review of historical and contemporary theories and methods employed in study of social change. Attention given to both macro and micro group change. (Same as Religious Studies 4540.)

4560 Formal Organization (4) Analysis of bureaucratization process, division of labor, delegation of authority, and formalized communication under a system of rationality.

4820 American Minority Groups (4) Minority groups and social structure in American society; analysis of intergroup relations with attention given to both past and present relationships of selected groups to broader society.

4930 Social Movements (4) Development, organization, and function of social movements; attention is given to the ideology, leadership and organization of political, religious and other types of social movements.

4940 Sociology of Religion (4) Interrelationship of society, culture, and religion. (Same as Religious Studies 4940.)

4960 Tradition, Change and Modernity in Asia (4) (Same as Religious Studies 4960.)

5000 Thesis

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

5040 Methodological Issues in Social Research (3)

5200 Seminar in Collective Behavior and Social Movements (3)

5210, 5420-30 Social Theory (3, 3, 3)

5220 Social Control (3)

5230 Seminar in Sociology of Medicine (3)

5240 Theory and Research in Human Migration (3)

5250 Selected Topics in Migration Research (3)

5310 Seminar in Methods of Sociological Research (3) Major methodological issues in sociology; scaling techniques: reliability, validity, sampling, and qualitative methodology.

5320-30 Social Statistics (3, 3) General survey of parametric and nonparametric procedures in analysis of sociological data; assumptions underlying procedures; advantages, disadvantages, and special applications. Must be taken in sequence.

5520 Crime, Law, and Social Control (3)

5530 Seminar in Community (3)

5550 Seminar on Community Power (3) Analysis of theories and methods used in studying social power in contemporary society.

5560-70 Field Research in Deviance (3, 3)

5580 Sociology of Mental Disorders (3) Relationship between psychological, sociological models and substantive theories of mental illness. Historical development of theoretical conceptualizations. Interdependence of theory and therapeutic techniques. Epidemiology of mental disorders. Revisions to study of small groups. Research designs to test selected theoretical problems. May be repeated.

5700 Sociology of Business (3) Structure and functions of human groups, with special attention to voluntary associations and administrative organizations.

5720 Small Group Theory and Research (3) Critical assessment, through reading and actual research, of contemporary theoretical orientations to study of small groups. Research designed to test selected theoretical problems. May be repeated.

5810 Seminar in Race and Culture (3) Critical examination of theoretical and conceptual approaches in study of intergroup relations.

5910 Urban and Regional Sociology (3)

5920 Seminar in Social Attitudes (3)

5940 Delinquency and the Social Structure (3) Critical assessment of contemporary theories of delinquency, research findings related to them, and their implications for formal strategies of control and rehabilitation.

5950 Seminar in Population Theory (3) Mathus, Marx, optimum population, and selected variables are examined. Prereq: 4110.

5960 Demographic Techniques (3) Life, table, standard rates, and survey techniques of population analysis.

5970 The Sociology of Development and Modernization (3) Comparative approach to institutional and organizational correlates of modernization. Relations between urbanization, industrialization, and modernization.

6000 Doctoral Research and Dissertation

6040 Experimental Research (3)

6050 Seminar on Methods of Social Research (3) Experimental research projects. (Same as Psychology 6050.)

6070 Field Research (3)


6000-100 Survey Design and Analysis (3, 3) Application of general methodological principles to particular operating context of survey. Systematic exploration of survey problems through student participation in design and analysis of survey (2 qtrs).

6130 Seminar in Mass Behavior and Related Topics (3)

6140 Advanced Reading in Sociological Theory (4)

6150 Advanced Reading in Sociological Methods (4)

6160 Advanced Special Social Investigation (4)

6170 Cross-cultural Aspects of Human Fertility (3) Historical, cross-cultural, and methodological approaches to human fertility and demographic problems. Consideration of relations obtained between socioeconomic and demographic change in various parts of world; fertility rates and national power; controversies on control of vital rates of growth.

6180 Theory and Method of Human Ecology (3) Theoretical perspective and research techniques of human ecology applied to selected research sites.

6190 Advanced Special Social Investigation (4)

6510 Advanced Issues in Criminological Theory (3) Emphasis on problems related to theory construction and measurement.

6520 Sociology of Deviance (3) Advanced studies in deviant behavior. Theories and findings regarding cause and procedures and programs for social control. Prereq: 4510 and 5520.

6530 Sociology of Law (3) Analysis of social and cultural factors influencing emergence and maintenance of law as social institution and affecting relations between law and deviant behavior; appraisal of theoretical and methodological issues encountered in studying law.

6540 Readings in Criminology and Deviance (3) Directed readings and selected topics on criminology and deviance.

6550 Advanced Studies in Community (3) Analysis of concepts of community, theories of community change, and techniques used in community research.

6610 Seminar in Formal Organization (3) Major formal organizational theories; bureaucracy; functions of theoretical models of organizations; major organizational variables; organizational authority patterns; communication in formal organizations. Prereq: 3610-20.

6710 Seminar in Class and Status (3) Classic and recent studies of class and status. Methods used in research and current position of theory.

6810 Advanced Studies in Social Psychology (3) Social interaction and personality; genesis and functioning of self; interplay of social structures and individual actions; theories of social psychology related to these problems and research. May be repeated. Prereq: 4130 or 5640 or Psychology 5950.

6840-50 Social Change (3, 3) Major theories, methods and research.

6940 Advanced Studies in Urban Sociology (3) Field work projects, community studies examined and/or applied in specified areas. Prereq: 4140-20.

Spanish

See Romance Languages

Speech and Hearing Sciences

See Audiology and Speech Pathology

Speech and Theatre

MAJOR

DEGREE

Speech and Theatre

M.A.

Professors:


Associate Professors:

4582 Public Discussion of Race (4) History and criticism of racial advocacy in America.

4591 Persuasive Uses of Imaginative Literature (4) Topics in social and political uses of novels, plays, and poems.

4811 Advanced Phonetics (4) Phonetic aspects of contemporary dialects of the English language. Prereq: Consent of instructor.

4999 Colloquium in Speech Communication (1) May be repeated.

5140 Communications Theory (3) Analysis of contemporary theories of human communication, emphasizing similarities and differences of communication processes in interpersonal, personal, and mass communications systems. (Same as Communications 5140.)

5210 Topics in Group and Interpersonal Communication (3) May be repeated. Maximum 9 hrs.

5220 Quantitative Projects in Speech Communications (3) May be repeated. Maximum 9 hrs.

5430 Studies in Tennessee Oratory (3) May be repeated. Maximum 9 hrs.

5440 Organizational Communication (3) May be repeated. Maximum 9 hrs.

5550-60-70 Studies in Persuasion (3, 3, 3)

5750-60-70 Studies in Rhetoric (3, 3, 3)

5911 Directing the Forensic Program (4) Philosophical and methodological aspects of directing curricular and extracurricular forensic activities in high school and college. Creative and noncreative approaches to directing debate, oral interpretation and public speaking events. (Same as Curriculum and Instruction 5911.)

Speech and Theatre

4170-80-90 Film History and Theory (3, 3, 3) Analysis of cinematic forms and styles. 4170—Narration. 4180—Exposition and persuasion. 4190—Experimental forms; films and other media.

4640 Group Performance of Literature (4) Oral interpretative techniques of choral reading, readers theatre and chamber theatre.

5000 Thesis

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

5110 Introduction to Graduate Research in Speech and Theatre (3)

5120 Directed Reading and Research (3) May be repeated. Maximum 9 hrs.

5160 Theory and Technique in Oral Interpretation (4) Literary, psychological, communicative, and aesthetic approaches to collection, adaptation, and oral presentation of literature. May be repeated. Maximum 8 hrs.

Theatre

3121-22 Advanced Acting (4, 4) Historical styles of acting. 3121—Renaissance. 3122—seventeenth and eighteenth centuries. Prereq: Consent of instructor.

3151 Theatre Practicum: Performance (1-4) Supervised work on departmental productions. Available for credit only to theatre majors or with consent of department. Prereq: Consent of instructor.

3152 Theatre Practicum: Production (1-4) Supervised work on departmental productions. Available for credit only to theatre majors or with consent of department. Prereq: Consent of instructor.

3153 Outdoor Repertory Productions (4) Supervised work on productions at Hunter Hills Theatre.
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4951-52 Playwriting (4, 4) Prereq: Consent of instructor.
5011-12-13 Projects in Lieu of Thesis (3, 3, 3)
5280 Seminar in Playwriting (3)
5310 Studies in European Theatre History (3) May be repeated. Maximum 9 hrs.
5320 Studies in American Theatre History (3) May be repeated. Maximum 9 hrs.
5280 Projects in Lighting Design (3) May be repeated. Maximum 9 hrs.
5630 Projects in Play Directing (3) May be repeated. Maximum 9 hrs.
5640 Projects in Scene Design (3) May be repeated. Maximum 9 hrs.
5650 Projects in Costume Design (3) Problems of play interpretation and theatrical costume design centralizing around individual projects. Students will design costumes for complex plays for public performance. May be repeated. Maximum 9 hrs.
5660 Projects in Technical Theatre (3) Problems of set design, interpretation, and execution.
5670-71-72-73-74-75 Master Class in Acting (5, 5, 5, 5, 5, 5)
5660-81-82 Design and Technical Theatre Seminar (6, 6)
5890 Studies in Theatrical Production (3) May be repeated. Maximum 9 hrs.
5912 Play Production in Secondary Schools (4) Prereq: Consent of instructor. Repeatable. Maximum 9 hrs. (Same as Curriculum and Instruction 5912.)
5950-60-70 Studies in Dramatic Theory and Criticism (3, 3, 3)

Speech Pathology
See Audiology and Speech Pathology

University Studies
(Non-Departmental)
University Studies deal with important contemporary topics which are sufficiently comprehensive to require the study and attention of students and faculty from more than one college. They are open to all qualified members of the university community.

4100 Energy Needs and Our Environment (3) Prereq: Consent of instructor and projects energy resources and demands; economic, behavioral, legal, technical and environmental opportunities and constraints; regional impacts of energy production and consumption. Topical focus will change from quarter to quarter. May be repeated. Maximum 9 hrs.
5912 Play Production in Secondary Schools (4) Prereq: Consent of instructor. Repeatable. Maximum 9 hrs. (Same as Curriculum and Instruction 5912.)
5950-60-70 Studies in Dramatic Theory and Criticism (3, 3, 3)

Zoology
MAJOR
DEGREES
M.S., Ph.D.
Professors:
J. T. Tannehill, Ph.D. Brown; R. M. Bagby, Ph.D. Illinois; D. L. Bunting, Ph.D. Oklahoma State; J. G. Carlson (Emeritus), Ph.D. Pennsylvania; A. C. Cole, Jr. (Emeritus), Ph.D. Ohio; J. C. Daniel, Jr., Ph.D. Colorado; G. A. Ehler, Ph.D. Minnesota; R. C. Fraser, Ph.D. Minnesota; R. F. Grall, Ph.D. Tennessee; B. Hochman, Ph.D. California (Berkeley); J. C. Howell (Emeritus), Ph.D. Cornell; K. W. Jeon, Ph.D. London (England); A. R. Jones, Ph.D. Virginia; J. R. Kennedy, Ph.D. Iowa; J. N. Liles, Ph.D. Ohio State; L. E. Roth, Ph.D. Chicago;


Associate Professors: K. D. Burnham, Ph.D. Iowa; A. C. Eckert, Ph.D. Kansas; A. A. El-Banna, Ph.D. Washington State; D. J. Fox, Ph.D. Hopkins; A. M. Jungreis, Ph.D. Minnesota; J. A. MacCabe, Ph.D. California (Davis); M. L. Pan, Ph.D. (Emeritus), R. Reichert, Ph.D. Wisconsin; G. A. Vaught, Ph.D. Duke; H. G. Welch, Ph.D. Florida; M. C. Whiteside, Ph.D. Indiana.

Assistant Professors: K. Foreman, Ph.D. Idaho; E. Frederick, Ph.D. Northern Arizona; N. G. Hefner, Ph.D. Rutgers; M. A. Handel, Ph.D. Kansas State.

The Department of Zoology offers the Master of Science and Doctor of Philosophy degrees with concentrations in aquatic biology and ecology, cell biology and radiation biology, physiology, genetics, organismal and field biology, and reproduction and developmental biology.

Requirements for admission: Applicants for graduate study are expected to have a background no less extensive than that required of undergraduate majors in this department. This includes a knowledge of the basic principles of cell biology, genetics, and ecology. Other requirements for admission are: (1) general zoology or general biology, 12 quarter or 8 semester hours; (2) upper division zoology, 18 quarter or 12 semester hours; (3) chemistry, two years including 12 quarter or 8 semester hours of general inorganic; (4) mathematics, 9 quarter or 6 semester hours including differential and integral calculus; (5) physics, 12 quarter or 8 semester hours; (6) Graduate Record Examination scores (Verbal, Quantitative and Advanced Biology); and (7) a grade point average of 3.0 out of a possible 4.0. Otherwise superior students, deficient in one or more of the above requirements, may be admitted at the discretion of the Graduate Affairs Committee.

A course in biostatistics is required of all candidates for an advanced degree in Zoology.

All aspirants for advanced degrees in Zoology must exhibit competency in four (M.S.) or five (Ph.D.) of six areas of zoology as determined by the candidate's faculty committee. Students must take this examination during the fall quarter of the first year and may repeat the examination following fall quarter if unsatisfactory scores are received. Competency must be exhibited within this two-year period for a student to continue in the program.

Preparation for thesis or dissertation: During the first year a written examination and a special research problem in each of two faculty members' laboratories will determine the student's preparation for thesis or dissertation study.

THE DOCTORAL PROGRAM

Special requirements in Zoology are as follows: (1) course requirements shall be determined by the candidate's faculty committee; (2) the preliminary examination will be an oral and written examination in zoology and in allied fields in which the candidate has had training; (3) the candidate for the Ph.D. degree must possess a reading knowledge of at least one foreign language in which there exists a sizeable and relevant to the major field of study. The student has the option of demonstrating a reading knowledge of this foreign language by (a) passing the official reading examination given by the language department or (b) earning at least a B in 3030 language courses. This requirement for the first language must be fulfilled before the student can take the preliminary examination.

The student's faculty committee may require of the student any level of training or proficiency in a second foreign language but may not require that the student take the official language examination in the second language.

3040 Natural History of the Vertebrates (5) Behavior, life history, phylogeny, and classification. 3 hrs and 2 labs or field periods.

3050 Comparative Vertebrate Embryology (5) Developmental morphology of selected vertebrates. 2 hrs and 3 labs.

3060 Comparative Vertebrate Anatomy (4) Anatomy of organ systems. Dogfish shark and cat used in laboratory. 2 hrs and 2 labs.


3110 General Entomology (5) Introduction to insects: basic structure, development, behavior; classification of insect orders and representative families; interpretation and use of keys. Prereq: Biology 3130 or consent of instructor. 3 hrs and 2 labs.

3150 Invertebrate Zoology (5) Biology of invertebrates (except insects) with emphasis on ecology and behavior. Prereq: Biology 3130. 3 hrs and 2 labs.

3220 Physiology of Reproduction (3) (Same as Animal Science 3220.)

3240 Zoology (4) Study of animal tissues. Prereq: Biology 3120. 2 hrs and 2 labs.

3410 Bioethics (3) Relationship between biological discoveries and human values. Open discussion of selected dilemmas arising from new knowledge about medicine, behavior, resources, and technology.

4007, 4010-4017 Minicourse in Zoology (2 hrs each). Selected, advanced topics in zoology, concentrated in time and subject matter. Consult departmental listing for actual topics offered. Prereq: As posted. May be repeated.

4050 Developmental Biology (4) Experimental morphogenesis, fertilization, cellular interactions, hormonal effects and related topics with examples drawn mainly from invertebrates and vertebrates. Prereq: 3050. 2 hrs and 2 labs.

4120 Undergraduate Research Participation (2) Experience in active research projects under supervision of staff members. Prereq: Consent of instructor.

4140 Practicum in Zoology (1-3) Participation in practical application of zoology in community institutions, government organizations and industry. Approximately 5 hrs involvement per week. Prereq: Biology 3110, 3120, 3130 and senior standing.

4190 Mammalogy (4) Classification, evolution, distribution, reproduction, adaptations, and behavior. 2 hrs and 2 lab or field periods.

4200 Ichthyology (5) Classification, collection and identification, distribution, life histories, and economic importance of fishes. Prereq: Biology 2120 or consent of instructor. 2 hrs and 2 lab or field periods.
4210 Cell Physiology (5) Development of modern concepts in cell physiology from point of view of information transport which examines kinetics and integration of cellular activities. Prereq: Cell biology, or any physiology, and organic chemistry. Recommended: Biochemistry. 3 hrs and 1 lab.

4240 Animal Ecology (4) Environmental factors determining distribution and numbers of animals; intraspecific relations; problems and methods. Prereq: Biology 3120. 2 hrs and 2 labs.

4250 Comparative Animal Physiology I (3) Environmental physiology. Survey of physiological mechanisms and their relation to ability of animals to survive in diverse physical environments. Prereq: Biology 3120-30 and 2 yrs chemistry.

4259 Comparative Animal Physiology Laboratory I (1) Coreq: 4250.

4260 Comparative Animal Physiology Laboratory II (3) Sensory, effector and integrative physiology. Prereq: 3080.

4269 Comparative Animal Physiology Laboratory II (1) Coreq: 4260.

4270 Advanced Immunology (2) (Same as Microbiology 4270.)

4280 Comparative Endocrinology (5) Comparative analysis of the physiology and morphology of endocrine glands in vertebrates and invertebrates. Their role and interaction in maintenance of the organism and species. Prereq: 3080 or 3920.

4290 Herpetology (4) Classification, distribution, life histories, collection and identification of amphibians and reptiles, primarily of local species. 2 hrs and 2 labs or field periods.

4300 Ornithology (4) Morphology, physiology, behavior, reproduction, populations, evolution, field identification. 2 hrs and 2 labs or field periods.

4310 Nuclear Cytology (4) Chromosome structure and behavior in mitosis and meiosis. Prereq: Biology 3110. 1 hr and 3 labs.

4320 Microtechnique (4) Prereq: 3320 recommended. 2 hrs and 2 labs.

4330 General Cytology (4) Study of cellular organelles at the light and electron microscope levels and the functioning of these organelles. Prereq: Biology 3120.

4380 General Genetic Laboratory (2) Mainly Drosophila experiments designed to illustrate basic principles of inheritance. Prereq: Biology 3110.

4390 Organic Evolution (3) Modern concepts of animal evolution. Prereq: Biology 3110.


4410 General Parasitology (4) Morphology, taxonomy and ecology of parasitic worms and protozoa, with emphasis on host-parasite relationships. 3 hrs and 1 lab. Prereq: Biology 3120 or consent of instructor.

4430 Medical Entomology (4) Distinctive morphological features, distribution, life histories, and control of arthropods that parasitize man or serve as vectors of human pathogens. Recommended prereq: Agricultural Biology 3210 or Biology 3130.

4450 Protozoology (4) Morphology, taxonomy, and physiology of protozoa in relation to fundamental biological concepts. 2 hrs and 2 labs. Recommended prereq: Biology 3120.

4461-20 Comparative Animal Pathology (2, 2) Abnormal conditions of the organs and their causes. 4610—Cell and tissue changes. 4620—Organ, organ system, and organism changes. Recommended: 3060, 3080, 3320.

4469-29 Comparative Animal Pathology Laboratory (2, 2) 4610—Cell and tissue changes. 4620—Organ, organ system, and organism changes. Coreq: 4810-20.

4660-70 Limnology (4, 4) 4660—Effects of origin, age, and location of lakes on their physical and chemical nature. 4670—Lake communities, productivity and pollution. Prereq: Chemistry 1110-20-30 and Biology 3130. Recommended: Botany 1110-20-30 and 3080. 2 hrs and 2 labs (4660); 3 hrs and 1 lab (4670). Must be taken in sequence, except with consent of instructor.

4700 Arachnology (4) Biology of spiders, mites, scorpions, and relatives. Prereq: 3110, or 3150. 2 hrs and 2 labs.

4720 Comparative Animal Behavior (4) Methods and principles. (Same as Psychology 4720.)

4729 Comparative Animal Behavior Laboratory (4) Laboratory and field studies. Coreq: 4720.

4810-20-30 Insect Morphology and Taxonomy (4, 4, 4) 4810—Internal morphology of both generalized and specialized forms. 4820—Taxonomy of major orders. 4830—Taxonomy of minor orders and immature forms. Prereq for 4820-30: 3110 or consent of instructor. 2 hrs and 2 labs.

4940 Physiology of Exercise (4) Functions of body in muscular work; physiological aspects of fatigue, training, and physical fitness. Prereq: 2920-30 or 3080. 3 hrs and 1 lab.

5000 Thesis

5080 Graduate Research Participation (3) Advanced research techniques studied under supervision of staff research director whose research area coincides with interests of student. Open to all graduate students in good standing. Prereq: Consent of department and research director. May be repeated with consent of department. S/NC only.

5110-20-30 Special Problems (2, 2, 2)

5150 Zoological Bibliography (1) Methods of locating and using zoological literature, bibliographies, and abstracts, and of preparing bibliographies and scientific papers.

5180 Fresh Water Invertebrate Zoology (4) Ecology and taxonomy of fresh water invertebrates exclusive of insects. Laboratory and field study. Prereq: 3130.

5210 Plant Parasitic Nematodes (4) (Same as Agricultural Biology 5210.)


5270 Advanced Neurophysiology (4) Physiological and pharmacological considerations of the nervous system in vertebrates. Prereq: 4280, 4300. 3 hrs and 2 labs.

5280 Insect Physiology (4) Functions and interrelationships of systems relative to metabolism, growth, coordination, movement, and reproduction. Prereq: 4810. 1 yr general chemistry or consent of instructor. S/NC only.

5280 Insect Physiology (4) Functions and interrelationships of systems relative to metabolism, growth, coordination, movement, and reproduction. Prereq: 4810. 1 yr general chemistry or consent of instructor. S/NC only.

5290 Quaternary Problems (4) (Same as Geology 5290.)

5310-20 Seminar in College Zoology (2, 2) Current concepts and principles in teaching of zoology; modern techniques and instrumentation; supervised application of teaching principles and methods. Must be taken in sequence. Prereq: Consent of instructor. S/NC only.

5350 Biometry (3) Statistical methods used in analysis of quantitative biological data. Prereq: 1 qr statistics or consent of instructor.

5410 Advanced Parasitology (4) Life cycles, techniques of collection, preservation, and identification of parasitic worms and protozoa. Prereq: Consent of instructor.

5430 Advanced Medical Entomology (3) Prereq: 4430.

5510-20 Advanced Animal Physiology (5, 5) Primary mammalian physiology, 5610—nervous system, cardiovascular system, control of circulation, endocrine glands in vertebrates and invertebrates, and metabolism. Should be taken in sequence if both courses are taken. Prereq: General under-graduate anatomy and physiology and Biochemistry 4120 or equivalent or consent of instructor. Biochemistry 4120 also recommended. (Same as Animal Science 5510-20.) 4 hrs and 1 lab.

5550 Advanced Ornithology (4) Classification, distribution, and anatomy of birds. Prereq: 4300.

5570 Animal Populations (3) Characteristics and methods of study of animal populations.

5590-20 Foundations of Radiation Biology (4, 4) Physical, chemical, and biological mechanisms involved in actions of different kinds of radiations on living cell and its components. Recommended prereq: 1 yr biological science, general physics, biochemistry; calculus. (Same as Radiation Biology 5610-20.) 3 hrs and 1 lab.

5630 Methods of Experimentation with Laboratory Mammals (3) Designed to give competence in handling research mammals. Techniques of anesthesia, drug administration, radiography and surgery. Prereq: 4505, or 4410, or consent of instructor.


5670 Cellular Immunology (4) Laboratory course with emphasis on immunology of the immune system at cellular level. Preparation and use of immunofluorescent reagents, macrophage migration inhibition, skin allograft reactions, diffusion chamber cultures, and antibody formation at cellular level. 4 hrs and 2 labs.

5760 General Vertebrate Neuroanatomy (3) (Same as Psychology 5760.)

5780 Radiation Physics (4) Effects of different kinds of radiations on functions of cells, tissues, and organs of systems of animals. Recommended prereq: 5610. (Same as Radiation Biology 5780.)

5790 Transport of Ions Across Epithelia (4) Operational principles and methods needed to study electrical and kinetic properties of epithelia and electrically excitable tissues. Quantitative methods of measuring ion fluxes and flux ratios. Prereq: Two upper-division physics courses, graduate standing, or consent of instructor. Recommended: Chemistry 4160.

5800 Methods of Taxonomy (4) Classification of animals; rules of nomenclature; problems in priority; preparation of keys, descriptions, and figures. Prereq: Consent of instructor.

5840 Aquatic Insects (4) Taxonomy and biology of aquatic insects, emphasis on immature forms. Offered spring quarter. 2 hrs and 2 labs.

5860 Geographic Distribution of Animals (4) Distribution patterns of vertebrate and invertebrate animals in all major habitats. Prereq: Consent of instructor.

5870 Insect Systematology (4) Ecology of insect communities.

6000 Doctoral Research and Dissertation

6110 Seminar in Cellular Biology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

6140 Seminar in Immunology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
6210 Seminar in Physiology (2) Prereq: Two physiology courses or consent of instructor. May be repeated. Maximum 6 hrs.

6310 Seminar in Cytology (2) Prereq: 4310. May be repeated. Maximum 6 hrs.


6410 Seminar in Parasitology (2) Prereq: 5410. May be repeated. Maximum 6 hrs.

6510 Seminar in Genetics (2) Prereq: General genetics. May be repeated. Maximum 6 hrs.

6610 Seminar in Ornithology (2) Prereq: 4300. May be repeated. Maximum 6 hrs.

6650 Seminar in Aquatic Biology (2) Prereq: Any 2 of 4200, 4660-70, Botany 5061, or consent of instructor. May be repeated. Maximum 6 hrs.

6710 Seminar in Ecology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

6810 Seminar in Entomology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

6910 Seminar in Radiation Biology (2) Prereq: 5610. Coreq: 5620. May be repeated. Maximum 6 hrs. (Same as Radiation Biology 5910.)
Successful completion of the equivalent course work in another field of study is acceptable if the applicant demonstrates the equivalent level of knowledge and skills in that field. If the Bachelor's degree is not in Nursing, the applicant must demonstrate the equivalent level of knowledge and skills in that field.

GENERAL REQUIREMENTS

1. Hold a Bachelor's degree in Nursing.
2. Collaborate with other health professionals in systematic implementation and evaluation of health care delivery to large groups in agency and community settings.
3. Utilize appropriate advanced teaching, administrative and clinical practice skills in the discharge of one's professional responsibilities;
4. Participate in clinical research activities by means of data collection, tabulation, and analysis, and by generating research topics for referral to nurse researchers.
5. Meet requirements for admission to the Graduate School.

MAJOR DEGREE

The College of Nursing offers a five-quarter program of study leading to the Master of Science in Nursing degree. The general purpose of the program is to prepare at the graduate level nurses who are qualified to function as practitioners, clinicians, educators, and administrators in all segments of the health care delivery system. Upon successful completion of the program, graduates will be able to:

1. Provide advanced high quality, comprehensive nursing care to individuals and groups in a variety of settings;
2. Collaborate with other health professionals in systematic implementation and evaluation of health care delivery to large groups in agency and community settings;
3. Utilize appropriate advanced teaching, administrative and clinical practice skills in the discharge of one's professional responsibilities;
4. Participate in clinical research activities by means of data collection, tabulation, and analysis, and by generating research topics for referral to nurse researchers.
5. Demonstrate successful completion of the equivalent level of knowledge and skills in another field of study.

DEGREE REQUIREMENTS

1. Students must complete 60 quarter hours of graduate level course work with a cumulative GPA of 3.0 or better.
2. The 60 credit hours must include the following components:
   - Core requirement: 14 hrs
     - Clinical concentration option: 26-30 hrs
     - Functional concentration option: 11 hrs
   - Electives: 5-9 hrs
   - Total: 60 hrs
3. A Master's thesis is not required, but those students who wish to complete a thesis as a part of their program may substitute the thesis for the 9 elective hours.
4. Those students who do not choose the thesis option must successfully complete a comprehensive final examination.
5. Students may choose either primary or secondary care as a clinical concentration option. Students selecting the primary care nursing option must complete the following courses: 4770, 5050, 5240, 5260, 5650. Students selecting the secondary care nursing clinical option must complete the following courses: 5120-30 (or 5140-50), 5160, 5310, 5330.
6. The core requirement which must be completed by all students regardless of clinical option includes 5010, 5209, 5210, and a graduate level statistics course which must be approved in advance by the student's faculty advisor.
7. Students may select a functional concentration option in teaching, management or advanced clinical practice. Students selecting the teaching option must complete 6 hours of graduate level courses in education and 5630. Students selecting the management option must complete 6 hours of graduate level courses in administration and 5730. Students selecting the advanced clinical practice option must complete 5560 and 5660 if their clinical option is primary care or 5320 and 5340 if their clinical option is secondary care. All courses taken in other colleges must be approved in advance by the student's faculty advisor.

Faculty

Professor:
S. E. Hart (Dean), Ph.D. New York.

Associate Professors:
M. E. Groer, Ph.D. Illinois; B. K. Kant, Ph.D. Illinois; J. Marian, Ph.D. Purdue; B. M. Reid, M.S.N. Columbia.

Assistant Professors:
K. P. Conlon, M.S.N. SUNY (Buffalo); M. M. Fenske, M.N. Florida; C. Knapper, M.N. Vanderbilt; M. F. Kollar, M.N. Vanderbilt.

Courses

4350 Oncology Nursing (3) In-depth exploration of the cancer problem, medical and nursing intervention. Relates cellular kinetics to theories of carcinogenesis and metastasis, and examines treatment modalities and nursing intervention employed in all phases of the disease. Interdisciplinary approach analyzed. Prereq: Nursing 4230, R.N. status, or consent of instructor.
4770 Comprehensive Health Assessment (6) Principles and theories underlying health screening of children and adults, including health history, interviewing and physical examination. Prereq: All 3000-level nursing courses or equivalent or consent of instructor. 4 hrs and 2 labs.

5000 Thesis

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

5010 Applied and Pathophysiology (5) Advanced physiological theories and principles related to normal and abnormal body function with particular emphasis on those processes which, when altered, are most commonly encountered in acute and chronic disease states.

5020 Current Health Issues (2) Weekly seminar dealing with current and pending legislative, political, and community issues, concerns, and actions that have direct or indirect implications for nursing and health care.

5050 Applied Pharmacology (4) Advanced pharmacological concepts applied to clinical situations; in-depth exploration of indications, contraindications, common dosages, side effects, interactional effects and expected action of selected pharmacological agents.

5103 Independent Study in Nursing (1-4) In-depth exploration of a nursing topic of special interest to the student. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5110 Geriatrics and Gerontology (4) Physiological, psychological, developmental, economic, and sociocultural aspects of aging; health needs of aging people; common health problems associated with aging process in management of health care for elderly. Prereq: 5010. 2 hrs and 2 labs.

5120 The Acutely Ill Adult I (6) 6 credit hours examination of acute illness usually associated with adulthood. Medical and nursing therapeutic modalities will be explored and analyzed. Prereq or coreq: 5010. 3 hrs and 3 labs.

5120 The Acutely Ill Adult II (6) Continuation of 5120 with further exploration and analysis of impact of acute illness on children and their families. Prereq: 5010. 3 hrs and 3 labs.

5140 The Acutely Ill Child I (6) In-depth exploration of physiological and pathological manifestations encountered in acute illness usually associated with adulthood. Medical and nursing therapeutic modalities will be explored and analyzed. Prereq or coreq: 5010. 3 hrs and 3 labs.

5140 The Acutely Ill Child II (6) Continuation of 5140 with further exploration and analysis of impact of acute illness on children and their families. Prereq: 5010. 3 hrs and 3 labs.

5160 Emergency and Intensive Care Nursing (3) Nursing approaches needed for effective management of emergency and crisis situations. Nursing knowledge and skills to monitor and care for persons in overwhelming traumatic and/or disease states. Prereq: 5010. 1 hr and 2 labs.

5170 Reading in Applied Physiology (3) Carefully planned library study of selected topics in physiology and pathophysiology related to various body systems. Prereq: 5010.

5210 Nursing Research Methods (4) Utilization of research process to identify and solve common nursing problems; data collection and analysis; use of the literature; presentation and publication of findings. Prereq: Graduate level course in behavioral or biomedical statistics.

5240 Management of Common Health Problems (5) Indications for treatment and referral; use of protocols and treatment plans; pharmacological agents in common use; intervention in emergencies. Prereq: 5010, 4770. 3 hrs and 2 labs.

5250 Chronic Health Problems (4) Demonstration and in-depth exploration of health problems of long-term or lifelong nature common to people in various age groups over life continuum; nursing and health care management of individuals and groups who must deal with one or more chronic health problems throughout most or all of their lives. Prereq: 5010, 4770. 2 hrs and 2 labs.

5260 Advanced Family Health Care (4) Nursing and health care management of families in childbearing and child-rearing stages of development; advanced developmental theory, family dynamics, management of women during pregnancy, labor and delivery, and post partum period, assessment of newborn infants. Prereq: 5010, 4770. 2 hrs and 2 labs.

5310 Secondary Care Nursing Field Work I (9) Advanced clinical practice in acute care hospital settings with opportunities to apply newly acquired nursing knowledge to more complex clinical nursing situations. Prereq: 5120-30 or 5140-50.

5320 Secondary Care Nursing Field Work II (9) Continuation of 5310 with emphasis on further acquisition and refinement of nursing skills needed to provide high quality nursing care to acutely ill patients. Prereq: 5310.

5330 Secondary Care Nursing Seminar I (2) Weekly on-campus seminar taken concurrently with 5310; topics focus on discussion of nursing problems commonly encountered in acute care settings.

5340 Secondary Care Nursing Seminar II (2) Continuation of 5330 to be taken concurrently with 5320.

5410 Principles of Community Mental Health I (3) Epidemiology of mental health; sociocultural, religious, and economic variables affecting mental health status of individuals, families, and communities; function and status of community mental health centers.

5420 Principles of Community Mental Health II (3) Continuation of 5410 with emphasis on recognition and developing approaches to mental health promotion and maintenance.

5430 The Adult and Mental Health (3) Coping and adjustment problems commonly experienced from post adolescence through middle adulthood; nursing approaches to alleviation of mental health problems of both institutionalized and noninstitutionalized adults.

5550 Nurse Practitioner Fieldwork I (9) Placement in selected off-campus primary health care delivery site for purposes of applying newly acquired knowledge and developing clinical skills necessary to function as a nurse practitioner. Prereq: 5050, 5240, 5260.

5560 Nurse Practitioner Fieldwork II (9) Continuation of 5550 with further emphasis on acquisition of nurse practitioner skills coupled with ability to function more autonomously. Prereq: 5550.

5630 Teaching Strategies and Practicum (5) Analysis and application of curricular and teaching modalities; field placement with supervised opportunities to provide both classroom and clinical instruction to undergraduate nursing students. Prereq: 6 hrs approved education courses or consent of instructor. 2 hrs and 3 labs.

5650 Nurse Practitioner Seminar I (2) Weekly on-campus seminar taken concurrently with 5550; topics focus on common nursing and health problems identified by nurse practitioner field students and on role of nurse practitioner in health care delivery.

5660 Nurse Practitioner Seminar II (2) Continuation of 5650 taken concurrently with 5560.

5730 Management Strategies and Practicum (5) Analysis and application of managerial and supervisory theories and strategies; field placement in nursing service facility with supervised practice in nursing service administration. Pre-
The University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, located within the Biology Division of Oak Ridge National Laboratory, offers programs leading to the Master of Science and Doctor of Philosophy degrees. The National Laboratory, one of three installations operated at Oak Ridge by Union Carbide Corporation for the Department of Energy, is a well-known center of basic research. The school utilizes the staff and facilities of this laboratory, and thus brings directly into the mainstream of full-time graduate study in the life sciences the talent and experience of that staff, as well as the most advanced research methods and technology.

The program of study, which incorporates a high faculty-to-student ratio, is based on intensive graduate courses supplemented by tutorial instruction, participation in a wide variety of seminars, and a heavy emphasis on communication skills, research training and independent study. The program encourages students to pursue graduate studies to the limits of their abilities.

The School is not departmentalized, and, apart from certain basic requirements, each student's curriculum is planned to meet individual needs, with the aim of giving: (1) strength in the basic sciences; (2) perception of the biomedical sciences as a whole; and (3) experience and training in a chosen specialty.

The research areas available for Master's thesis and Ph.D. dissertation work are biochemistry, biophysics, carcinogenesis, genetics, and cellular, developmental and mammalian biology. Included are such subjects as immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation and environmental biology, virology, developmental biology, experimental pathology, microbial and mammalian genetics, mutagenesis, and problems of aging.

ADMISSION REQUIREMENTS

A Bachelor's degree or its equivalent is required. Students with M.S., D.V.M., or M.D. degrees are also encouraged to apply. Completed applications, Graduate Record Examination scores and letters of reference should be sent to the address below. The student will need previous training in biology, calculus, physics, and organic and physical chemistry. However, a course in physical chemistry is offered by the School in order to meet this requirement. It is recommended that deficiencies in meeting entrance requirements should be eliminated prior to entrance.

Requests for application forms, information on admission, financial support, and housing should be sent to: Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Biology Division, ORNL, Box Y, Oak Ridge, Tennessee 37830.

THE DOCTORAL PROGRAM

Requirements for the Ph.D. degree are:
1. Satisfactory (B grade or better) completion of the following core courses or their equivalent: Biochemistry (5110-20); Biophysics (5140); Genetics (5160); Molecular Genetics (5170); Cell Biology (5180-90); Mammalian Physiology (5200); and Statistics for Biologists (5740).
2. Three quarters of Biomedical Sciences Laboratory (5310-20-30-40).
3. Participation in Biomedical Sciences Seminar (5350-60-70) for one year.
4. Participation in at least one of the seminar courses (6110-70) during each quarter of residence after the first year is strongly recommended.
5. Satisfactory completion of formal advanced courses in the areas of the student's interests. The number and nature of the required advanced courses will vary depending upon the student's background and area of specialization.

6. Pass both written and oral examinations.
7. A dissertation reporting the results of original and significant scientific research. A minimum of 36 quarter hours of course work is required.
8. A final oral examination on the dissertation.
9. A formal seminar presentation of the dissertation research.

SPECIAL MASTER OF SCIENCE DEGREE PROGRAM

The graduate faculty has designed a Master of Science program in Biomedical Sciences primarily to fill the need for such a degree within the Oak Ridge National Laboratories; however a limited number of students from other institutions may be accepted if qualified and as space is available.

Requirements for the M.S. degree are:
1. Graduate credit or a proficiency in the following core courses: Biochemistry (5110-20); Cell Biology I (5180); Cell Biology II (5190); plus any three of the following four courses: Biophysics (5140); Genetics (5160); Molecular Genetics (5170); and Mammalian Physiology (5200). Additional credits may be obtained (6 to 15 credit hours) with electives. The student will need previous training in biology, calculus, physics, organic and physical chemistry.
2. Forty-five credit hours of approved graduate courses including a minimum of 9 quarter hours for thesis (maximum 18 quarter hours of credit for course 5310).
3. For admission to candidacy: Completion of any required prerequisite courses and one quarter of graduate course work with a B average. Admission to candidacy forms must be filed at least one full quarter prior to receipt of degree.
4. A Master's Committee of three approved faculty members upon admission to candidacy.
5. A thesis reporting results of original and significant scientific research.
Courses

The courses below are not necessarily available every year.

5000 Thesis

5070-80 Physical Chemistry for the Life Sciences (3, 3) Thermodynamics, phase equilibria; chemical equilibria; structure; kinetics; surface chemistry; electrolyte solutions, kinetics, conductance, viscosity, diffusion. Prereq: 5160.


5140 Biophysics (3) Energy levels and excited states of large molecules; optical instrumentation; adaptations to system perturbations; properties of macromolecules in solution; molecular interactions; inter- and intramolecular forces; principles of microscopy. Prereq: 5070-80.

5150 General Genetics (3) Mendelian genetics, mitosis, and meiosis. Transmission genetics, mapping, and linkage.

5160 Advanced Genetics (3) Genetics of phage, bacteria, and eukaryotes. Mapping; linkage; mutation, cytoplasmic inheritance. Mechanisms of recombination; chromosomal recombination and replication; Prereq: 5150 or equivalent.

5170 Molecular Genetics (3) Molecular biology of prokaryotic and eukaryotic genomes. Gene regulation; codon-anticodon-translation; suppression of missense and nonsense mutations; mutagen mechanisms; complementation; recombination. Prereq: 5110 or 5160.

5180 Cell Biology I (3) Structure and composition of major nucleic and cytoplasmic organelles of eukaryotic cells. Particulate organelles and techniques; mitosis and meiosis, cell cycle; chromosome structure; molecular RNA metabolism; nucleoli and ribosome biogenesis; survey of specialized cells. Structure of genetic transcription and translation in bacteria. Coreq: 5110.

5190 Cell Biology II (3) Comparative biochemical approach to cell structure and function: Membrane systems and metabolism; development and function of mitochondria, chloroplasts, peroxisomes and other organelles as related to metabolism and regulation; transport phenomena; cell communication. Coreq: 5110 or 5160.

5200 Mammalian Physiology (4) Mammalian organ systems and their functions. Nervous, muscular, endocrine, digestive, respiratory, circulatory, reproductive, and excretory systems. Interactions of these systems and fundamental importance of interactions in contemporary biological research. Prereq: 5190.

5230 Biochemical Concepts in Medical Sciences (3) Biochemical mechanisms involved in physiological and pathological processes of human body. Dynamic functions of organ systems; biochemical pharmacology, hormone actions; neurobiochemistry. Current biochemical advances in basic and clinical medicine. Prereq: 5200. 5110-20.

5310-20-30-40 Biomedical Sciences Laboratory (3, 3, 3, 3) To acquaint students with both approaches and technologies in various areas of modern biology. Students spend a quarter in each of three or four laboratories conducting research in different areas of biomedical science. Required of all first-year students. Prereq: 5110.

5350-60 Biomedical Sciences Seminar (1, 1) Critical analyses of current journal publications in selected area of modern biology. Written evaluation of papers and written presentations by each student. Required of all first-year students.

5370 Biomedical Sciences Seminar (1) Basic principles of scientific writing. Research articles, grant and thesis proposals, abstracts, review articles, progress reports. Required of all first-year students.

5420-21 Teaching Science Laboratory (2, 2) Methods of teaching introductory and advanced laboratory courses. Associated with 5100 and 5101.

5430-31 Introduction to Teaching (1, 1) Readings in teaching methods in a variety of areas in modern biology. Prereq: 5100 and 5101. Prereq: Consent of instructor. May be repeated.

5510-20-40 Special Topics in Biomedical Sciences (3, 3, 3, 3) Tutorials or formal lectures. Potential topics include X-ray crystallography; medical state biophysics; medical chemistry of macromolecules; computer science, pathology; cytology and cyogenetics; mammalian genetics; human genetics; cancer research; plant physiology; radiation biology; aging research. Additional courses developed on any subject of mutual interest to individual students and staff members. May be repeated.

5700 Developmental Biology (3) Principles of early embryogenesis and tissue interactions that initiate cellular differentiation and regulation of differential gene action and regulation of protein synthesis pertinent to cellular differentiation. Prereq: 5110 or equivalent.

5740 Statistics for Biologists (3) Application and interpretation of statistical methods in data analysis. Random variations; normal, binomial, and Poisson distributions; statistical presentation of data; estimating means and variance; confidence intervals; tests of significance for comparing samples; analysis of variance; contour tables; chi-square tests; correlation and association; linear regression. Prereq: Introductory statistics or consent of instructor.

5840 Bioorganic Reaction Mechanisms (3) Nature of chemical bond, nucleophilic and electrophilic reactions, molecular rearrangements, oxidation, reduction, condensation, protein and nucleic acid modification reagents, reactions involving proteins and nucleic acids on polymer supports.

5880 Cryobiology (3) Physical and chemical responses of cells and biomolecules to low temperatures and ice formation. Relation of these responses to permeability, structure of semipermeable membranes, contamination of macromolecules, and nature and state of water in cells; and how they bear on other fields of biology and medicine—including electron microscopy, photobiology, cell physiology, exobiology, ecology, and cryosurgery. Prereq: 5070-80 or equivalent, and 5190.

5920 Mammalian Genetics (3) Orderly presentation of known genetic variants affecting each organ system of experimental mammals, especially laboratory mouse. Prereq: 5110 or equivalent.

5940 Classic Experiments in Genetics (3) Original papers presenting new and lasting concepts in genetics. Prereq: 5170.

6000 Doctoral Research and Dissertation

6110 Seminar in Plant Physiology (1) May be repeated. Maximum 12 hrs. S/NC only.

6120 Seminar in Cellular and Developmental Biology (1) May be repeated. Maximum 12 hrs. S/NC only.

6130 Seminar in Genetics (1) May be repeated. Maximum 12 hrs. S/NC only.

6140 Seminar in Mammalian Research (1) May be repeated. Maximum 12 hrs. S/NC only.

6150 Seminar in Immunology (1) May be repeated. Maximum 12 hrs. S/NC only.

6160 Seminar in Biophysics (1) May be repeated. Maximum 12 hrs. S/NC only.

6170 Seminar in Biochemistry (2) May be repeated. Maximum 24 hrs. S/NC only.

6180 Advanced Seminar in Biomedical Sciences (1-3) Presentation, evaluation and discussion of current research in various areas of biomedical sciences, including cell biology, genetics, biochemistry, pharmacology, and biochemistry. Prereq: Consent of instructor. May be repeated. S/NC only.

*Staff of Oak Ridge Associated Universities
6190 Seminar in Animal Virology (1) Discussion of experimental data and in-depth surveys of active research problems in virology through use of literature. Prereq: Microbiology 4521 or equivalent and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only.


6210 Protein Chemistry and Enzyme Mechanisms (3) Theoretical and practical aspects of protein chemistry including chemical and physical characterization of proteins, chemical modification of proteins, and structure-function relationships. Latter emphasizes enzymes, includes approximation of substrates, covalent catalysis, general acid-base catalysis, and strain and distortion of substrates. Prereq: 5110-20.


6240 Chemistry and Metabolism of Lipids (3) Nomenclature, chromatographic isolation, chemistry, physical properties, and enzymology of lipids. Hormonal action of prostaglandins and role of lipids in membranes, enzymic expression, and nervous tissue. Lipid biochemistry of mammals; comparative aspects, particularly lipid pathways in bacteria and yeast. Prereq: 5110-20.

6270 Viral Carcinogenesis (3) History of viral oncology and descriptive catalog of tumor viruses. Biology of normal and transformed cells. DNA tumor viruses; replication cycle; transformation; genetics; natural history. RNA tumor viruses; endogenous and exogenous states; genetics; Induction; transformation; natural history.


6290 Cancer Biology and Biochemistry (3) Pathology and nomenclature of cancer. Tumor immunology and immunotherapy. Biochemistry of tumor cells; enzymology, metabolism; membranes; DNA repair; regulation; strategies in chemotherapy.

6300 Mutagenesis (3) Basic mechanisms in chemical and radiation mutagenesis and dosimetry in variety of systems including bacteria, fungi, Drosophila, and mice.

6510-20-30-40 Advanced Topics in Biomedical Sciences (3, 3, 3, 3) Current and future research developments. Topics listed under Special Topics Courses, can be taken either as tutorials or as literature survey courses requiring substantial student participation. May be repeated.
Graduate School of Library and Information Science

Ann E. Prentice, Director

MAJOR
Library Science

DEGREE
M.S.L.S.

The Graduate School of Library and Information Science provides a library education program leading to the preparation of librarians for work in all types of libraries. The programs of study of this School include the graduate curriculum leading to the degree of Master of Science in Library Science.

MASTER OF SCIENCE IN LIBRARY SCIENCE

The goal of the program is to prepare graduates to function effectively in libraries and information centers. The program is designed to:

1. Enable students to examine critically the role and function of libraries and information centers in our society, and to define and redefine that role as the needs of society demand;
2. Enable students to understand and use the concepts and procedures related to the selection, acquisition, organization, and dissemination of knowledge;
3. Enable students to understand and apply the principles of management to the library and information center;
4. Enable students to assume individual and collective responsibility for the well-being and development of their profession and of professional service;
5. Enable students to make informed assessments and decisions regarding various career opportunities in libraries and information centers.

PROGRAMS OF INSTRUCTION

The program leading to the degree of Master of Science in Library Science involves a total of 51 quarter hours of graduate courses, 21 hours of which form a core curriculum required of all students. Either a thesis or a non-thesis program is available, with 9 hours allowed for thesis credit. At least 36 hours must be taken in the Graduate School of Library and Information Science, allowing up to 15 hours outside the School. Upon completion of the program, all students are subject to an examination. For students who elect the thesis option, the examination will be a defense of the thesis. Students who elect the non-thesis option will be given a written comprehensive examination. Programs are designed for persons interested in school libraries, public libraries, academic libraries, special libraries and information centers as well as a variety of library and information related activities.

ADMISSION REQUIREMENTS

The minimum grade point average for admission to the Graduate School is 2.5. Candidates who have at least a 3.0 average in the junior and senior years will receive first consideration. Applicants are required to take the aptitude test of the Graduate Record Examination. The test should be taken at least one quarter in advance of application for admission to the Graduate School.

Foreign applicants are required to take the Test of English as a Foreign Language.

APPLICATION PROCEDURE

Admission to the programs in the Graduate School of Library and Information Science should be made in advance of the quarter for which admission is requested. Applicants should submit the "Application for Admission" form (printed as the first page of the Graduate School Catalog) and should request the registrars of all colleges and universities attended to send two official transcripts to the Graduate School.

FINANCIAL ASSISTANCE OPPORTUNITIES

Employment with the University of Tennessee Libraries may provide a work-study opportunity for selected students who wish to obtain experience in academic librarianship while pursuing the degree. Such students usually work at least 20 hours each week and thus extend the period required for the degree up to two years.

Similar opportunities exist with some other libraries in the Knoxville area. A limited number of graduate assistantships are available through the School for the degree. Assistantships of this type carry a waiver of tuition and fees as well as a stipend, and require that recipients work 10 hours per week in the School.

Information on financial assistance is available from the Director of the Graduate School of Library and Information Science.

Faculty

Professors:
E. E. Mauldin, M.S.L.S. Illinois; G. R. Purcell, Ph.D. Case Western Reserve.

Associate Professors:

Assistant Professors:
J. Knightly, Ph.D. Texas; J. M. Pemberlon, Ph.D. Tennessee; G. M. Sinkankas, Ph.D. Pittsburgh.

Courses

4140 Libraries and Librarianship (3) Librarianship as an occupation; its organization, responsibilities, problems and prospects.

4150 School Library Administration (3) Objectives, functions, and place of school library; relationship to local and state services; cooperative planning for quarters and materials; evaluation. (Same as Curriculum and Instruction 4150.)

4270 Organization of Library Collections I (6) Acquisitions, cataloging and maintenance of library collections.
4330 Introduction to Reference Materials (3) Basic information sources and services for all libraries.

4750 Utilization of Instructional Media (3) (Same as Curriculum and Instruction 4750 and Vocational-Technical Education 4750.)

5000 Thesis

5002 Non-Thesis Graduation Completion (3-19) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities for research and for a time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110-20-30 Problems in Library Science (3, 3, 3) May be repeated with consent of the instructor.

5140 Research Methods in Library Science (3) Research methods applicable to librarianship. Process and conduct of research; analysis of published research.

5200 Subject Reference and Bibliography (3) General patterns of bibliographic organization and basic information sources in subject fields including non-English materials; experiences in bibliographic methods and search techniques. Prereq: 5330.

5210 Sources and Services for the Social Sciences (3) English and non-English literature and bibliographic sources in social science: history, geography, anthropology, psychology, and sociology; organization of collections for optimum use. Prereq: 5200.

5220 Sources and Services for the Natural Sciences (3) English and non-English literature and bibliographic sources in mathematics, physics, astronomy, chemistry, geology, biology and medicine; organization of collections for optimum use. Prereq: 5200.

5230 Sources and Services for the Humanities (3) English and non-English literature and bibliographic sources in literature and language, fine arts, music, philosophy and religion; organization of collections for optimum use. Prereq: 5200.

5240 Organization of Library Collections II (3) Construction and maintenance of library catalog as retrieval instrument; indexing and subject analysis theory; comparative classification with emphasis on catalog of Congress system, and problems in reclassification. Prereq: 4270.


5260 Government Publications II (3) Acquisition, organization, and utilization of publications of foreign governments and international organizations such as United Nations, UNESCO, and others.

5270 Legal Bibliography (3) Introduction to literature of Anglo-American jurisprudence. Use of reports, statutes, administrative regulations and decisions, treaties, periodicals, and indexes as bibliographic tools.

5300 Library Management (3) Management and organization concepts applicable to libraries and librarians.

5310 Library Systems and Services (3) National, state, and regional information systems. Design and analysis of existing systems within academic or special library sphere.

5330 Academic Libraries (3) Persistent and current problems. Topics vary depending upon needs and interests of group.

5350 School Libraries (3) Persistent and current problems. Topics vary depending upon needs and interests of group.

5360 Technical Libraries and Information Centers (3) Purpose, functions and organizational characteristics of those libraries and information centers, private and public, which offer scientific and technical information services. Problems related to acquisition, organization, and servicing of technical information collections.

5370 The Library in the Community (3) Public library as social agency; role in education and communication systems of community.

5380 Seminar: Academic, Public, School or Special Libraries (3) Prereq: Consent of instructor.

5400 Library Facilities (3) Problems inherent in planning and construction of library quarters. Interrelationship of staff, materials, and user space requirements.


5510 Multimedia Resources of Libraries (3) Selection, acquisition, processing, storing, and servicing non-book materials, with special attention to films, recordings, microforms, photo-copying.

5520 History of Books and Printing (3) Development of alphabet and writing; early writing materials; book in manuscript; history and technique of printing; book illustration and binding; standards of modern fine printing.

5530 Contemporary Publishing (3) Creation, production, marketing, and distribution of materials acquired by libraries, with special attention to various types of publishers.

5540 Special Collections—Archives and Rare Books (3) Problems involved in acquisition, organization, housing, preservation and utilization of rare books and archival materials.

5600 Reading Guidance for Children and Young People (3) Organization to meet needs, interests, abilities of different age and socioeconomic groups. Prereq: 5640 or consent of instructor.

5610 Mass Communications and the Library (3) Mass media of communication in terms of their relation to modern library service, considered as forces that influence what people read, see, and hear.

5620 Traditional Literature and Oral Narration (3) Fundamental principles of art of storytelling; techniques of adaptation and presentation for various age groups; instruction and practice in oral techniques.

5630 Critical History of Children’s Literature I (3) Development of literature for children noting influence of changing social and cultural factors; attention to emerging genres through primary sources. Fifteenth century to 1820.

5640 Critical History of Children’s Literature II (3) Development of literature for children noting influence of changing social and cultural factors; attention to emerging genres through primary sources. 1920 to present.

5691 Advanced Production of Audiovisual Software (3) (Same as Curriculum and Instruction 5691.)

5700 Automation of Library Processes (3) Analysis of application of data processing methods to basic library operations such as bibliographic control, technical processes, circulation control, and management functions.

5710 Introduction to Information Science (3) Content and method of information science; application of research findings to general library practice.

5720 Information Systems Analysis and Design (3) Elements in design and operation of information retrieval systems, including acquisition, indexing vocabularies, information representa-
The Graduate School of Planning offers a two-year graduate course leading to a degree of Master of Science in Planning with concentrations in land use, transportation, environmental, regional, administrative, health, and historic preservation planning.

The purpose of study is the education of professional planners, competent to handle positions of increasing technical and administrative responsibility. Graduates are candidates for professional service in regional, city, county, and metropolitan area planning agencies; in local, state, and federal agencies concerned with physical, economic and administrative planning; in private businesses and organizations dealing with urban problems; and in private consulting practices.

The curriculum is organized on a basis of six quarters, or 72 credit hours, and provides the student with core courses in planning theory, methods, and techniques, and also takes advantage of offerings at the University of Tennessee in related fields such as government, economics, geography, civil engineering, and sociology.

The course of study ordinarily requires two years with an optional work internship during the summer between the two years. Planning courses as well as related courses will be offered during the summer period. This is to serve the needs of those planners now in the field who wish to acquire their professional degree but who can spare only the minimum amount of time from their jobs because of financial or family considerations.

Entering students follow a program of courses which provides education in the basic elements of planning. These include studies in theory, history, analytical methods, and legislation, as well as related courses in government, geography, sociology, and economics. Students are permitted to pursue particular interests through the choice of electives approved by the Graduate School of Planning. Practice in research and analysis on a particular planning problem or topic is obtained through the preparation of a thesis or major study option.

Core planning courses are taught by the faculty of the Graduate School of Planning. Related courses are taught by other specialists drawn from the University faculty. In addition, the services of experienced professional planners in TVA and other public and private organizations are called upon to broaden the scope of the students' understanding. A variety of outside speakers and seminar leaders provide insight into particular problems of significance to planners.

ADMISSION PROCEDURES

All applicants should submit two letters of recommendation with their applications. Both letters should be from teachers familiar with the applicant's undergraduate or, where applicable, graduate academic record. In the event the applicant has had planning experience, a third letter is required from a supervisor or other person familiar with the planning work of the applicant. All applicants who wish to be considered for financial assistance from the University or the Graduate School of Planning should also submit recent Graduate Record Examination scores for the Aptitude (verbal and quantitative) portion of that test. All applicants are also requested to submit a statement of career goals.

All inquiries concerning admission should be addressed to the Director, Graduate School of Planning, The University of Tennessee, Knoxville, Tennessee 37916.

DEGREE REQUIREMENTS

Each student will be required to complete a minimum of 72 hours credit.

The following courses are the required core curriculum for the M.S.P. degree: 5040, 5045, 5100, 5110, 5130, 5180, 5230, 5270, 5280, 5340, 5435, 5440, 5465, 5500, Sociology 5220 or Statistics 5211. Waivers can be made by the faculty where competence is demonstrated.

Each student will be required to demonstrate competence in individual research. This may take either of two forms:

Plan I—Complete a thesis for 9 hours credit.

Plan II—Complete a major study with acceptable documentation. In order to be eligible for the major study the student must have earned a grade of B+ or higher in Research Methods II, have a 3.5 cumulative grade point at the time of approval of the major study proposal, and have completed at least 24 hours of graduate study. The student meeting these criteria may present a proposal for a major study which will include at least 9 hours of elective course work in an area of concentration. The proposal shall justify the area of study, the approach to the study, and the method of final documentation. Approval of the documentation, which must include written documentation, is a prerequisite for graduation.

Students in the Graduate School of Planning are given a comprehensive written examination after approximately four quarters of course work. In addition to testing the knowledge of the student, the information thus obtained is taken into account in advising students concerning the study program they should undertake during the balance of their academic program to remove any indicated deficiencies.

Each student will be encouraged, but not required, to complete a work internship equivalent to at least two and one-half months of full-time work in a planning agency at approximately the mid-point in course work.
Faculty

Professors:

Associate Professors:

Assistant Professors:

Courses

4100 Survey of Planning (3) History of city development and of planning with special attention to the U.S. experience in urban and other levels of planning. State of the art, the process, the comprehensive plan, implementation devices. Planning issues in society. Not for credit for M.S.P. degree.

5000 Thesis

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

5005 The Planning Process (3) Identification and examination of generic aspects of planning process and planning techniques applied in a variety of settings. Not for credit for M.S.P. degree.

5040 Communications for Planners I (1) Introduction to basic communications, interpersonal and oral communications, graphic presentations, audiovisual equipment.

5045 Communications for Planners II (1) Graphic communications in planning. Maps and mapping, computer graphics, models and presentation graphics. Prereq: 5040.

5100 Theory of Planning (3) Analysis of nature and objectives of planning process; role of planner and planning function in public decision-making. Prereq: 5045.

5110 Introduction to Planning (3) History of planning, familiarization with operations of contemporary planning, concept of systems, current trends and issues. Relationship between planning and society in which it occurs. Designed for DSPS students.

5130 Planning Research Methods I (2) Research techniques in subject areas associated with city and regional planning. Research tools, data collection and analysis as basis for planning and decision-making. (Same as Water Resources Development 5130.)

5135 Planning Research Methods II (3) Application of rigorous investigation techniques in solving planning problems, including statistical analysis and mathematical models. Urban and regional information systems as resource and tool in problem identification and solution. Prereq: 5130.

5145 Library Research for Planning (1) Survey of publications of interest to planners, including research and research techniques. Use of facilities and collections of UTK library.

5160 Planning and Utilities (3) (Same as Environmental Engineering 5160 and Water Resources Development 5160.)

5170 Planning for Historic Preservation (3) Planning for preservation, restoration and conservation of historic buildings, areas and sites as related to comprehensive planning process. National, state, and local governmental role in preservation, designation of sites, legislative needs, financing and administrative organizations.

5180 Planning Analysis and Forecasting (3) Methods of quantitative analysis and modeling in urban and regional studies. Population, employment, and economic growth with emphasis on forecasting techniques. Prereq: 5130.

5230 Urban and Site Design (3) Principles of design of residential subdivisions and some components of physical community such as shopping centers, institutional complexes, central business districts. Problems of reviewing alternative designs against each other or written regulations. Extensive laboratory experience.

5235 Urban and Site Design II (3-6) Prereq: 5230.

5270 Planning and Transportation (3) (Same as Civil Engineering 5270.)

5280 Planning Methods (5) Tooling up studies; methods for preparation of land use and public facility elements of comprehensive development plans, including visual aspects. Prereq: 5180.

5300 Regional Planning (3) Making planning process operative in intergovernmental context. Theories of regions and analysis of metro planning, area planning, regional planning by states, single-purpose agency planning, and TVA. Prereq: 5100.

5310 State Planning (3) Evolution of planning function in state government, with emphasis on institutional environment in which planning occurs. Context and scope of state planning, and relationships with other branches and levels of government. Prereq: 5100.

5340 Implementation (3) Policy formulation, information systems, taxation, capital improvement programming, and other aspects of plan implementation. Programming public actions to affect development. Prereq: 5440.

5360 New Towns (2) Historical development of planned new towns and implications for national urbanization policy in United States; process by which new towns are created, from establishment of objectives to administration of development process and provision of public services; organizational alternatives for new town planning, development and management in context of past experience and future objectives. Prereq: 5110 and consent of instructor.

5380 Housing (3) Nature and demand for housing in U.S. and abroad with emphasis on U.S. experience. Private market processes and public influences. Problems of change in housing supply, impact of new technology, and governmental programs to improve supply and quality of housing. Coreq: 5110 or consent of instructor.

5390 Futures (3) Alternative futures and their implications for future living patterns and community planning. Techniques of futures research.

5410-20-30 Special Topics in Planning (1-3, 1-3, 1-3) Lecture, group discussion, and individual research and study on specialized topics in planning not covered in depth in other courses. May be repeated. Prereq: Consent of instructor.

5435 Planning and Government (3) Governmental context within which planning occurs. Policy making as public process. Planning structures, powers, and policies.


5455 Urban Revitalization (3) Goals, principles and strategies for restoring and revitalizing cities. Review and analysis of historic, current, and proposed public and private programs aimed at urban revitalization, physical building and restoration activities as related to financial and administrative requirements. Relationships between construction oriented activities and economic and social development programs is emphasized. Prereq: 5110 or consent of instructor.

5460 Planning Administration (2) Planning agency management, program development, and agency finance. Prereq: 5435.

5465 Planning and Property Development (3) Process of urban physical growth and change with emphasis on functioning of private sector real estate development and its relationship to planning. Partnership roles of public and private sectors in urban development and redevelopment. Prereq: 5440.

5560 Synthesis (3) Problem-oriented experience to integrate knowledge from previous courses. Interrelationships stressed; student required to use judgment in evaluation and creation of plans and policies addressed to real world situations. Extensive laboratory experience. Prereq: Required planning courses or consent of faculty.

5670 Social Planning (3) Theory, philosophy and implications of programs for planned social change. Consideration of major social planning issues in diverse fields of service; aging, corrections, education, health, manpower, mental health, social services. Prereq: Consent of instructor. (Same as Social Work 5567.)

Graduate School of Planning 153
The University of Tennessee School of Social Work is a fully accredited two-year graduate professional school, with a program (thesis or non-thesis option) leading to the degree of Master of Science in Social Work. The full two-year curriculum is offered in all three branch locations.

GRADUATE PROFESSIONAL EDUCATION

The School of Social Work has as its primary objective the education and training of persons for leadership in the social welfare profession and the social work practice community. Leadership roles include positions in social welfare administration, social planning and policy development, and positions as treatment team leaders, supervisors, consultants, and expert practitioners.

Central to professional leadership are a commitment to the values and goals of the profession and a developed capacity for self-awareness and self-discipline. The experience of a graduate professional education builds commitment, and the School's program guides students into independent; analytical thought and prepares them to use their skills and knowledge to effective purpose.

The School of Social Work recognizes and enjoys the challenge of cultural pluralism in society and encourages applications for admission from minority group members. Through the planned inclusion of significant and pertinent racial and ethnic content in the curriculum, the School provides students with the educational background needed to take creative roles in the social work profession's efforts toward the elimination of racism and such other social ills as poverty, crime, neglect, and social injustice.

A special bulletin describing the facilities, admission, fees, and degree requirements is obtainable from The School of Social Work, 2014 Lake Avenue, Knoxville, Tennessee 37916.

AREAS OF PROFESSIONAL PRACTICE

Specializations within the School's curriculum prepare students for social work careers in such practice fields as criminal and juvenile justice systems; family and child welfare services in public and voluntary agencies; group services in neighborhood and community centers; health services; mental retardation; public welfare services; mental health services; manpower training programs; governmental and voluntary human services planning agencies; rehabilitation services; school social work; and social gerontology.

THE PROFESSIONAL CURRICULUM

The School of Social Work's curriculum is designed to provide the student with the basic components of professional competence through a progression of course work and supervised practice experience. Students may elect a thesis or non-thesis option. The two-year, six-quarter program includes a core curriculum, a specialization in one of two areas—social work treatment or social welfare administration and planning—and concurrent field practice.

The Core Curriculum

The core curriculum is offered during the first two quarters of the first year and is required of all students. It is a 30-quarter-hour sequence of five basic courses. As the initial phase of the School's educational program, the core curriculum contributes to the process of socialization and professional identification, and presents students with a comprehensive and broad knowledge base from which to operate in the future as practitioners and administrators.
AREAS OF SPECIALIZATION

Social Work Treatment
Social work treatment deals with those individual, family, and group methods utilized to enhance the social functioning of individuals and effectively ameliorate problems of social dysfunction. The specialization attempts to develop a thorough knowledge of the theory and methodology basic to the individual, family, and group methods applicable in the treatment of diverse client problems.

Social Welfare Administration and Planning
Social welfare administration and planning deals with the design, implementation, and continued operation of effective programs for client service. Specifically, the method deals with the assessment of client characteristics, development of environmental resources, design of effective organizational structures, planning, development, program evaluation, social planning, neighborhood and community development, financing, and coordination of services.

Field Practice
Field practice is a critical component of the student's first- and second-year program. Because the School of Social Work cooperates with a wide range of social agencies and human service programs in the principal cities in Tennessee and areas immediately adjacent to the State, the School is able to provide field placements in a variety of social work practice areas. The faculty works closely with the placement agency and the field instructor to assure that the student has a quality field practice experience which meets the objectives of the core curriculum and the specialization.

The first-year curriculum is on a concurrent class and field plan, with students engaged in classroom study two or three days per week and in field practice the remainder of the week. First-year agency placements are selected to provide the student with practice experience related to the core curriculum content and beginning specialization. Within the placement, each student's experiences are planned and designed according to the educational needs.

In the second year, students are engaged full time in classroom courses during the fall quarter. The winter and spring quarter plan consists of a block field placement of four days per week and at least one concurrent classroom course each quarter. Second-year placements are selected according to the student's area of specialization, individual career interests, and educational needs. The student actively participates with the field practice coordinator and the specialization committee in selection of the second-year placement. The second-year field practice experience focuses on the integration of social work knowledge and values, and emphasizes the acquisition and development of full practice skills.

Students are responsible for meeting the requirements of their placement agencies in terms of office hours and workload coverage. This responsibility takes precedence over scheduled University breaks and may result in variations in holidays and office hours for the student.

DEGREE REQUIREMENTS
1. Satisfactory completion of the curriculum.
2. All courses taken as part of the degree programs, whether taken within the School of Social Work or outside, must be acceptable for graduate credit, relevant to social work and to the student's career objectives, and have the approval of the student's faculty advisor.
3. Achievement of a B average on all work presented for the Master's degree.
4. Students who elect a thesis must pass an oral examination conducted by a faculty committee.
5. Students who elect a non-thesis option must pass a written comprehensive examination.
6. Credits to be counted toward the degree must be earned within six years from the beginning date of the earliest coursework applied toward the degree, except in cases where permission to update courses has been granted.
7. The minimum number of credit hours required for the degree shall be 79 hours including a maximum of 36 S/N credit hours.

ADMISSION REQUIREMENTS
Admission to the professional curriculum is based on the following requirements:
1. A Bachelor's degree from an accredited college or university with some preparation in the social sciences. At least three-fourths of the applicant's undergraduate work should be in the social sciences, humanities, physical sciences, and other liberal arts subjects. Those with other academic backgrounds may request consultation regarding ways in which they might be admitted.
2. A grade point average of 2.5 on a 4.0 scale, with those having below a 3.0 average to be admitted on supplemental evidence of ability to perform at a satisfactory level. The University of Tennessee School of Social Work allows a maximum of 45 credit hours of graduate course work taken at another accredited institution to be transferred into the student's Master's program. Such work must have been taken for graduate resident credit and passed with a B or better. In addition, it must be part of an otherwise satisfactory graduate program (B average) and be approved by the branch director and the dean. This coursework must be completed within the six-year period prior to the receipt of the degree. In addition, S/N credit earned for the field practicum is also acceptable.

Graduate students majoring in fields other than social work are admitted to certain social work courses with the approval of the School of Social Work and the student's major professor.

Faculty
Professors: M. H. Bloch, M.S.S.A.; R. C. Bonovich, D.S.W.; G. W. Fryer, Ed.D.; B. P. Granger, Ph.D.; B. E. Orchard, M.S.S.A. (Emeritus); J. H. Spencer, M.S.W. (Emeritus);
Courses

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

5070 Social Work Research I (3) Research methodology as appropriate to student's program under advisement. Problem formulation; development of research design; instrument construction; data collection, analysis, and presentation; and report writing.

5080 Social Work Research II (2) Continuation of Social Work Research I.

5081 Evaluative Research in Social Work (2-3) Advanced research course. Topics include sociopolitical and organizational context of evaluative research, research methodology appropriate to evaluative research, and utilization of research in social work practice. Prereq: Completion of core or consent of instructor.

5082 Practicum in Social Work Research (3-6) Supervised practice in application of research methods and tools to social welfare program. Prereq: Minimum one year standing as a graduate student in social work, or social welfare agency or organization. Prereq: 5070-80 and consent of faculty member conducting the practicum. S/NC only.

5083 Directed Readings in Research (2-4) May be repeated with approval of instructor. Maximum 4 hrs.

5090 Special Problems in Social Work (2-9) Individual study or research on problems of special significance to student's program under supervision of major professor. May be repeated.

5110 Social Welfare Policy and Services I (3) Interests of social work profession in development of contemporary social policy at local, state, national, and international levels of organization. Contribution of social work professionals can make to formulation of public policies through working with public policy agencies and interest groups. Policy lab may be used to focus on beginning skill development.

5120 Social Welfare Policy and Services II (3) Examination of theories of complex organizations applied to social welfare service delivery settings. Transformation of collective social welfare resources into divisible and indivisible social welfare benefits through organized instrumental action of professional nature.

5130 Social Policy Analysis (2-3) "Policy science" techniques are considered for appropriateness in assessing social, political, and economic implications of social policy proposals. Prereq: Completion of core or consent of instructor.

5161 Social Welfare Seminar (2-3) Problem area or field of practice seminar focusing on substantive knowledge about social problem or condition and interrelationships among problem definition, social policy, social welfare program, and social work practice. Fields such as health, mental health, child and family welfare, mental retardation, education, corrections, housing, labor force development, income maintenance, and aging. Prereq: Completion of core or consent of instructor. May be repeated. Maximum 9 hrs.

5210-20 Human Behavior and Social Environment I and II (3) Examination of theories pertinent to individual, family, and small group within context of functions, structures, roles and processes. Behavior of these systems conceptualized along functional-disfunctional and normal-deviant continuum. Organizes themes, development of systems, maturation, adaptive and disadaptive technique of systems approach used to understand interrelationships of biological, psychological, and social variables with emphasis on problems of culture and ethnicity.

5290 Special Accelerated Program in Social Work (15) Ten-week program providing qualified students with intensive academic and field practice experiences which qualifies them to enter second year of graduate study upon successful completion of this term. S/NC only.

5310 Human Behavior and Social Environment (2-3) Development and extension of student's knowledge of range of adaptive behavior; continuum of behavior from optimum social functioning through pathology. Prereq: Second-year status. May be repeated.

5311 Imaginative Perspectives on the Human Condition (2-3) Examination of usefulness to social work students of prose, drama, and poetry, which illuminate and expand knowledge and appreciation of every person's humanity. Application of theories of extraordinary and ordinary life situations and events, portrayed by creative writers. Artistic representation of life behavior. Prereq: Consent of instructor. Prereq: Completion of core or consent of instructor. May be repeated.

5312 Psychodrama and Social Deviance (2-3) Theories of and recent research in etiology of psychic dysfunction and social variance. Categorization of deviant behavior and differential from other approaches to human behavior. Prereq: Completion of core or consent of instructor.

5313 Deviant Behavior of Children and Youth (2-3) Development and conduct disorders of children and youth, etiology, symptomatology, and range of social services and treatment modalities. Prereq: Completion of core or consent of instructor.

5314 Comparative Theories of Personality (2-3) Those personality theories with most relevance for social work practice with individuals, groups, or families. Prereq: Completion of core or consent of instructor. Taught at branches only. Available at UTK as Psychology 4510.

5315 Human Sexual Problems (2-3) Desensitization and desensitization of personal and sexual attitudes toward sexual behavior, clinical problems and solutions. Prereq: Consent of instructor. Prereq: Completion of core or consent of instructor.

5316 Mental Health and Employment (2-3) Work as major life task and values, attitudes toward work, patterns of employment, effect of changing technologies on individual and community, interdependence of individual and organization, meaning of work in assessing mental health. Prereq: Completion of core or consent of instructor.

5410 Social Work Practice I (3) Basic theory, values and beginning skills development generic to social work intervention at various system levels. Combines classroom skills and laboratory experiences.

5420 Social Work Practice II (3) Assessment, planning, methodology and skills development fundamental to social work intervention. Combines classroom skills and laboratory experiences.

5440 Family Therapy in Social Work Practice (2-3) Designed to aid student's knowledge of range of adaptive behavior; continuum of behavior from optimum social functioning through pathology. Prereq: Second-year status. May be repeated.

5442 Short-term Treatment (2-3) Foundation of and theoretical practice of short-term treatment focusing on nature of methods, characteristics of clients responsive to this approach, and designs of programs providing short-term treatment services. Specific techniques of assessment and treatment applied to practice with individuals and groups in crisis. Prereq: Completion of core or consent of instructor. May be repeated. Maximum 6 hrs.

5444 Social Work Practice with the Poor (2-3) Problems, issues, and dilemmas of practice in social services with poor and attributes of service-delivery systems which make that practice possible. Prereq: Completion of core or consent of instructor.

5460 Social Work Treatment with Individuals and Families (3) Social work literature, social case-work as method of social work practice and as foundation for interpersonal skills. Prereq: Completion of core or consent of instructor.

5470 Contemporary Treatment Modalities: Individual and Family (2-3) Well-established and developing treatment modalities as they relate to social work intervention at various system levels. Combines classroom skills and laboratory experiences. Prereq: Core or consent of instructor.

5611 Transactional Analysis (2-3) Philosophical, historical, and practical application of transactional analysis. Lectures, discussion, and experiential methods facilitate acquisition of knowledge and skills to use transactional analysis as treatment modality. Prereq: Completion of core or consent of instructor.

5642 Long-term Treatment (2-3) Theory and practice of long-term treatment focusing on nature of methods, characteristics of clients responsive to this approach, and designs of treatment programs providing long-term treatment services. Specific techniques of assessment and treatment applied to practice with individuals and groups in crisis. Prereq: Completion of core or consent of instructor. May be repeated. Maximum 6 hrs.

5644 Social Work Practice with the Poor (2-3) Problems, issues, and dilemmas of practice in social services with poor and attributes of service-delivery systems which make that practice possible. Prereq: Completion of core or consent of instructor.

5670 Comprehensive Methods of Group Treatment (3) Comprehensive methods of group treatment applied to work with individuals in groups. Prereq: Consent of instructor. May be repeated.

5770 Planning and Management of Change in Social Welfare (2-3) Theories and models of change such as planned change, conflict, and evolutionary change in relation to organizational change, community improvement, locality development, and economic development related to social welfare services. Prereq: Completion of core or consent of instructor.

5701 Administration in Social Work (2-3) Introduction to administrative practice as it relates to social work purpose and values and development
of administrative principles that make possible effective provision of welfare services.

5702 Organizational Design of Social Welfare Agencies (2-3) Core problems of adapting organizational structure and operational patterns to new tasks, objectives, and mandates. Planning and design techniques for new programs and for modification of existing programs for appropriate deployment of resources and personnel for maximum effectiveness and efficiency. Integration of theory and experience for development of practical skills for coping with various situations. Prereq: Second-year administration or community organization students; or consent of instructor; 5761 or equivalent.

5741 Supervision in Social Work (2-3) Dual roles of supervisor in various settings, and supervision distinguished from consultation and from direct practice. Responsibility and accountability to client system, supervisee, and executive, problems of middle management position of supervisor. Differences and similarities in supervision of varying levels of personnel, tasks, techniques, and processes in relation to individual and group supervision and field instruction. Prereq: Second-year status or consent of instructor.

5742 Consultation in Social Work (2-3) Constellation of roles, relationships, and behaviors required of consultant distinguished from supervision, administration, and direct practice. Types of consultation in relation to various settings and levels of responsibility. Processes and practices of consultation and dilemmas and pitfalls of consultant's position. Prereq: Second-year status or consent of instructor.

5743 Management of Human Resources in Social Welfare (2-3) Personnel function in administration of human services programs and agencies. Personnel recruitment, selection, appointment, and supervision; staff development, training, and evaluation; salary and benefit systems; employer-employee relations; and fair employment practices. Prereq: Completion of core or consent of instructor.

5744 Education and Training in Social Welfare (2-3) Philosophies and practices of teaching and learning related to adults in social work and social welfare. Distinctions between teaching and learning; training and education; unique aspects of adult learning; measurement issues; models and styles of education. Prereq: Completion of core or consent of instructor.

5745 Professional Leadership in Social Work (2-3) Leadership in social welfare. Theories of leadership; complexity of leadership; function, effectiveness, and satisfactions of leaders; leadership styles; values, motivation and morale; and leadership development and training. Prereq: Completion of core or consent of instructor.

5746 Social Welfare Administration and Planning (3) Topics significant to managerial-planer role such as decision making, budgeting, planning, and programming. Prereq: Completion of core or consent of instructor.

5762 Seminar in Social Welfare Administration and Planning (3) To assist students in acquiring specific administrative and planning techniques appropriate for social welfare delivery systems. Prereq: Completion of core or consent of instructor.

5771 Information Systems and Decision Making (2-3) Decision making in human services organizations, utilization of information in policy formulation, delivery of services, and evaluation of organizational performance. Information generation, collection, processing, storage, retrieval, and utilization in management and decision for maximum effectiveness and efficiency. Prereq: Completion of core or consent of instructor.

5772 Financial Management for Social Welfare Administration (2-3) Centralized decision making related to allocation of scarce resources in social services organizations. Technical aids to budgetary choice and other aspects of financial management examined for utility, parsimony, and feasibility. Prereq: Completion of core or consent of instructor.

5800 Management of Residential Settings (2-3) Issues and trends in management and programming in residential institutions for children, aged, mentally ill, mentally retarded, juvenile and adult offenders, and other groups. Prereq: Completion of core or consent of instructor.

5812 Organizational Perspectives in Juvenile Justice (2-3) Aspects of juvenile justice system: overview of juvenile delinquency, introduction to theories of causation, role of police in detecting delinquency and apprehension of delinquent offenders, police procedures, role of juvenile court, alternatives to institutions, correctional institutions, aftercare programs, and preventive strategies. Prereq: Second-year standing.

5820 Social Aspects of Illness (2-3) Social, economic, and emotional problems arising from or related to illness and disability as they affect individual, family, and community. Services needed to obtain optimum results from medical care. Lectures, discussion, illustrative case material.

5825 Drugs: Use and Abuse (2-3) Survey and analysis of social, cultural, medical, and psychological factors underlying alcoholism and drug abuse, recent research and treatment innovations, social work with user and family. Prereq: Completion of core or consent of instructor.

5826 Social Work Treatment for Marital Adjustment (2-3) Theories regarding social and cultural values and personality processes which gain expression in marriage, concepts regarding contemporary marriage styles, problem areas in marriages, and appropriate treatment approaches. Prereq: Completion of core or consent of instructor.

5830 Law and Social Work (2-3) Basic principles of law which relate to social work practice; organization of courts; legal aid societies; and other problems of legal nature that affect social work.

5860 Social Gerontology (2-3) Physical, psychological, and social aspects of aging; economic and health status of aging; older person and family; community programs for aging; retirement—phenomenon of modern society.

5865 The Roles of Women (2-3) Roles and statuses of women; emphasis on contemporary American scene. Empirical research as well as popular literature. Ascribed and achieved facets of women's statuses.

5910-20 Field Practice (3, 4) Instruction and supervised practice in methods of social work with individuals, groups and communities. Prereq: Admission to the School; 5410 concurrently or prior to 5910, 5420 concurrently or prior to 5920. Must be taken in sequence. Required course. S/NC only.

5930-40-50 Field Practice (4, 8, 8) Specialized instruction and supervised practice in methods of social work practice; administration, and planning in community health and welfare programs and agencies. Prereq: Admission to the School. Must be taken in sequence. S/NC only.

5961 Integrative Seminar (2) Required seminar facilitating integration of two-year M.S.S.W. program; attention given to current issues in profession and to pressing social problems. Student participation in symposia, discussions, simulations, and gaming situations prepares graduating student to assume positions of responsibility and leadership within profession. Graduate student helps to plan toward continuing his/her education and professional development. S/NC only.

5970 Outcomes in Social Work Practice (2-3) Application of substantive knowledge to comprehensive problem-solving within existing service and community systems. Critical analysis of functional relationships between problem, policy, planning, practice, and outcomes. Examination of problems from practice to determine key elements of optimal services and implications for policy decisions. S/NC only.
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