<table>
<thead>
<tr>
<th>Month</th>
<th>Events and Dates</th>
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<tr>
<td>Winter Quarter, 1977</td>
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<tr>
<td>January 3-4 (Monday-Tuesday)</td>
<td>Registration</td>
</tr>
<tr>
<td>January 5 (Wednesday)</td>
<td>Classes Begin</td>
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<tr>
<td>February 8 (Tuesday)</td>
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<tr>
<td>March 15 (Tuesday)</td>
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<tr>
<td>March 17 (Thursday)</td>
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<td>Spring Quarter, 1977</td>
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<tr>
<td>March 24-25 (Thursday-Friday)</td>
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<tr>
<td>March 28 (Monday)</td>
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<tr>
<td>April 8-9 (Friday-Saturday)</td>
<td>Easter (No Classes)</td>
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<tr>
<td>May 2 (Monday)</td>
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<td>Summer Quarter, 1977</td>
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<td>June 15-16 (Wednesday-Thursday)</td>
<td>Registration, First or Both Terms</td>
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<td>June 17 (Friday)</td>
<td>Independence Day (No Classes)</td>
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<td>July 5 (Tuesday)</td>
<td>Classes End, First Term</td>
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<td>July 19 (Tuesday)</td>
<td>Registration, Second Term</td>
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<td>July 20 (Wednesday)</td>
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<td>July 21 (Thursday)</td>
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<td>July 21 (Thursday)</td>
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<td>August 8 (Monday)</td>
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<td>August 23 (Tuesday)</td>
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<td>October 26 (Wednesday)</td>
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<td>December 6 (Tuesday)</td>
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<td>March 17 (Friday)</td>
<td>Commencement</td>
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</table>
The Graduate School
10 Graduate Programs
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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

Assistantships
Head of department in which you plan to major

Loans
Work Study
Part-Time Employment
Student Loans

Carolyn Cuddy, Director, Financial Aid, 301 Student Services Bldg.

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

International Student Advisor
Dixon Johnson, Alumni Hall

Scholarships and Fellowships
Sean Van Pallandt, 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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### 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

L. Evans Roth, A.B., M.S., Ph.D., Vice Chancellor for Graduate Studies and Research  
Margaret N. Perry, B.S., M.S., Ph.D., Dean for Graduate Studies  
Carl O. Thomas, A.B., M.A., Ph.D., Dean for Research  
William M. Konnert, B.A., M.A., Ed.D., Administrative Assistant to the Vice Chancellor for Graduate Studies and Research  
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Robert Lyle Young, B.S., M.S., Ph.D., Associate Dean for Educational Program, UT Space Institute  
William M. Konnert, B.A., M.A., Ed.D., Director, Oak Ridge Resident Graduate Program  
Marvin Goodman, B.S., M.S., Director, Kingsport Graduate Program  
Alexander Hollaender, A.B., A.M., Ph.D., Director of Archival Center for Radiation Biology and Special Assistant for Life Sciences  
James A. Spencer, B.A., M.C.P., Director, Graduate School of Planning  
Dan Billen, A.B., Ph.D., Director, UT-Oak Ridge Graduate School of Biomedical Sciences  
Floyd C. Larson, C.E., M.S., P.E., Director, Water Resources Research Center  
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Gary R. Purcell, B.A., M.Lib., M.A., Ph.D., Director, Graduate School of Library and Information Science

### The Graduate Council

Membership January 1, 1977

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<tr>
<th>Ex Officio Members</th>
<th>Appointed Members</th>
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<tr>
<td><strong>Vice Chancellor</strong>, L. Evans Roth</td>
<td>Dr. Hans E. Jensen</td>
</tr>
<tr>
<td><strong>Dean</strong>, Margaret N. Perry</td>
<td>Dr. Franklin Hamilton</td>
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<td>Dr. Edwin H. Hammond</td>
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<th>Date of Expiration</th>
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<td>Col. of Agriculture</td>
<td>Dr. W. W. Overcast</td>
<td>Dec. 31, 1977</td>
<td>Dr. Gary Lessman</td>
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<tr>
<td>Col. of Bus. Admin.</td>
<td>Dr. H. Dudley Dewhirst</td>
<td>Dec. 31, 1979</td>
<td>Dr. Norman E. Dittrich</td>
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<tr>
<td>Col. of Communications</td>
<td>Dr. Jerry Lynn</td>
<td>Dec. 31, 1977</td>
<td>Dr. Sheryl K. Zeigler</td>
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<tr>
<td>Col. of Education</td>
<td>Dr. Robert Kirk</td>
<td>Dec. 31, 1977</td>
<td>Dr. Robert Howard</td>
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<tr>
<td>Col. of Engineering</td>
<td>Dr. John R. Ray</td>
<td>Dec. 31, 1977</td>
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<td>Col. of Home Economics</td>
<td>Dr. Jerry J. Bellon</td>
<td>Dec. 31, 1979</td>
<td>Dr. Woodrow Wyatt</td>
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<tr>
<td>Col. of Liberal Arts</td>
<td>Dr. Gerald Ubben</td>
<td>Dec. 31, 1979</td>
<td>Dr. A. Montgomery Johnston</td>
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<td>Dr. Charles H. Ball</td>
<td>Dec. 31, 1978</td>
<td>Dr. Peter M. Husen</td>
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<td>Dr. William H. Coffield</td>
<td>Dec. 31, 1978</td>
<td>Dr. Martha Peters</td>
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<td>Dr. B. Dan Marks</td>
<td>Dec. 31, 1978</td>
<td>Dr. Bruce R. Dewey</td>
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<td>Dr. Charles J. Noel</td>
<td>Apr. 30, 1977</td>
<td>Dr. Grayce Goertz</td>
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<td>Dr. Robert J. Daverman</td>
<td>Dec. 31, 1977</td>
<td>Dr. Bethany Dumas</td>
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<td>Dr. B. J. Leggett</td>
<td>Dec. 31, 1978</td>
<td>Dr. Arthur G. Haas</td>
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<td>Dr. Jeffrey Becker</td>
<td>Dec. 31, 1978</td>
<td>Dr. Chip Hastings</td>
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<td>Dr. Otis Stephens</td>
<td>Dec. 31, 1979</td>
<td>Dr. Sidney Jumper</td>
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<td>Dr. James Tanner</td>
<td>Dec. 31, 1977</td>
<td>Dr. Patricia Waine</td>
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<td>(Any of these Liberal Arts proxies may serve for any elected member.)</td>
</tr>
</tbody>
</table>

### Graduate Student Council

Ms. Julie Walker  
Ms. Elizabeth  
Christy Hughes  
Dr. Gideon W. Fryer  
Dr. James Wu  

### School of Social Work

Dr. Christy Hughes  

### UT Space Institute

Dr. James Wu  

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June 1, 1978

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June 1, 1980

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June 1, 1980

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July 1, 1981

Marcus J. Stewart
July 1, 1981

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Amon Carter Evans,
  Nashville
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Ben Douglass, Lexington
Tom Elam, Union City
Lee Winchester, Jr., Memphis

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From Anderson, Bedford, Coffee, Franklin, Lincoln, Moore, and Warren Counties

June 1, 1979

From Davidson County

June 1, 1984

From Hamilton County

June 1, 1978

From Knox County

June 1, 1980

From Shelby County

July 1, 1981

July 1, 1981

From Weakley County

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Student Member

Marion Ridley
July 1, 1977

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C. Warren Neel, B.S., M.B.A., D.B.A., Acting Dean of the College of Business

Administration

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William H. Coffield, B.S., M.A., Ph.D., Acting Dean of the College of Education
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Joseph P. Goddard, B.S., M.S., Ed.D., Dean of the Division of Continuing Education
John J. McDow, B.S., M.S., Ph.D., Dean of Admissions (Undergraduate) and Records
### Majors and Degrees Available

<table>
<thead>
<tr>
<th>College of Agriculture</th>
<th>DEGREE</th>
<th>APT.</th>
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<th>LETTERS OF RECOMMENDATION</th>
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| School of Library and Information Science | M.S.L.S. | 3—Obtain forms from |
|------------------------------------------|---------| Department |
| School of Planning | M.S.P. | Obtain special forms from |
| Planning | | Department |
| School of Social Work | M.S.S.W. | Obtain special forms from |
| Social Work | | Department |
| (Memphis, Nashville and Knoxville) | | |

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1 Offered only at UT Space Institute.
2 Offered also at Oak Ridge and Kingsport and other off-campus locations.
3 Departmental doctoral option offered under the major of Home Economics.
4 Interdisciplinary, option offered in each department.
5 Ph.D. applicants only.
6 American applicants only.
7 Ed.D. applicants only.
8 Ed.S. applicants only.
9 International applicants only.
10 Interdisciplinary Ph.D. applicants only.
The Graduate School

L. Evans Roth, Vice Chancellor for Graduate Studies and Research

The mission of The University of Tennessee, Knoxville, is to offer in all colleges, but the search for new knowledge and its application to the changing needs of society is a major aim of The University of Tennessee.

So far as publicly-supported higher education is concerned, The University of Tennessee, Knoxville, is the center of advanced graduate training and research. The University provides Master's level work in over 100 fields of knowledge and doctoral work in 47, enrolling more than 6,600 graduate students.

The Graduate School

Off-Campus Graduate Centers

Kingsport University Center: The University of Tennessee offers at Kingsport resident graduate programs in science, engineering, and business at both the Master's and Doctor's level. 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 the 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 the Master's degree in industrial management, industrial education, and statistics; the Master's and Doctor's degrees are available in the areas of engineering, mathematics, and physical and biological sciences. Courses are given in the late afternoons, evenings and Saturdays, with research facilities provided by and used in cooperation with Oak Ridge Associated Universities, and the Union Carbide Corporation Nuclear Division.

This program is supported under a sub-contract with Oak Ridge Associated Universities with principal support coming from Union Carbide Nuclear Division. The University of Tennessee is one of the 43 colleges and universities which sponsors ORAU, a nonprofit education and research management corporation.

Information and applications to the Graduate School may be obtained by writing the Director, U.T.-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 the Director, Chattanooga Engineering Graduate Program, The University of Tennessee at Chattanooga, Chattanooga, Tennessee 37401.

The University of Tennessee Space Institute: Opportunities for graduate study leading to the degrees of Master of Science and Doctor of Philosophy in certain areas of engineering and science are offered by the Space Institute located adjacent to the Arnold Engineering Development Center, Tullahoma, Tennessee. At the present time, graduate degree programs are available with a major in aerospace engineering, aviation systems, computer science, electrical engineering, engineering science, applied mathematics, mechanical 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 aspects of atmospheric and 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; flow diagnostics including spectroscopic and electrooptic means; systems management and cybernetics. Course work 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 UTSI must be admitted to the Graduate School, University of Tennessee, Knoxville. Further information concerning the Institute may be obtained from the Dean, The University of Tennessee Space Institute, Tullahoma, Tennessee 37388. Application forms and an announcement of the Institute’s programs are available upon request.

The University of Tennessee at Nashville: Opportunities for graduate study leading to the degree of Master of Science in areas of civil engineering, engineering administration, and materials and structures are offered by The University of Tennessee, Knoxville, and are administered by the Vice Chancellor for Graduate Studies and Research.

Students who enroll in those 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, 10th 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 conjunction with 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 programs, see page 154.

Radiation Biology: A graduate major in the field of radiation biology leading to the M.S. and Ph.D. degrees is offered through the Institute of Radiobiology.

For complete information concerning the program, see page 146.

Admission and Registration

Admission to the Graduate School requires a Bachelor’s degree, or its equivalent, 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 a 3.0 for the senior year, is considered a satisfactory grade point average. Meeting the minimum admission requirement does not insure acceptance into a degree program since other factors may prevent admission in some cases.)

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.

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

Admission to the Graduate School does not imply admission to candidacy for the degree promised; 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 in which admission is requested, the file is destroyed after one year unless permission is requested and granted to enter in a future quarter. Applicants who reapply must submit a new application and fee.

Doctor’s 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 capabilities, and similar evidences of scholarly achievement. (Refer to description of doctoral programs for specific requirements for admission.)

Non-degree Graduate Students: No more than 18 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.

Eligibility of Seniors: A senior in The University of Tennessee who needs less than 45 quarter hours to complete the requirements for a Bachelor’s degree and has at least a B average (3.0), may take sufficient work for graduate credit to make a total of not more than 15 credit hours per quarter, subject to the approval of the Vice Chancellor for Graduate Studies and Research. Such approval must be obtained each quarter at registration through the Graduate Office.

Admission of Faculty Members: Faculty members 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 University of Tennessee system administration holding the rank of assistant professor and above or equivalent status, except in the case of Institute of Agriculture personnel specified in "b" above.

Any exceptions to this policy shall be made by petition to the Graduate Council of The University of Tennessee, Knoxville.

Evasion of these restrictions through temporary resignation, acceptance of a lower rank, or leave of absence is not allowable.

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 point average of 80.0 or above for the last two years of a four-year program. A student from India must be First Class the last two
years of a four-year Bachelor's degree program after completion of the twelfth grade. All students with a Master's degree must be First Class. Applicants from other countries will be evaluated upon receipt of transcripts.

An applicant must present: (1) a complete and accurate chronological outline of all previous university-level education; (2) authorized school or university records, with certified translation if the records are in a language other than English; (3) evidence of financial resources sufficient to provide him/her with at least $4600 (U.S.) per academic year during the period of registration as a student; and (4) certification of proficiency in English. Every international student must submit a score of at least 750 on the Test of English as a Foreign Language (TOEFL) in order to gain admission.

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.

Anyone with a Bachelor's degree wishing to take courses for graduate credit, whether or not he or she desires to become a candidate for a degree, must make formal application for admission to the Graduate School before enrolling. A student 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 as a Post-Baccalaureate student.

A student 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 as a Post-Baccalaureate student. A student 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 as a Post-Baccalaureate student. No international applicant can gain admission as a post-baccalaureate or non-degree student. A student 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 as a Post-Baccalaureate student.

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 8-9 for majors requiring these examinations.)

Each applicant is individually responsible for arrangements for the examination and 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 the Educational Testing Service, Princeton, New Jersey 08540, or from the UT Graduate School Office.

The completed application form and examination fee must reach the proper office at the Educational Testing Service approximately one month in advance of the test date (dates 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 both examinations.

Registration Procedures

Dates of registration are listed in the University Calendar (front of catalog). Students must 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 obtain a signature. Registration requires two days. The University holds advanced registration each quarter (approximately four to six weeks after each quarter begins). 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 Athletic 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 full registration fee. Retroactive registration is not permitted.

Fees, Financial Aid, and Fee Classification

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:** $10.00

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 to a UT systems school.) If a student applies but does not enter graduate school within 12 months after the 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 $160.00

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

- PER QUARTER $300.00

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 $22.00 per quarter hour or fraction thereof; minimum charge $66.00
OUT-OF-STATE  
$52.00 per quarter hour or fraction thereof; minimum charge $156.00  
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 $15.00  
All graduate students taking in excess of six quarter hours per quarter will be assessed a university programs and services fee of $15 per quarter. Part-time students taking six 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 $12. Part-time students taking six 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 six 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 $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 .................................. $ 20.00

One hour lesson per week,  
per quarter ................................. $ 40.00

Payable by students receiving individual instruction in music.

GRADUATION FEE:  
Master's degree candidates ................. $ 16.00

Doctor's degree candidates ................. $ 41.00

There is no additional charge for diploma, binding, or microfilming.

DEFERRED PAYMENT SERVICE FEE: $3.00  
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 adjustment, etc.) is not paid within five regular business days after the date it was incurred.

Students should 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:  
Upon receipt of a class schedule, partial or complete, a student is responsible for payment of appropriate fees. Withdrawal from the University after receiving a class schedule, whether partial or complete, must be by official notification to the Office of Special Services because space in a class section is reserved until released. The minimum of 20 percent of fees will be charged even if classes are not attended. Failure to promptly notify the Office of Special Services when withdrawing could result in a larger percentage fee assessment. The effective date of withdrawal is the date the Office of Special Services is notified by completion of the official withdrawal request form.

For a regular academic quarter, withdrawal within seven 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.

No refund is due on independent courses which are dropped unless the sum of the remaining hours calculated at the hourly rate plus the adjusted charge for the course(s) dropped is less than the total amount paid or the maximum quarterly tuition and/or maintenance fee. On the Knoxville campus for a regular quarter, no refund is made for courses dropped later than 21 calendar days after the last regular registration day. A course for which a student has registered is not dropped until a drop/add slip is processed and recorded by the Records Office. Refunds resulting from dropped courses will be made after the final audit at the end of the quarter.

Rental charges and adjustments are determined by the Office of Residence Halls in accordance with the terms of the housing agreement or contract. Note: All charges and refunds will be made to the nearest even dollar.

The University is authorized by statute to withhold diplomas, grades, transcripts, and registration privileges until student debts and obligations (other than Student Loan Fund notes) owed to the University are satisfied.

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 receipt validated and supply necessary details concerning fee payment waiver.

Fee Classification for the Purpose of Paying University Fees

Shortly after a student applies to the Graduate School, notification of 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 Residency Clerk at the Graduate School Office.

If a student is classified as out-of-state and it is determined that said student is either a part-time student or a student who has domicile elsewhere than in this state shall be eligible as an in-state student for tuition purposes.

(2) The domicile of an unemancipated person is that of the parent.

(3) Upon moving to this state, an emancipated person who provides persuasive evidence of domicile may apply for in-state classification for said person's unemancipated children. The fee for said person is not in this state primarily as a full-time student, the emancipated children may at once be so classified, and may continue to be so classified so long as said person remains domiciled in this state.

(4) Any person who remains in this state when the parent, having theretofore been domiciled in this state, removes from this state, shall be entitled to classification as an in-state student so long as attendance at a school or schools in this state shall be continuous.

(5) An emancipated person whose parent is a member of the armed forces and stationed in this state or at Fort Campbell, Kentucky pursuant to military orders shall be classified as an out-of-state student but shall not be required to pay out-of-state tuition. The student, while in continuous attendance toward the degree for which he/she is currently enrolled, shall not lose his/her residence when the parent thereafter is transferred on military orders.

(6) Part-time students who reside in Tennessee and are employed full-time in the state or at Fort Campbell, Kentucky pursuant to military orders and who would be classified out-of-state in accordance with other provisions of these regulations,
will be classified out-of-state, but will not be required to pay out-of-state tuition while enrolled as part-time students. (Student must apply for this status each quarter).

Presumption. Unless the contrary appears from clear and convincing evidence, it shall be presumed that:
(1) No emancipated person shall be deemed to have gained residence while attending any educational institution in this state as a full-time student, as such status is defined by the governing board of such institution.
(2) The domicile of a married person shall be determined by the provisions of these regulations independent of the residence of the spouse.
(3) A person does not gain or lose in-state status for reason of his/her presence in any state or country while a member of the Armed Forces of the United States, provided that a member of the armed forces may obtain in-state status for the member and dependents by establishing domicile in this state.

Establishment of Domicile. If a student asserts that he/she has established domicile in Tennessee, the student has the burden of proving such assertion.

Appeal. The student who wishes to appeal his/her initial residency classification should contact the Residency Clerk in the Graduate Office.

Effective Date for Reclassification. If a student classified nonresident applies for in-state residency classification at the beginning of a quarter or semester and is subsequently so classified, the in-state residency classification shall be effective at the beginning of the quarter or semester in which application for reclassification was submitted.

Assistantships and Fellowships

Non-Service Fellowships supported by the University are awarded on the basis of need. Students who have helped the University in an extraordinary way are eligible for need based fellowships. The University also administers several fellowships and scholarships supported by non-University sources that are available to students classified as residents.

University of Tennessee Student Loans

Student loans from University sources, established by friends and alumni of the University, are available to currently enrolled students. One can be extended a loan of up to $250 per quarter to an annual maximum of $750. 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 end of a stated number of years from the date of the note. The borrower may, without penalty, pay all or part of the loan at any time before the maturity date.

Student Employment

The College Work-Study Program is administered in accordance with an agreement between The University of Tennessee and the United States Office of Education. Temporary work assignments are available for single graduate students. The position is a minimum of ten (10) hours per week, and is due at the end of a stated number of years from the date of the note. The borrower may, without penalty, pay all or part of the loan at any time before the maturity date.

Student should contact Director of Financial Aid for information concerning student loans.

Veterans' Benefits

The Office of the Registrar administers the University’s responsibility for programs of the Veterans Administration. Each veteran or child of a deceased or disabled veteran 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.

General Information

The University of Tennessee offers its programs of instruction to qualified persons regardless of race, color, creed, sex, or national origin.

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. Specific units of residence halls and of the apartment building have also been designated specifically for single graduate students. In Melrose Hall the graduate section offers community living units for groups of six to ten students with personal responsibility emphasized. The Holt Avenue Apartment Residence Hall accommodates, on a graduate floor, students in groups of three or 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 9 1/2-month basis. Summer employment may be possible. Further information can be obtained from the Office of Residence Halls, 405 Student Services Building.

Married Students: The University has provided excellent apartment facilities in several locations for married students. Information and application for these facilities may be secured from the Office of Rental Properties, Stadium Hall.

Vehicle Operation And Parking

The University of Tennessee endeavors to provide adequate facilities for the in-
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, its professional staff serves as advisors on personal and related problems.

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

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

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 a facility where domestic and international students may come together to relax and discuss matters of mutual interest. The small library at "I" House contains both books and periodicals from all over the world.

The University Library

The University of Tennessee, Knoxville, Library owns approximately 1,280,400 volumes, 1,801,300 manuscripts, 42,500 microfilm reels and 721,300 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 Library's archival 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

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 Students' Rights and Responsibilities 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, they are exceeded by those of the individual departments. In some cases, departments have brochures describing in detail their programs and requirements.

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. It 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 are allowed conditional registration for graduate credit after filling 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 this course. Should the student not be so admitted, whether because of lack of
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 week after the beginning of classes.

The deadline for change of registration (from credit to audit, audit to credit, graduate to undergraduate, undergraduate to graduate, withdrawal, etc.) is set at mid-quarter, 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 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 week of classes and before the withdrawal deadline, the grade of W will automatically be entered on the student’s record and on the final 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 the grade of F unless the student can clearly demonstrate that one of the following conditions exists:

- a. illness or injury of the student as verified by the student’s health service or private physician,
- b. serious personal or family problems as verified by the student’s parents, minister, physician, etc.,
- c. necessary change in work schedule as verified by the student’s employer,
- d. change of major to a program in which the course that the student wishes to drop will not normally be used in satisfying degree requirements. Acceptance of the student into the new program should be verified by the Graduate School.
- e. financial inability to continue at the University,
- f. call to active military service.

One of the same conditions must exist for any change of registration. A student will not be permitted to drop a course simply to avoid a poor grade.

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 or the appropriate change on the student’s permanent record.

Maximum Load

All graduate students are urged to register each quarter for only that number of hours which they can successfully complete. The maximum load for a graduate student is 15 hours and, nine to twelve hours is considered a full load. Registration for more than 15 hours during any quarter including the summer quarter is not permissible without prior approval of the Vice Chancellor for Graduate Studies and Research, who may allow registration of up to 18 hours if the student has achieved an average of 3.6 or better in at least 9 hours of graduate work. Graduate assistants or others who have part-time duties with the University are expected to enroll for no more than an appropriate fraction of the maximum load.

Advisors

The Vice Chancellor for Graduate Studies and Research is the general advisor for all graduate students, but so far as particular courses are concerned, a student is counseled by an advisor from the major department. A new student seeking an advisor should go to the department in which the student is to major. At the time of each registration, the advisor must approve the program of study for a student. If the student is pursuing a collateral area of study, the advisor, in approving the student’s program, should secure the advice of the department representing the collateral area.

Auditors

Persons who wish to attend certain classes regularly, without taking examinations or receiving grades or credit, may do so by completing a graduate application, paying the application fee, registering as auditors, and paying regular fees. Auditors are not permitted to participate in class discussions and recitations, or use laboratory equipment and materials.

Grades

Grades in the Graduate School have the following meanings:

- A — (4 quality points per quarter hour); indicates superior work.
- B+ — (3.5 quality points per quarter hour); indicates above satisfactory work.
- B — (3 quality points per quarter hour); indicates satisfactory work.
- C+ — (2.5 quality points per quarter hour); indicates performance less than expected.
- C — (2 quality points per quarter hour); indicates work of borderline quality. This grade represents work below the standard expected of graduate students.
- D — (1 quality point per quarter hour); indicates clearly unsatisfactory work and carries no graduate credit.
- F — (no quality point value); indicates unsatisfactory work and carries no graduate credit.
- I — (no quality point value); indicates that the student has done satisfactory work in the courses, but because of circumstances beyond control—has been unable to finish all requirements. It is not be given to enable a student to do additional work to bring up a deficient grade. All incompletes must be removed within 2 quarters. If a supplementary grade report has not been received in the Graduate Office one week prior to 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 his 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. S/N is used for courses which culminate in a thesis, dissertation, or preliminary examination. The N grade takes on the value of the S when the thesis or dissertation is accepted by the Graduate School. 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 48-hour non-thesis program or 18 hours in a doctoral program of 72 hours excluding dissertation hours.

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. Transferred work will not be counted in computing the grade average on courses completed in 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

* If a student receives an I after finishing the course work for the Master’s degree but has not received the degree, the I may be converted with an F with the approval of the Vice Chancellor for Graduate Studies and Research.


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.

The minimum residence for any Doctor's degree is one academic year or three consecutive quarters of full-time study. A student in residence is devoting essentially all his/her 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 non-degree to a degree program or 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 Educational Specialist 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.

Proficiency Examination

A proficiency examination may be given in any academic course offered for graduate credit. 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 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 courses 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.

Law Courses

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

Transfer Credits

A maximum of nine quarter hours (six 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.) 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), 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 may consist of 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 nine 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 before any transfer of credit will be approved.

Credits accepted in either the Master's or Doctor's program will not affect the minimum residence requirements, nor will they be counted in determining the student's grade average. Neither will they count toward meeting 5000- or 6000-level requirements for an advanced degree. Special rules apply for courses completed within The University of Tennessee System.

Thesis Consultant

All theses and dissertations are submitted to the Graduate School Thesis Consultant for approval before they are officially accepted for the Graduate Council. A student may confer with the Thesis Consultant regarding any problems or questions encountered during the preparation of the final copy of the thesis or dissertation. Students should also consult the Graduate School Thesis and Dissertation Manual as a guide to the correct format for the thesis or dissertation.

Before a thesis is deposited in the Library, it is the responsibility of the Thesis Consultant to examine the materials and to make sure that the report is mechanically accurate and attractively presented, is free of technical errors in format, is suitable for binding, and can be accepted for the University and its graduate program. If the form of the thesis is not thus approved, the student must make whatever corrections are necessary and submit the materials again.

A one-hour Thesis Workshop is held each fall quarter and each summer quarter for all interested students. The date for the Workshop is announced in the Graduate School News.

Requirements for Advanced Degrees

Master's Degrees

Master's degree programs offered in the Graduate School are listed under "Majors and Degrees Available" on pp 8-9. See also chart, p. 19 for 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 credit of course work except in the MBA degree program. A minor shall consist of not less than nine or more than 18 quarter hours of course work.
All courses for which a student registers must be completed (unless officially dropped) before graduation. At least one-half of the total courses in the graduate program must be at or above the 5000-level, of which no more than nine hours may be thesis courses. These courses must be completed at The University of Tennessee. (5000- and 6000-numbered courses are open to graduate students only — 3000- and 4000-numbered courses may be taken for graduate credit if listed in the Graduate School Catalog.)

The Specialist In Education program requires 60 quarter hours, nine hours of which must be devoted to the preparation of a thesis (some departments permit the student to take additional courses in lieu of a thesis — see departmental requirements) and three hours of which will be comprised of a three-quarter, one credit-hour seminar in the principles and techniques of college teaching. In the two-year program, the candidate also spends six quarters as a teaching intern. The emphasis in the program will be on training prospective teachers of undergraduate courses. Participating departments are indicated in the list of " Majors and Degrees Available" on pp. 8-9.

Master's Committee: A committee for the Master's degree is formed at or before the time the student applies for admission to candidacy. The student should consult with the major professor concerning the composition of a committee. This committee consists of a minimum of three members, with the rank of assistant professor or above. If a student does not have a minor, all members may be from the major department. If a student does have a minor, one member of the committee must be from the minor department. A student should consult with the advisor or department head concerning the Master's committee after one quarter of graduate level work.

Admission to Candidacy: Application for admission to candidacy for the Master's degree is made after the student completes any required prerequisite courses and at least 15 hours of graduate course work with a B average (no incompletes) in all courses taken for graduate credit. 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 he/she plans to graduate. The deadline for submission of this form is given each quarter in the Graduate School News.

Thesis Registration: A minimum of nine quarter hours and, in some approved programs, a maximum of 18 quarter hours of credit (course number 5000 which is variable credit) in the major may be earned in the preparation of an acceptable thesis, representing original, independent work. A student may register for a thesis course each quarter work is being pursued on the thesis. If the thesis is not completed during the quarter in which the student registers for the last three hours of 5000, the candidate shall continue to register for a minimum of three hours of 5000 each quarter while actually working on the research and thesis through the quarter in which the thesis is accepted by the Graduate School. Similar rules apply when problems are used in lieu of the thesis.

Non-Thesis Registration: All non-thesis students using University facilities or faculty time must be registered for course 5002 if not registered for other courses. Students taking the final examination but not otherwise registered must pay a fee of $50. Final exams will not be scheduled until one of the above is met.

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 must be scheduled through the Graduate Office, shall be held at least one week 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 all 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 chairman. (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 department may or may not follow this examination with an oral examination. 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. This examination must be scheduled through the Graduate Office in accordance with the Graduate School News deadlines. This examination will be conducted by a committee of not fewer than three faculty members, with the student's major professor as chairman. (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.

Thesis: The thesis represents a culmination of an original research project completed by the student under the guidance and supervision of the major professor, and subject matter of the thesis is important in conveying to others the results of such research. Two copies of the thesis must be submitted to and approved by the Graduate School on or before the dates specified by the Graduate School. If a student is unable to meet this deadline, and the thesis is approved prior to the first day of registration for the next quarter, the candidate may then graduate the next quarter (or later) without being registered if properly registered for three hours of 5000 the quarter the thesis was accepted. Each copy of the thesis must include an approval sheet, signed by the member 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 additional 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 area in which 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 shall include a minimum of two members from the department or area of specialization. See chart, p. 20 for summary of procedures for this degree.

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
Summary of Procedures for Master’s Degrees

<table>
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<tr>
<th>PROCEDURE</th>
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<th>DATE</th>
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<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 receiving 18 hours of course work</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, no I’s, 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>
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**GRADUATION REQUIREMENTS**

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>UNDER DIRECTION OF</th>
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<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 one week 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.

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 1/2 of the last 45 hours of course work, exclusive of the thesis or problems, must be in 5000- or 6000-level courses. The last 45 hours of a student’s program (including thesis or problems) must be completed within six years.

**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 nine 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 this course (minimum of three hours) 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 dates given in the *Graduate School News*. In case of failure, the student may not appear for reexamination until the following quarter. The result of the second examination is final.

Doctor's 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 Doctor's 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. 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, p. 22, for summary of procedures for this degree.

Doctoral Committee: The student's committee is nominated by the student's major professor and/or department head and approved by the Vice Chancellor for Graduate Studies and Research, usually at the beginning of the second year of graduate study. This committee shall consist of at least four members, with at least one member from outside the major department. Three of the four members, including the chairman, must be approved by the Graduate Council to direct doctoral research.

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 three 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. (NOTE: 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 oral or written examination which is an indication of the student's fitness for completing the program is required of each person working toward the doctorate. The nature and time of the examination will be determined by the student's major depart-

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**Summary of Procedures for Specialist in Education Degrees**

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<tr>
<th>PROCEDURE</th>
<th>UNDER DIRECTION OF</th>
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<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>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>
<tr>
<td>GRADUATION REQUIREMENTS</td>
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<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, Vice Chancellor for Graduate Studies and Research, and student</td>
<td>Not later than one week prior to oral or written examination*</td>
</tr>
<tr>
<td>Submission of thesis or problems to faculty committee</td>
<td>Faculty committee</td>
<td>At least one week prior to oral examination</td>
</tr>
<tr>
<td>Oral examination</td>
<td>Major professor and committee</td>
<td>Not later than one week prior to thesis/problems 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.
ment 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. The doctoral program must be completed within a period of five years after passage of preliminary examinations.

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 examination. (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 passage 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 nine 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 Doctor's 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 one week 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 three 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. 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 its contents to be satisfactory. 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 Doctoral Degrees

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>UNDER DIRECTION OF</th>
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<tbody>
<tr>
<td><em>Preliminary examination</em></td>
<td>Major department</td>
<td>Prior to admission to candidy</td>
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<tr>
<td><em>Foreign language examination(s)</em>**</td>
<td>Major department and language department jointly</td>
<td>Prior to admission to candidy</td>
</tr>
<tr>
<td><em>Appointment of faculty committee</em></td>
<td>Vice Chancellor for Graduate Studies and Research on recommendation of major department</td>
<td>Prior to admission to candidy</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>
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### GRADUATION REQUIREMENTS

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<thead>
<tr>
<th>Procedure</th>
<th>Under Direction Of</th>
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<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 examination</td>
<td>Faculty committee and Vice Chancellor for Graduate Studies and Research</td>
<td>When approved by faculty committee and at least one week prior to oral examination **</td>
</tr>
<tr>
<td>Submission of dissertation to faculty committee</td>
<td>Faculty committee</td>
<td>At least two weeks prior to oral examination</td>
</tr>
<tr>
<td>Oral examination</td>
<td>Faculty committee</td>
<td>Not later than one week before dissertation 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 dissertation, doctoral forms, and thesis card.</td>
<td>Faculty committee and Vice Chancellor for Graduate Studies and Research</td>
<td>After oral examination and at least two weeks before Commencement **</td>
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* The order of these items varies with individual programs.
** Dates are printed in Graduate School News quarterly.
*** Not required in some programs.

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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 professional objectives. 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...

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...
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: College of Agriculture, Agricultural Experiment Station, and Agricultural Extension Service.

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
Thomas J. Whatley, Associate Dean

The Agricultural Experiment Station was established by the University’s Board of Trustees on June 8, 1882, which was 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 pastures through improved fertilization and mechanization, and more efficient feeding and management of livestock.

The program is designed and administered through 16 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-ERDA Comparative Animal Research Laboratory is located about 20 miles west of Knoxville near Oak Ridge, where a program of radiobiology research in the field of agriculture is carried out by the Agricultural Experiment Station under contract to the Energy Research and Development Administration. The program includes research with farm and laboratory animals, with soils, and in applied radiobiology and plant breeding.

Agricultural Extension Service

W. D. Bishop, Dean
M. L. Downen, Assistant Dean
T. W. Hinton, Assistant Dean
Mildred 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 95 counties of the state. Education emphasis includes work in five major program areas: agricultural production, marketing of agricultural products, development and conservation of natural resources, 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 informational 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 three 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, teaching, research, and extension. The College of Agriculture 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, ethical, 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 education, agricultural mechanization, animal science, food technology, 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 the 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 will depend upon the student's background, interests, and professional objectives. For example, a student majoring in agricultural biology may pursue work with an emphasis either in the area of plant pathology or economics.

Normally, graduate programs will include the thesis requirement. There are, however, two exceptions.

In a program involving a major and two minors, or one involving a minor in general agriculture, the research requirement may be met by three special problems in lieu of thesis. This program is provided to meet the needs of those working in fields of agriculture where general training is suitable rather than the more specialized subject-matter programs which usually characterize graduate study. The special problems in lieu of thesis must represent at least two of the fields of study selected. A student should have completed at least six hours of graduate work in a subject before pursuing a special problem in lieu of thesis in that field. Problems in lieu of thesis will be written to meet normal thesis standards of quality.

A non-thesis option is offered in the Department of Agricultural Economics and Rural Sociology in addition to the thesis option and 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.
- 8 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, and Plant and Soil Science are offered in the College.

General Graduate School requirements relative to admission, faculty advisory committees, residence, grades, research, and admission to candidacy for degree apply 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 their competence in examinations in the following areas:

A. A major area of concentration to be selected from the following:

1. General agricultural economics
2. Agricultural marketing and price analysis
3. Farm management and production economics
4. Economics of agricultural 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 are:

1. A minimum of 108 quarter hours credit beyond the Bachelor's degree, exclusive of the 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. A minimum of 30 quarter hours credit will be in courses numbered 5000 and 6000, exclusive of Doctoral Research and 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.
4. 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 chairman of the faculty advisory committee and will direct the research and preparation of the dissertation.

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 production

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 must 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.

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.

Some of the specific requirements for the degree are:

1. Minimum of 108 quarter hours credit beyond the Bachelor's degree exclusive of Master's thesis. Of 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.

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 chairman 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.
4250 Agricultural and Rural Program Planning (3) Decision-making concepts applied to design and implementation of local-action programs. Case examples from the U.S. and other countries. Prereq: Introduction to Social Sciences in Agriculture and Introductory Economics or consent of instructor.

4310 Agricultural Finance (3) Agricultural credit: nature and source of capital; credit and demand for land; principles and theories of rent, property, value, and income.

4320 Agricultural Policies (3) Agricultural policy in democratic society; relationship of farm groups to public policy; problems giving rise to policy; impact of agricultural policy and appraisal of results; policy problems.

4330 Land Economics (3) Problems and policies of land use, conservation, development, taxation, and tenure; population growth and demand for land; principles and economic framework for managerial decision making.

4630 Advanced Agricultural Marketing (3) Theory of production and costs. Application of cost theory to the production organization of the marketing firm and problem of plant operation. Market organization, structures, and price policies. Application of imperfect competition theory to the market policies of agricultural processing and merchandising firms.

4710 Agricultural Law (4) Survey of law and application to the farmer, his family and the agricultural industry. Property, contracts, torts, fraud, bankruptcy, landlord-tenant relationship, taxation and insurance, forms of business organization, estate planning, regulatory laws and other selected topics.

5000 Thesis

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

5011 Special Problems in Lieu of Thesis (3)

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

5130 Advanced Agricultural Production Economics (3) Theoretical 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 problems in agricultural economics and rural sociology. Graded on a pass/fail basis and interpreted by credit and workload which may be repeated. Maximum 9 hrs.

5410 Agricultural Marketing Analysis (3) Application of tools of economic analysis and measurement to problems at all levels of the marketing system for agricultural commodities. Prereq: 4630 or equivalent.

5420 Advanced Land Economics (3) Problems in land tenure, land use, and conservation in the United States and selected foreign countries. Prereq: 4530 or equivalent.

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

5610 Quantitative Methods in Agricultural Economics (3) Study of analytical techniques useful in estimation of functions—supply, demand and production—and prediction of economic variables. Emphasis on the 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) Study of linear programming technique with empirical applications, made to problems of maximizing profit, minimizing cost, farm growth, transportation, and location. Other topics include input-output analysis, recursive programming, dynamic programming, and nonlinear programming. Prereq: Economics 4180 or consent of instructor.

6000 Doctoral Research and Dissertation

6120-30 Seminars in Agricultural Economics (3, 3) Topics will be selected from the areas of economics of production, consumption or distribution in agricultural 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 programs related to agricultural modernization, food supply, and rural living. The decision-making process and useful roles of social scientists. Analysis of current issues in U.S. and developing nations. Prereq: Consent of instructor.

6410 Agricultural Supply Analysis (3) Estimating agricultural supply 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 efficiency and economic use. Emerging problems in marketing and resource use. Wastes management in the marketing systems to conserve resources and environment. Prereq: 5410 or consent of instructor.

Rural Sociology

3420 An Introduction to Rural Sociology (3) Nature of rural society; social systems concept; rural-urban differences; nature of social relations; law and economics; movement; problems of rural people; tenancy, farm labor, health, services, educational facilities, churches, local government; impact of industrialization.

4450 Diffusion of Agricultural Technology (3) Analysis of the diffusion process thereby new technology spreads from scientists to final users. A multiple regression model is developed for the adoption process, communication behavior, mass media, role of professional change agents, opinion leadership, and two-step flow hypothesis. Prereq: 3420 or consent of instructor.

5340 Special Problems (3) Special topics in rural sociology. Prereq: 3420 or consent of instructor. May be repeated. Maximum 9 hrs.

5430 Seminar in Rural Sociology (3) Current rural sociological literature and research; relevance of general sociological theory and methodological techniques. Prereq: 3420 or equivalent.

5450 Advanced Rural Sociology (3) The application of sociological concepts to analyze the changing structure and function of rural life. Social values, attitudes, and norms as they influence the behavior of the individual, family, and social groups. Prereq: 3420 or equivalent.

5470 Research Problems in Rural Communities (3) Emphasis is given to problems that arise in survey research in rural areas. Problems arising from sampling procedures, questionnaire construction, interviewer selection, training, and control, and legitimation needs are covered. Prereq: Undergraduate course in statistics.

5490 Rural Population Analysis (3) Analysis of the U.S. and world population changes and the determinants of fertility, mortality, and migration with emphasis upon changes in the rural sector. Prereq: Sociology 4110 or equivalent.

Agricultural Engineering

MAJORS

AGRICULTURAL ENGINEERING

DEGREES

M.S., Ph.D.

Professional

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) Design of water control and waste utilization systems including earth dams, irrigation, drainage, dams, irrigation, drainage, land grading, hydraulic transport of wastes, and application of wastes on agricultural land. Prereq: 3610 or permission of Instructor. 1 hr and 2 labs.

4620 Design of Structures for Production, Processing and Environmental Control (3) Functional planning and structural design of agricultural buildings; emphasis placed on complete design of structure or system; design to include functional, structural and environmental aspects, ranging from design to construction. 1 hr and 2 labs.

4630 Design of Processes and Materials Handling Systems (3) Design of production systems and components for integrated agricultural processing considering mass and energy balances, product characteristics, equipment 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 machine component design; synthesis of mechanisms, mechanical and hydraulic drives. Team effort in completing machine design project. Prereq: 3040 or permission of Instructor. 1 hr and 2 labs.

5000 Thesis
5240 Environmental Control in Agricultural Structures (3) Engineering analysis of factors as they relate 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: Functional Design of Agricultural Structures; Applied Engineering Thermodynamics; Differential Equations; 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 as related to agricultural and forest purposes. Prereq: Drainage and Irrigation, and Water Resources 3330 or consent of instructor. 2 hrs and 1 lab. (Same as Water Resources Development 5340).

5440 Instrumentation in Agricultural Systems (3) Analysis of specific instrumentation needs in agricultural industry and research problems; principles and design in utilization of specialized instrumentation. Prereq: Electrical Engineering 3120 and Differential Equations or consent of instructor. 2 hrs and 1 lab.

5540 Engineering Properties of Agricultural Materials and Products (3) Fundamental engineering properties of agricultural products and materials as related to their handling, processing, and other agricultural engineering related problems. Prereq: 5440; Fluid Mechanics; and Mechanics of Materials. 2 hrs and 1 lab.

5640 Research Problems in Agricultural Engineering (3) Theoretical and experimental studies relating to current problems in agricultural engineering. May be repeated. Maximum 9 hrs.

5710-20 Similitude in Design and Research (3, 3) Dimensional analysis in the development of models; prediction equations; interpretation of data; applications to machinery, soil and water structures, agricultural buildings, and other agricultural engineering problems. Prereq: 5440 and Mechanics of Materials. 2 hrs and 1 lab.

5860 Research Problems in Agricultural Engineering (3) Theoretical and experimental studies relating to current problems in agricultural engineering. May be repeated. Maximum 9 hrs.

5910 Seminar (1) Discussion of 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 the design of engineering experiments and applications to including appropriate computer applications, statistical evaluations, and feedback control in agricultural problems. Prereq: 5440; Mathematics 4710; Agricultural Plant and Soil Science 5310; or 6 hrs of approved statistics. 2 hrs and 1 lab.

6510 Selected Topics in Agricultural Engineering (3) Lecture, group discussion, and individual study on specialized developments in power and machinery, soil and water structures, and processing. May be repeated. Maximum 9 hrs.

6610 Doctoral Research and Dissertation

6710 Seminar (1) Discussion of current research and literature related to engineering in agriculture. May be repeated. Maximum 3 hrs.

6810 Seminar (1) Discussion of current research and literature related to engineering in agriculture. May be repeated. Maximum 3 hrs.

6910 Seminar (1) Discussion of current research and literature related to engineering in agriculture. May be repeated. Maximum 3 hrs.

5310 History, Philosophy and Objectives (3) Historical and philosophical foundation of informal Adult Education in American Agriculture from the Agricultural Societies (1785 to present) with attention to key figures, issues, legislative movements, farmer organizations and programs. Emphasis on Agricultural Extension Service, its origin, legislation and growth and the nature of present day objectives and programs. Prereq: 3110 or consent of instructor.

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

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

Animal Science

DEGREES

MAJOR Animal Science

M.S., Ph.D.

Professors: R. R. Johnson (Head), Ph.D. Ohio State; M. C. Bell, Ph.D. Oklahoma State; J. K. Bieker, Ph.D. Ohio State; C. C. Chamberlain, Ph.D. Iowa State; H. M. Jamison, Ph.D. Tennessee; J. B. McLaren, Ph.D. Auburn; G. M. Merriman, D.V.M. Michigan State; J. M. Montgomery, Ph.D. Wisconsin; R. L. Murphy, Ph.D. Wisconsin; D. O. Richardson, Ph.D. Ohio State; R. D. Upham, Ph.D. Illinois; R. R. Shrode, Ph.D. Iowa State; E. W. Swanson, Ph.D. Missouri; R. T. Tugwell, Ph.D. Kansas State; R. R. Shrode, Ph.D. Iowa State; E. W. Swanson, Ph.D. Missouri; R. T. Tugwell, Ph.D. Kansas State.


Assistant Professors: J. A. Corrick, Ph.D. Tennessee; D. C. Doyle, D.V.M., Ph.D. Cornell; J. F. Ritchie, Ph.D. Michigan State; J. W. Rolf, D.V.M. Ohio State; F. B. Mamm sphere, Ph.D. Kansas State; J. A. Cornwell, D.V.M.; Ph.D. Purdue; M. Sims, Ph.D. Auburn; J. D. Smalling, Ph.D. Texas A & M.

3210 Soil and Water Conservation Facilities (3) Leveling, topographic surveying, planning, construction, and maintenance of drainage, irrigation, and erosion-control systems. Prereq: Introduction to Agricultural Engineering; General Mathematics; Soil. 2 hrs and 1 lab.

3220 Agricultural Structures (3) Functional planning of structures; environmental control construction methods; properties of building materials; and cost estimation. Prereq: Introduction to Agricultural Engineering; General Mathematics (5 hrs). 2 hrs and 1 lab.

3510 Agricultural Utilities and Processing Equipment (4) Electrical equipment; controls; water and gas distribution, heating, and refrigeration systems; food processing systems; waste disposal systems. Prereq: Introduction to Agricultural Engineering; Introductory Physics (8 hrs). 3 hrs and 1 lab.

4160 Agricultural Waste Utilization and Disposal (3) Techniques and structures for utilizing, treating, and disposing of agricultural wastes by land spreading, lagooning, and processing. 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 and techniques for application of liquid, solid, and gaseous chemicals; system components; operational characteristics; safety considerations; calibration; selection and management; materials handling and disposal methods. 2 hrs and 1 lab.

4210 Agricultural Machinery and Tractors (4) Agricultural machinery and power units; adaptation to agricultural practices; field efficiencies, capacities, adjustment and servicing. Prereq: Introduction to Agricultural Engineering; General Mathematics (6 hrs). 3 hrs and 1 lab.

5000 Thesis

5100 Special Problems in Agricultural Mechanization (3) Research problems related to recent developments and current practices in agricultural mechanization. May be repeated. Maximum 9 hrs.

5120 Electro-Mechanical 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: 3220 and 3510. 2 hrs and 1 lab.

5140 Agricultural Machinery Systems Analysis (3) Analysis of current field machinery; adaptation planning for specific field operations; machinery for unique and alternate production and harvesting 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 DEGREE Animal Extension

M.S.

Professor: R. S. Dotson (Head), Ph.D. Pennsylvania State.

Associate Professor: C. E. Carter, Jr., Ph.D. Ohio State.

3110 Introduction to Agricultural Extension (3) History; philosophy; organization; teaching methods; relationships with other educational agencies. Graduate credit for non-majors only.

4110-20 Field Studies (3, 3) Supervised work experience with county extension agents in a designated county. Prereq: 3110, and permission of instructor. Residence training on a campus for a specified time.

5000 Thesis

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

5100 Special Problems in Agricultural Extension (1-6) May be repeated. Maximum 9 hrs.

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

5220 Seminar (3) Review of literature and developments in agricultural extension methods. 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 and to determine progress of clientele. Prereq: 5100 or consent of instructor.

5310 History, Philosophy and Objectives (3) Historical and philosophical foundation of informal Adult Education in American Agriculture from the Agricultural Societies (1785 to present) with attention to key figures, issues, legislative movements, farmer organizations and programs. Emphasis on Agricultural Extension Service, its origin, legislation and growth and the nature of present day objectives and programs. Prereq: 3110 or consent of instructor.

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

5330 Supervision of Agricultural Extension Programs and Personnel (3) Theories of human effectiveness; principles of successful supervision applied to various parts of county, district and other extension programs; and planning for effective office management. Prereq: 5210 or 5220 or consent of instructor.
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growth, parturition and initiation of lactation; endocrine regulation of reproductive phenomena. Prereq: Zoology 3210 or consent of instructor. 2 hrs and 1 lab. (Same as Zoology 3220.)

3230 Animal Nutrition (3) Properties, functions, utilization and deficiency symptoms of essential nutrients; value determinations and their use. Prereq: Animal Science for Agriculture and one quarter of organic chemistry. 3 hrs and 1 lab.

3330 Feeds and Ration Formulation (3) Feedstuffs, additives, feeding standards; nutrient requirements and ration formulation for beef and dairy cattle, swine, poultry, and laboratory animals. Prereq: 3320. 2 hrs and 1 lab.

3410 Heredity in Animals (3) Basic chromosomal mechanism of heredity with emphasis on Mendelian principles and exceptions to these such as linkage and cytoplasmic inheritance. Introduction to the biochemical basis of heredity and to quantitative inheritance. Illustrations of principles with examples in species with which students in agriculture are familiar. Prereq: Animal Science for Agriculture. 2 hrs and 1 lab.

3420 Principles of Animal Breeding (3) Genetic principles of breeding, of economically important species. Genetic basis of variation. Partitioning of variation according to various kinds of characters: multiple and binary measurements; environment. Selection and its consequences. Mating systems and their effects on populations. Prereq: 3410 or equivalent. 2 hrs and 1 lab.

3510 Animal Hygiene and Sanitation (4) Parasitic, viral and bacterial organisms in farm animals; immunization; control and protection against disease; veterinary regulations and quarantine; herd health programs. Prereq: General Microbiology or consent of instructor. 3 hrs and 1 lab.

3520 Avian Diseases (3) Major avian diseases; characteristics, prevention and treatment; management practices and systems for domestic birds, upland game birds and water fowl. 2 hrs and 1 lab.

3810 Nutrition and Management of Laboratory Animals (3) Principles of feeding, breeding and handling of animals in scientific investigations; specific species' requirements, peculiarities and research for which best fitted; laws governing use and handling of laboratory animals. Prereq: Principles of Animal Nutrition and Physiology and Laboratory animals. 3 hrs and 1 lab.

4210 Physiology of Lactation (3) Development, anatomy, and function of mammary glands; enzymatic conversions for mammary development and milk secretion; factors affecting yield and composition of milk. Prereq: 3210.

4220 Avian Physiology (3) Anatomy and physiology of avian species with emphasis on poultry. Prereq: 3210. 2 hrs and 1 lab.

4230 Applied Reproduction in Farm Animals (3) Methods and techniques in collecting, evaluating, processing and preserving semen; insemination of females; pregnancy determinations; gestation and parturition. Male and female infertility. Prereq: 3220. 1 hr and 2 labs.

4310 Feeding Systems for Ruminants and Horses (3) Nutrition and feeding principles in the management of these two important species. Feeding systems used during the life cycle of cattle, horses and sheep. Prereq: 3330. 2 hrs and 1 lab.

4320 Feeding Systems for Poultry and Swine (3) Principles and the application of systems used in the comparison of feeding systems utilized during the life cycle of poultry and swine. Laboratory feeding trials. Prereq: Animal Science for Agriculture or consent of instructor. 3 hrs and 1 lab.

4410 Applied Animal Breeding (3) The principles studied in 3420 (breeding of important classes and species). Team taught by specialists in the 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. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production response and economic returns. 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 will include the structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production responses and economic returns. 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 marketing in a complete pork production and management program. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production responses and economic returns. 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) Structure of the poultry industry, organization and management of poultry enterprises including rearing, housing, feeding, processing and marketing. 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) Integration of principles of nutrition, physiology and breeding into a light horse management program. Structure of the industry; systems of production and production practices; individual animal and herd improvement programs; tack, equipment and facilities for both pleasure owners and commercial producers. Alternatives will be evaluated in terms of production response and economic returns. 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) Integration of the principles of selection, nutrition, breeding, physiology and marketing of sheep and lambs into a complete production and management program. Structure of the industry, enterprise establishment, systems of production responses and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab.

5000 Thesis

5011 Problems in Lieu of Thesis (1-6) May be repeated. Maximum 6 hrs.

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

5210 Endocrine Relations in Animal Production (4) Endocrine glands related to growth and reproduction: hormone preparation for altering growth and reproductive rate of farm animals. Prereq: 3210 or consent of instructor. 2 hrs and 1 lab.

5230 Advances in Mammalian Reproduction (3) Control of ovulation, transport, metabolism, and preservation; fertilization and embryonic mortality. Prereq: 3220 or 4230. 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: 4210. 1 hr and 1 lab.

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

5321 Energy in Animal Nutrition (4) Energy sources in animal feeds; carbohydrate and lipid compounds; nutritional functions, metabolism, evaluation and requirements. Prereq: 3320 or consent of instructor. 3 hrs and 1 lab.

5331 Proteins in Animal Nutrition (3) Proteins in feeds, amino acids and non-protein nitrogenous compounds, nutritional functions, metabolism, evaluation and requirements. Prereq: 3320 or consent of instructor.

5341 Vitamins and Minerals in Animal Nutrition (3) Nomenclature, history, identification, chemical properties, mode of action, determination, nutritional deficiency syndromes, sources and requirements. Prereq: 3320 or consent of instructor.

5410 Genetics of Animal Populations (3) The population and the individual, genes and zygotic frequency of certain species of populations; forces influencing genetic changes; application to animal breeding. Prereq: 3240 or consent of instructor. 2 hrs and 1 lab.

5710 Methods of Evaluating Experimental Data in Animal Science. May be repeated. May be applied to data from experiments in animal science based upon such statistical procedures as analysis of variance, covariance, linear regression and correlation, and multiple regression. Prereq: Statistics 5211 or equivalent. 2 hrs and 1 lab.

5720 Design and Interpretation of Experiments in Animal Science. Principles of experimental design and their 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


6160 Topics in Dairy Microbiology (3) Microbiological problems related to various phases of the dairy industry and the proper use of computers in statistical analyses. Prereq: Consent of instructor. 2 hrs and 1 lab.

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

6229 Environmental Physiology of Farm Animals (3) Environmental factors and their measurement; physiological mechanisms of response to environmental factors and their measurement; interrelationships of animals and environment in terms of productivity and health. Prereq: Consent of Instructor. 2 hrs and 1 lab.

6320 Animal Growth and Development (3) Physiological and nutritional aspects of growth of farm animals, growth and reproductive rate of farm animals. Prereq: 5321 and 5331 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.

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

MAJOR DEGREE
Food Technology and Science M.S.

Professors:
J. T. Miles (Head), Ph.D. Wisconsin; W. W. Overcast, Ph.D. Iowa State.

Associate Professors:
J. L. Collins, Ph.D. Maryland; B. J. DeMott, Ph.D. Michigan State; H. O. Jaynes, Ph.D. Illinois; C. C. Melton, Ph.D. Kansas State.

Assistant Professors:
S. L. Melton, Ph.D. Tennessee; M. J. Riemann, Ph.D. Kansas State.

3200 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. Prereq: General Chemistry. 3 hrs and 1 lab.

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

3840 Meat Science (3) Processing methods, carcass characteristics of meat animals; slaughter, cutting, selection, curing, freezing and cooking. 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: 3020. 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 Food Analysis 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: Food Analysis or equivalent.

4410 Food Crop Products (3) Food products from crops with emphasis on types, manufacturing systems, quality attributes and utility.

4810 Microbiology in Food Manufacturing (3) Relationship of growth of common food microorganisms in fermentative and enzymatic changes occurring during processing and manufacturing of foods. Prereq: General Microbiology or equivalent. 1 hr and 2 labs.

4820 Fermented Foods (3) Role of microorganisms in preparing foods with emphasis on development of certain desirable characteristics, flavor, aroma, texture, and keeping quality. Prereq: Food Microbiology. 2 hrs and 1 lab.

4840 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 2 labs.

5000 Thesis

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

5120 Food Color (3) Chemistry of natural food pigments and their measurement, notation, and preservation in food. Prereq: Food Analysis. 2 hrs and 1 lab.

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

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

5150 Fats and Oils (3) The application of least squares adjustment of data; the partitioning of variance; phenolic, and environmental correlations; repeatability; heritability; and selection indexes. Prereq: 5410 and 5710.

5200 Research (1-5) Research in selected areas. Credit for non-forestry majors only. Prereq: 5410 or Microbiology 3810. 3 labs.

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

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

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 the conversion of muscle to meat and the ultimate influence on the quality and composition; meat packaging, preservation, and quality control. Prereq: 3840. 2 hrs and 1 lab.

5520 Microorganisms Common in Food Products (3) Identification of desirable and undesirable microorganisms in foods and their relationship to manufacturing operations. Isolation and characterization of microorganisms from fermentation 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

MAJORS DEGREES
Wildlife and Fisheries Science M.S.

Professors:
J. W. Barrett (Head), Ph.D. Syracuse; H. A. Core, Ph.D. Syracuse; E. Thor, Ph.D. North Carolina State; F. W. Woods, Ph.D. Tennessee.

Associate Professors:

Assistant Professor:
B. L. Dearden, Ph.D. Colorado 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) Classification, nomenclature, identification, and distribution of the more common woody angiosperms native to North America: native ranges, 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 botany or botany. 2 hrs and 1 lab.

3110 Forest Measurements and Biomometry (4) Measurements of individuals in animal and plant populations; linear regression; sampling of forest populations; growth and potential production. Prereq: Plant and Soil Science 3910 and Computer Programming, business-oriented 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 decision making in private and public sectors. Prereq: Principles of Economics.

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

3230 Wildlife Management (3) Important game species in the U.S.; factors influencing wildlife populations; same as Wildlife and Fisheries Science 3230.
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 General Ecology; 3040; Soils.

3730 Conservation (3) Forest resources of the 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—sawmills, tree-timber grading; pulpwood operations, flooring plants, treating plants; plant layout, flow diagrams. Prereq: 3120.

4003 Field Methods of Timber Inventory (4) Field measurements of forest trees; timber cruising; determining appropriate sample design for specific purposes; tree and stand growth; site evaluation; field problems. Prereq: 3110.

4004 Forest Practice (3) Management of forest lands by public and private organizations; the "multiple-use" concept as it influences management decisions; impact of public pressure for timber production on management decisions; management prescriptions. Prereq: 4006. S/NC only.

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: 4002, 4003.

4020 Forest Watershed Management (5) Water as a forest resource; role of forests in the hydrologic cycle; control of water quantity, quality, and regimen; watershed planning. Prereq: 4020 or consent of instructor. Two overnight field trips.

4210 Forestry Organization and Administration (3) Forestry organization; planning concepts and types of plans; administration; decision-making in forest-resource management. Prereq: Junior Field Session for majors in forest resources management or senior standing for majors in the recreation option and wildlife and fisheries science.

4220 Forest-Resource Management (4) The forest as a resource; role of forests in the hydrologic cycle; control of water quantity, quality, and regimen; watershed planning. Prereq: 4210 or consent of instructor. Two overnight field trips.

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, water-shed services, and wildlife; producing multiple services; preparation of a complete plan based on optimizing forest uses. Prereq: 4210. 1 lab.

4330 Forest Policy (3) The history of forestry in the United States with emphasis on the development of forest resource policies; current policies influencing the development and management of forest resources; brief survey of the policy implications of forest resource organizations in the public and private sectors. Prereq: 4004.

4340 Aerial Photography in Forest-Resource Management (3) Use of conventional aerial photographs in forest-resource management; interpretation and use of aerial photographs, preparation of cover-type maps; use of other remotely sensed imagery. Prereq: Civil Engr. 4210 and Forestry 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 tree cytology and population genetics of a natural forest source; variation, selection of superior genotypes and development of seed orchards; hybridization; seed production and seed certification. Prereq: 4006. 2 hrs and 1 lab.

4430 Regional Silviculture of the United States (3) Factors that influence the silviculture management of the important tree species in North America. Impact of the history of the forestry profession on the region; a region; physiology, geology, soils, climate, and weather; sites and sites, types, ecology, problems in detection, and silvicultural characteristics of the more important species. Prereq: 4006 and 4210.

4440 Forest Recreation (3) Forest lands as a recreation resource; the interrelationships of forest recreation and other management activities; development and management of forest recreation areas; the socio-economic and political determinants of recreation development and management. Prereq: 6 credits in sociology and/or economics. 2 hrs and 1 lab.

5000 Thesis

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

5220 Seminar in Forest Tree Biology (3) Growth, reproduction, and physiology of forest trees; forest ecology; variability and taxonomy of forest trees. Prereq: 3330 or Botany 4310.

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

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

5250 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development on forests and associated lands; analysis and critique of specific contemporary plans. 2 hrs and 1 lab. Overnight field trips may be required.

5260 Industrial Forestry (3) Structure and analysis of forest industries; management principles of seed orchards. Prereq: 4230 or consent of instructor.

5270 Topics in Forest Industries Management (3) Current problems in industrial forestry are discussed and analyzed. Forestry executives from the public and private business sector (concerned with forest industry) are invited to conduct classes in selected topics. Prereq: 4230 or consent of instructor.

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

Wildlife and Fisheries Science

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

4450 Game Mammals (4) The classification, identification, distribution, natural history, and management principles of game mammals in North America. Prereq: 3230 or 1 year of zoology. 2 hrs and 2 labs.

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

4460 Game Birds (4) The biology, classification, identification, distribution, and management of game birds in North America. Prereq: 3230 or 1 year of zoology. 2 hrs and 2 labs.

4510 Freshwater Fishery Biology (4) Principles and methods of fish population dynamics; sampling techniques and equipment; warm- and cold-water environments as commercial and sport fisheries. Prereq: 1 yr. biology and 8 hrs. mathematics 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 fishes; 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 9 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, 4460, and 4470 or consent of instructor. May be repeated. Maximum 6 hrs.

**Ornamental Horticulture and Landscape Design**

MAJOR DEGREE

Ornamental Horticulture and Landscape Design

Professor: D. B. Williams (Head), Ph.D. Pennsylvania State.


Assistant Professors: J. W. Day, Ph.D. Mississippi State; G. L. McDaniell, Ph.D. Iowa State.

3030 Plant Propagation (3) Physiology, morphogenesis, and environmental requirements for propagation. Prereq: 8 hrs of biological science. 3 hrs and 1 lab.

3110 Greenhouse Management (3) Factors involved in management of greenhouses for pro-
duction and research. Structures, soils, pest control measures, heating, ventilating, lighting, water supply, crop succession. Prereq: Consent of instructor. 2 hrs and 1 lab.

4120 Landscape Design (4) Design and development of properties; planning, organizing, selecting, layout, and management of public gardens; use pressure modification and maintenance of park and recreation facilities. Resource management and performance analysis; Department of Natural Resources. 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, analysis of contemporary trends and objectives, projected needs and development of plans. Prereq: 4120 or equivalent. 2 hrs and 2 labs.

4150 Wholesale Nursery Management (3) Production, labor and sales management; location, layout, culture, equipment and facilities. Prereq: 3030 or equivalent. 2 hrs and 1 lab.

4160 Retail Nursery Management (3) Essentials of good nursery management: location, layout and operation of landscape nurseries, garden centers and chain store outlets. 2 hrs and 1 lab.

4180 Park Design (4) Design criteria for parks and outdoor recreation systems. Park site selection, analysis, planning and management as related to soils and natural and cultural resources. Evaluation of aesthetic and functional quality of parks and their impact on environmental quality of rural and suburban communities. Prereq: 4120. Recommended: 4140. 2 hrs and 2 labs.

4210 Advanced Turfgrass Management (4) Principles and scientific basis of turfgrass culture; adaptation, ecology, physiology, soil fertility and grass nutrition; climatic influences on grass culture; physiology of clipping and water management; traffic affects and compaction and the physiological influences of pest infestations and control measures. Prereq: Turfgrass Management. 3 hrs and 1 lab.

4310 Floriculture I (3) Principles and practices employed in producing cut flower crops. Application of principles of plant physiology as they control flowering, plant quality, and harvesting schedules. Prereq: Greenhouse Management, Crop Physiology, or equivalent. 2 hrs and 1 lab.

4320 Floriculture II (3) Principles and practices employed in producing horticultural crops in pots and other containers. Analysis of problems associated with growing plants in a very restricted soil volume under controlled greenhouse conditions. Prereq: Greenhouse Management, Crop Physiology, or equivalent. 2 hrs and 1 lab.

4400 Individual Problem Study (1-5) May be repeated. Maximum 10 hrs.

5000 Thesis

5011-21 Special Problems in Lieu of Thesis (3-5, 3-5)

5100 Special Problems in Ornamental Horticulture and Landscape Design (3) May be repeated. Maximum 9 hrs.

5210 Golf Course Design, Development, and Management (4) Principles and applications in design, development, and management of a golf course, including classification and utilization of grass varieties and other plant materials and development of specifications for their nutritional, chemical, and mechanical maintenance. Financing, equipment, and labor management; and public relations. Prereq: 4210 and consent of instructor. 2 hrs and 2 labs.

5310 Park and Public Grounds Management Systems (4) Design criteria affecting management systems requirements. Protection and cultural care of trees, shrubs, and turf in parks and public grounds; use pressure modification and maintenance of park and recreation facilities. Resource management and performance analysis. Department of Natural Resources. Prereq: Consent of instructor. 2 hrs and 2 labs.
5250 Pedology (4) Factors and processes of formation as related to the physical, chemical, and mineralogical properties of soils; soil in an ecosystem; classification of soils. Prereq: 4320 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: 3610 or equivalent.

5340 Soil Physics (3) Chemical and physical relationships among the solid, liquid, and gaseous phases of the soil mass; their 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 their physiochemical reactions, ion exchange, Donnan equilibrium, double layer theory. Prereq: 4110; Chemistry 4110 or concurrent registration.

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

5710 Advanced Plant Genetics (3) Importance of polyploidy in plants; detailed study of genome relationships, genetic recombination, mutation, heterosis, quantitative inheritance, heritability selection and self-incompatibility systems in relation to genetic principles. Prereq: Basic Genetics or consent of instructor.

5720 Quantitative Genetics (3) The genetic constitution of population and changes in gene frequency; recognition and measurement of continuous variation; estimation of variable components and genetic advance under different breeding procedures. Prereq: Basic Genetics or consent of instructor.

5750 Advanced Plant Breeding (4) Historical development of plant breeding concepts and methods, effects of heterosis, inbreeding, hybridization and selection. Improvement of self and cross pollinated crops. Prereq: 5710. 3 hrs and 1 lab.

5810 Crop Climatology (4) Meteorological factors affecting crop plants; crop distribution and centers of origin; general and specific climatic, weather, and vegetative systems; microclimatic influences on plant growth. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

5820 Advanced Crop Physiology and Ecology (4) Historical development of research in crop physiology and ecology. Interrelationships between physiologic processes and environmental factors. Crop adaptation to specific environmental conditions. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

5850 Mechanisms of Herbicide Action (3) Principles of the uptake, translocation, mode of action and basis of selectivity of herbicides. The effects of herbicides on plant morphology, metabolic systems and enzymatic activities will be discussed. Prereq: Botany 3210 and Biochemistry 4110 or consent of instructor.

6000 Doctoral Research and Dissertation

6100 Special Topics in Soil Science (3) May be repeated. Maximum 9 hrs.

6200 Special Topics in Plant Breeding (3) May be repeated. Maximum 9 hrs.

6300 Special Topics in Crop Physiology and Ecology (3) May be repeated. Maximum 9 hrs.

6410 Experimental Designs (3) Principles of experimental designs used in agricultural research. Completely randomized, randomized complete block and Latin square designs; the factorial experiment and confounding; lattice designs; and covariance. Prereq: 5310.

6510 Growth Control with Chemicals (3) Character, theories of action and use of auxins, gibberellins, cytokinins and inhibitors. Range of effects on growth. Prereq: Botany 3210 or equivalent. 2 hrs and 1 lab.

6600 Seminar (1) May be repeated. Maximum 3 hrs.
Donald D. Hanson, Dean
William J. Lauer, Assistant Dean

Professors:

Instructor:
J. C. Chen, M.S. Tennessee.

Lecturers:
A. G. Anderson, M.A. Missouri; M. C. Martin.

4025 Accelerated Historical Studies I (4)
Relationship of historical and cultural development of the man-made environment. Concepts of ethics, aesthetics and criticism along with methods of historical research and analysis are introduced as a means of studying the classical tradition of architecture. In addition to the regular lecture series of the first course in Historical Studies, students are required to independently research aspects of study area for presentation to the accelerated seminar supplement.

4026 Accelerated Historical Studies II (4)
Concentrated examination of development of twentieth-century design and architectural theory and products as derivative or counterpoint to examples of historical development. Events occurring in specific time frames of pre-industrial and industrial periods are contextualized to demonstrate potential developments in the emerging post-industrial era. In addition to the regular lecture series of 2005, students are required to independently research aspects of study area for presentation to the accelerated seminar supplement.

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


4739 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 structure. Review of matrix algebra and vectors; development of member stiffness and flexibility matrices; assembly of structure stiffness and flexibility matrices. Prereq: Consent of instructor. (Same as CE 4850 and Engr. Sci. 4850.)

4900 Aspects of Urban Environment (4) Interdisciplinary course in urban problems. Prereq: Consent of instructor. (Same as Political Science 4900, Psychology 4900, Real Estate 4900.) S/N only.

4910 Architectural Photography (4) Use of 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.
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 six advanced degrees: the Doctor of Business Administration, the Doctor of Philosophy in Economics and in Management Science, the Master of Arts in Business Administration and the Master of Business Administration. Also, the Department of Industrial and Personnel 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 Psychology degrees. (See page 100.)

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.

There is no thesis requirement although ample opportunity is provided for research and writing in course work. Students may begin the program in any of the four quarters of the academic year; however, sequencing of courses is such that entry in the summer or fall terms may be advantageous.

The MBA student may select an area of concentration from the following fields:
- Accounting
- Economics
- Finance
- Forest Industries
- Management
- Governmental
- Financial
- Administration
- Industrial
- Management

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 M.B.A. 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.

34
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 69.

Quarter Hours
Acctg. 5050-60 Financial Accounting. 6
Bus. Law 5050 Legal Environment of Management Science. 3
Econ. 5050-60 Economic Analysis, Problems and Policies. 6
Fin. 5050 Survey of Finance
Functions of Business. 3
Ind. Mgt. 5050 Production Management. 3
Mktg. 5050 Survey of Marketing. 3
Off. Admin. 5510 Data Processing in Business. 3

Group B—Core for all Candidates.
Acctg. 5810, Accounting for Control. 3
Econ. 5070-80, The Firm and its Environment. 6
Fin. 5110 Theory of Financial Management. 3
Ind. Mgt. 5230, Human Problems in Administration. 3
Mktg. 5200, Marketing Management. 3
Stat. 5311, Probability Theory. 3
Quantitative Option (select one): Mgt. Sci. 5100, Introduction to Management Science. 3
or
Stat. 5312, Statistical Methods. 3
Bus. Adm. 5310, Business Policy. 3
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—Electives. (All double concentration programs should be coordinated through the Graduate Programs Office of the College of Business Administration.)

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. Graduate students are eligible for the CPA examination in Tennessee. Area prereq.: Introductory Financial Accounting (6); Introductory Cost Accounting (6); Intermediate Theory (9); and Federal Income Tax (3).

The following areas must be included in the concentration unless taken in under-graduate 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 Masters and Ph.D. programs in this area.) Area prereq.: Intermediate Macro- and Micro-Economic Theory (6).

Any combination of 12-18 quarter hours of economics courses listed in this catalog as approved by the faculty advisor.

Finance. Area prereq.: Finance 5050 or equivalent; 5110 (core course). A minimum of three courses must be taken in one of the following areas:

Financial Management: 5120, 5130, 5140, 5620, 5600, 5990
Investments: 5420, 5430, 5810
Monetary and Fiscal Policy: 5210, 5220, 5320, 5810, 5820, 5830

Forest Industries Management. Area prereq.: B.S. degree in forestry, or equivalent.

Organization, planning and control: Ind. Mgt. 5110, 5120, 5130
Ind. Mgt. Forestry: Forestry 5260

Group D—Electives. Unless the student elects two areas of concentration, a minimum of six but not in excess of 12 quarter hours of graduate level course work may be taken in any of the colleges of the University subject to approval of the student’s faculty advisor.

Total, Group D. 6-12

Total Program (except Group A). 51

Other Requirements. The application for Admission to Candidacy (see p. 18) 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 concentration area(s) 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.

Joint J.D.-M.B.A. Program

The College of Business Administration and the College of Law offer a coordinated joint program leading to the conferment of
Admissions. Applicants for the J.D.-M.B.A. 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 M.B.A. degree, and by the Joint Degree Committees. Application may be made at any time prior to, or after, matriculation in either college, but prior to completion of the second year of law school (84 quarter hours), and prior to entry into the last 24 quarter hours of the M.B.A. program.

Curriculum. A joint program candidate must satisfy the graduation requirements of each college. The student withdrawing from the joint 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 joint 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. Three of the 12 quarter hours must be earned in Accounting 5810 or a more advanced accounting course. If College of Law credit is given for such an accounting course, the joint program student may not receive College of Law credit for Legal Accounting (Law College Course 6590).

The College of Business Administration will award credit toward the M.B.A. degree for acceptable performance in a maximum of 12 quarter hours of approved graduate level courses offered by the College of Business Law. Except while completing the first year courses in the College of Law, students are encouraged to maximize the integrative facets of the joint 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 either 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 M.B.A. degree.

The DBA Program
The basic objective of the Doctor of Business Administration program is to provide the student an 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 area. Moreover, the student's educational experience should develop perspective toward education in business in a manner that will enable the student to contribute to the advancement of the state of knowledge in this area. 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 socio-economic systems and environmental forces. Second, the student's program is flexible enough to respond to individual needs and interests yet formulated within a sound framework so as to achieve overall objectives. Third, emphasis is placed upon conceptual foundations and analysis of decision-making processes rather than the descriptive aspects of business administration. Fourth, the student does work in advanced economic theory and in both the behavioral and quantitative sciences coupled with an in-depth assessment of one of the three areas.

Program Framework. Program prerequisites include at least one year of college mathematics to include college algebra, matrix algebra, calculus of a single variable and partial differentiation; knowledge of computer programming (FORTRAN); Intermediate economic theory; and introductory courses in financial accounting, financial management, marketing management, operations (production) management and the legal environment of business. Entering students deficient in any of these prerequisite areas may enroll in courses especially designed to meet these requirements. Previously completed graduate courses will be evaluated against DBA program requirements and where equivalence is found, credit will be allowed. Each student's program consists of three major segments:

I. Course Work
A. CORE FOR ALL STUDENTS. The courses listed below provide a graduate level foundation in the key decision-making, or functional, areas of business coupled with a study of economic theory, behavioral science and quantitative analysis.

<table>
<thead>
<tr>
<th>Quarter Hours</th>
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<tbody>
<tr>
<td>Acct. 5810 Accounting for Control</td>
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<tr>
<td>Acct. 5820 Corp. Reporting Prob.</td>
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<tr>
<td>Economic Theory Option</td>
</tr>
<tr>
<td>Econ. 5111-12 Microecon. Theory (3,3)</td>
</tr>
<tr>
<td>Econ. 5121 Macroecon. Theory (3)</td>
</tr>
<tr>
<td>Econ. 5111 Microecon. Theory (3)</td>
</tr>
<tr>
<td>Econ. 5121-22 Macroecon. Theory (3,3)</td>
</tr>
<tr>
<td>Fin. 5110 Theory of Financial Mgt.</td>
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<tr>
<td>Ind. Mgt. 5110 Organizational Theory</td>
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<tr>
<td>Ind. Mgt. 5610-20 Organizational Behavior</td>
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<tr>
<td>Mkgt. 5200 Marketing Management</td>
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<td>Mgt. Sci. 5100 Mgt. Science Techniques</td>
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<tr>
<td>Stat. 5311 Probability Theory</td>
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<tr>
<td>Stat. 5312 Statistical Methods</td>
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<tr>
<td>Trans. 5210 Business Logistics</td>
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<tr>
<td>Total Core</td>
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</tbody>
</table>

The above requirements may be satisfied by completing course work at this or another accredited institution or by passing proficiency examinations in certain of the areas. These courses may be taken concurrently with courses required under B, C, D, and E below.

B. CONCENTRATION AREA. This is the focal point of the program and the area in which the student expects to do his/her research and dissertation. A minimum of 12 quarter hours (including at least 9 quarter hours of doctoral-level work taken at The University of Tennessee, Knoxville) is taken in one of the following areas: Accounting, Finance, Management, Marketing, Transportation and Logistics.

C. SUPPORTING AREA (minimum of 12 quarter hours). The purpose of this work is to expand the student's understanding of business beyond the area of concentration and to complement the dissertation research effort. The chosen area should have a clear relationship to the concentration and serve to strengthen the student's overall capacity to do scholarly work in specific areas of research interest within his/her concentration. The area may be selected from those offered within the College of Business Administration or in other fields within the University, including but not limited to mathematics, engineering, communications, public administration and political science, history, philosophy, psychology, sociology, law, and other relevant areas.
D. OPTIONAL AREA (Minimum of 12 quarter hours). The student has the option of choosing either behavioral science, economics, or quantitative methods as an area in which to gain proficiency beyond work completed in the core. Requirements for this area are as follows:

<table>
<thead>
<tr>
<th>Area</th>
<th>Quarter Hours</th>
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<tbody>
<tr>
<td>Behavioral Science</td>
<td>2</td>
</tr>
<tr>
<td>Electives in Behavioral</td>
<td>6</td>
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<tr>
<td>Science (6000 level)</td>
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<tr>
<td>Economics: A field in</td>
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<td>economics to be chosen</td>
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<td>from advanced economic</td>
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<td>theory, econometrics, or</td>
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<td>monetary economics to be</td>
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<td>approved by the student's</td>
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<td>academic committee.</td>
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<tr>
<td>Quantitative Methods.</td>
<td>12</td>
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</table>

E. RESEARCH METHODS AND ACADEMIC PRACTICUM (minimum of six quarter hours). The objective of work in this area is to develop the student's capabilities in research and university level teaching methods and techniques.

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<thead>
<tr>
<th>Area</th>
<th>Quarter Hours</th>
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<tbody>
<tr>
<td>Business Adm. 6900 Res.</td>
<td>3</td>
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<tr>
<td>Meth. in Business</td>
<td></td>
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<tr>
<td>Business Adm. 5900</td>
<td>3</td>
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<tr>
<td>Academic Practicum</td>
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</tbody>
</table>

II. Admission to Candidacy. A student may apply for Admission to Candidacy for the MBA degree with a cumulative grade point average of at least a B average in course work, successful completion of preliminary examinations in the concentration area, supporting area and option area, and acceptance of his/her research proposal for the dissertation.

III. Research and Dissertation (minimum of 30 quarter hours). The purpose of this segment is to provide the candidate with a research experience that meets the general standards of the profession. The dissertation is supervised by the candidate's faculty committee, who must certify its completion and acceptability after the candidate's oral defense of his/her research effort.

Minimum Academic Performance Standards

A graduate student in the College of Business Administration must achieve a cumulative 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 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 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) 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 score a minimum of 500 on the GMAT and meet the quantitative methods prerequisites stated in the program description.

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 socio-economic information. The faculty of the College in seeking funding for research projects. Staff members conduct research in regional economics, public finance, and areas related to socio-economic 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 governmental organizations and private industry. The Center publishes periodically the *Tennessee Statistical Abstract* and bi-monthly the *Survey of Business*. The Center is a member of the Association for University Business and Economic Research.

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 increasingly 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 32 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 deep 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.

Departments of Instruction

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

Accounting and Business Law

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

ACCOUNTING

Professors:
N. E. Dittrich, Ph.D. Ohio State, C.P.A.;
R. W. Metcalf (visiting), D.B.A. Indiana, C.P.A.

Associate Professors:
J. E. Nigter, Ph.D. Missouri, C.P.A.;
G. E. Nichols, Ph.D. Louisiana State, C.P.A.;
I. A. Posey, M.S. Tennessee, C.P.A.;
W. L. Single, M.S. Tennessee, C.P.A.;
R. L. Townsend, Ph.D. Texas, C.P.A.;
F. W. Watkins, Ph.D. Louisiana State, C.P.A.

Assistant Professors:
H. C. Herring, III, Ph.D. Alabama, C.P.A.;
F. A. Jacobs, Ph.D. Georgia, C.P.A.;
M. C. Letsinger, M.S. Tennessee, C.P.A.

4120 Advanced Auditing (3) Legal and professional responsibilities of the auditor, evaluation of internal control, utilization of EDI and statistical techniques in auditing, and auditing reports. Prereq: 4110 with C or better.


4960 Individual Research in Accounting (3) Special projects undertaken by majors in accounting under the direction of faculty members of professional rank. Prereq: Intermediate Accounting with C or better.

4990 Senior Seminar (3) Advanced problems in the financial accounting area are analyzed and discussed by students. Prereq: Intermediate Accounting with C or better.

5000 Thesis

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during a 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.

5050-60 Introduction to Financial Accounting (3, 3) Classification and presentation of financial data, basic accounting concepts underlying asset valuation and income measurement, interpretation of financial statements. (Available only as stated on page 35.)

5110 Seminar in Accounting Theory (3) Accounting postulates, principles, and procedures. Concepts of value as they relate to the measurement of performance and position. Prereq: Three quarters or two semesters of Intermediate Accounting.

5120 Seminar in Advanced Auditing (3) Standards and procedures in auditing, and special investigations; audit reports and reports filed with the S.E.C. Auditing EDP systems and use of statistical sampling are emphasized. Prereq: A course in auditing concepts or equivalent.

5130 Seminar in Current Accounting Topics (3) Current controversial issues in financial accounting. Prereq: three quarters or two semesters of Intermediate Accounting.

5210 Seminar in Advanced Cost Accounting (3) Direct costing, return on investment, capital budgeting, cash-flow analysis, distribution costs, cost justification under the Robinson-Patman Act, and others. Prereq: Second quarter of Introductory Cost Accounting or equivalent.

5310 Auditing Concepts (3) Concepts and theory of auditing, the environment of internal and external auditing, nature of evidence, internal control evaluation, and reporting. Not intended for persons who have credit for an auditing course. Prereq: Intermediate Accounting, and prereq or coreq: Statistical Sampling and 5630 or equivalent.


5340 Consolidations and Business Combinations (3) Theoretical and practical aspects of accounting for interrelated business entities—domestic and foreign. Not intended for persons who have credit for a course with similar content. Prereq: Intermediate Accounting.

5420 Seminar in Advanced Taxation (3) Income determination, tax planning organization of the Internal Revenue Service, administrative settlements in tax disputes. Prereq: A course in advanced income tax.

5510 Governmental Accounting (3) Theory and practice of governmental and fund accounting, financial reports, measures of output and accomplishment, and financial performance auditing for governmental and nonprofit organizations. Not more than 9 hrs of accounting and consent of instructor.

5520 Accounting Systems and EDP Concepts and Control (3) Elements and operation of a computer in a business environment. The analysis, design, implementation, documentation, and control of accounting systems. Prereq: Introductory Cost Accounting and knowledge of a computer programming language.

5540 Seminar in Management Information Systems (3) Survey of the literature on business information systems and advanced systems analysis and design concepts. The information needs of all functional areas and the interfacing of these areas will be considered. Prereq: 5630 and consent of instructor.

5610 Accounting for Control (3) Funds statements, analysis of financial statements, budgets, responsibility accounting, impact of income taxes, cost and profit control and other techniques on management accounting. May not be taken for credit by students whose undergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5050-60 or equivalent.

5820 Corporate Reporting Problems (3) A user-oriented analysis of corporate current and future financial reporting problems and issues. May not be taken for credit by students whose unde-

Assistant Professors: N. G. Adler, M.A. Pittsburgh; H. S. Chang, Ph.D. Vanderbilt; S. M. Craghtan, B.A. Arizona; R. J. Gaston, Ph.D. California (Los Angeles); R. D. Gustafy, Ph.D. Syracuse; H. W. Herzog, Ph.D. Maryland; A. M. Schottmann, Ph.D. Washington (St. Louis).

Master's program
The minimum requirements for a graduate major in the Master of Arts and the Master of Science degrees consist of the following: (1) Economics 5111-5112 and Economics 5121-5122, (2) nine additional hours in economics at the 4000 or above level, (3) a thesis, or an additional nine 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 final written comprehensive examination.

The requirements for a graduate minor in Economics are as follows: Either (1) 5111-12 and 5121, or (2) 5111 and 5121-22, or (3) 5111 or 5112, 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 nine hours to meet unusual conditions.

Master of arts in College Teaching Degree
The requirements for the MAG degree are listed on page 18. A thesis is required.

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 six hours in economic history 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 three additional hours in this area at the 6000 level with an average grade of B or better or by satisfying an examining committee.
   d. Mathematical and quantitative methods in economics, by completing Economics 5180, 5190, and 5510 with the 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.)
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 list and only one of which may be from the first three fields listed:
   a. Advanced economic theory
      Economic theory
      History of economic thought
   b. Econometrics
   c. Economic development
   d. Economics of centrally planned economies
   e. Economics of labor and manpower
   f. Industrial organization
   g. International economics
   h. Regional and urban economics
   i. Agricultural economics
   j. Monetary economics
   k. Public finance and fiscal policy

   Fields, as offered by the department, combining two or three of the above fields (in some cases, a combined field may "count" as two fields).

   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 contents determined by students and instructor with approval of the department.
   5000 Thesis
   5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such student uses departmental facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.
   5011-12 Problems in Lieu of Thesis (3, 3)
   5910-20-30 Economics Seminar (1, 1, 1) Recommended to accompany student initiative. Subject matter and contents determined by students and instructor with approval of the department.
   6000 Doctoral 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. (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, the statistical methods for analyzing business fluctuations, the theoretical explanations of cycles, and the policies that have been proposed to combat them. Prereq: Intermediate Macro Theory or consent of the instructor.
4150 History of Economic Thought (3) A review of the development of economic thought, tools of analysis, and economics as a social science, together with an analysis of the socio-economic conditions which influenced this development. Prereq: 4170 through 1936. Prereq: 1 yr of Principles of Economics and consent of instructor.
4170-80 Introduction to Mathematical Economics (3, 3) Application of mathematical methods in the theoretical study of micro- and macroeconomic phenomena. Designed for beginning graduate students who have limited training in advanced calculus. Must be taken in sequence. Prereq: Intermediate Micro Theory and college algebra, calculus, and analytic geometry or the equivalent.
5050 Introduction to Economic Analysis (3) The nature of economic problems; economics as a science; basic survey of the tools of economics; analytical tools of macro- and microeconomics. (Available only as stated on page 53.)
5060 Introduction to Economic Problems and Policies (3) Economics as a basis for problem solving; tools of public and private policies for economic stability, growth and minimum income, international economic relations and the problems of the developing economies. (Available only as stated on page 53.)
5070-80 The Firm and Its Environment (3, 3) Macroeconomic environment; economic forecasting; microeconomic environment; organizational analysis; behavioral aspects of imperfect markets; legal aspects of imperfect markets; responsibilities of the businessman. Must be taken in sequence. Prereq: 5050-60.
5111-12 Microeconomic Theory (3, 3) Fundamental theory of price determination in partial and general equilibrium settings, including theories of preferences and consumer behavior, production, short and long-run profit maximization under conditions of perfect and imperfect competition, and demand for factors of production and distribution. Prereq: 4170 and intermediate microeconomic theory or equivalent.
5121-22 Macroeconomic Theory (3, 3) Determination of the levels of employment and prices for the economy as a whole, focusing on the relationships between interest rates, price expectations, productivity, and the quantity of money, on the one hand, and aggregate saving, investment, and liquidity preference on the other. Prereq: Intermediate economic theory or equivalent.
5160 History of Economic Thought (3) Development of economic ideas from the mercantilists through Alfred Marshall; emphasis given to the classical and neo-classical tradition.
5180-90 Mathematical Methods in Economics (3, 3) Applications of basic concepts in the differential and integral calculus, difference and differential equations, linear algebra and stochastic models to the application of the theory of the firm, growth models, game theory, linear programming, and decision making under uncertainty. Prereq: 1 yr of calculus.
5510 Quantitative Methods in Economic Research (3) Methods of estimation and testing of economic relationships with the use of time series and cross-section data, with applications to current economic problems. Prereq: Introductory statistics or Statistics 5211 or the equivalent.
5520 Introduction to Econometrics (3) Statistical demand analysis, production and cost analysis, distribution of income and wealth, models of growth and cycles, macroeconomic applications. Should not be taken by students who contemplate taking Economics 6170-80-90.
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.)
6111 Seminar in Advanced Microeconomic Theory (3) Topics in microeconomic theory. May be repeated for credit with permission of the department. Prereq: 5111, 5112 and consent of Instructor.
6121 Seminar in Advanced Macroeconomic Theory (3) Topics in macroeconomic theory. May be repeated for credit with permission of the department. Prereq: 5121, 5122 and consent of the instructor.

6150-90 History of Economic Doctrines (3, 3) Important ideas of economic thinkers from the Middle Ages to the present.

6170-90 Eco-nometric Methods (3, 3, 3) Theory and techniques of statistical testing of economic hypotheses, and construction and estimation of econometric models. Review of the classical least squares regression model, extensions of the least squares regression model, and approaches to simultaneous equation models with application to current economic problems. Prereq: 5180-90 and 5510 or the equivalent.

INTERNATIONAL TRADE AND ECONOMIC DEVELOPMENT

4230 Problems in International Trade and Economic Development (3) Problems or problem areas of current importance in the fields both of international economics and economic development.

4240 Economic Development of the United States (3) Historical developments in agriculture, industry, communications, transportation, banking, and trade and trade changes in government economic policy.

4250 Economic Development of Europe (3) The beginnings of capitalism in medieval Europe, the expansion of Europe and the dominance of mercantilism in early modern times, the mechanization of industry, changes in agricultural organization, and growing importance of commerce in the nineteenth century; two world wars and their economic consequences.

4260 Economics of Resources (3) Description, needs and allocation of resources. Benefits and costs of development and use of resources in industrial society.

5210 Seminar in International Trade Theory (3) Studies in pure theory of international trade.

5220 Seminar in Economic Development (3) Study of the economic problems of developing countries.

5250 Economic History of Europe (3) Studies of the nature and functioning of economic systems and policies in the history of western civilization; examination of some major issues of method and interpretation.

5260 Economic History of the U.S. (3) Studies of major issues in the interpretation of American economic structure and policies from colonial times.

5610 Location and Regional Development Theory (3) Theory of industrial, agricultural, and residential location; the economic basis for land use patterns; shift and shatter analyses; economic base studies, and regional input-output, linear programming, and econometric models.

6211-12, 6221-22 Seminar in International Economics (3, 3, 3, 3) Theory of specialization and trade. The balance of payments, exchange rates, monetary problems, capital movements, and foreign trade policy.

6231-32, 6241-42 Seminar in Economic Development (3, 3, 3) Development and application of analytical tools to problems of economic policy faced by developing regions and countries.

6250 Seminar in European Economic History (3) Selected topics in European economic history. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

6260 Seminar in American Economic History (3) Selected topics in American economic history. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

6270 Seminar in the Economic History of the Third World (3) Selected topics in the economic history of societies other than those of Western Europe and English-speaking North America. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

6610 Seminar in Regional Analysis (3) Selected topics in regional economic theory and analysis. May be repeated. Maximum 6 hrs.

6620 Regional Economics Workshop (3) Selected topics in applied regional research. Emphasis on student participation in model design and estimation, forecasting, simulation and mathematical and computer programming. May be repeated. Maximum 6 hrs.

INDUSTRIAL ORGANIZATION

4350 Industrial Organization Analysis (3) Monopoly and competition in the United States economy; market structure, business behavior, and economic performance and their interrelationships. Prereq: 9 hrs of introductory economics.

5240 Seminar in Private Enterprise and Public Policy (3) The structure of contemporary industry, factors in its development, and consequences for business conduct and performance; social control of business through antitrust and other government regulation.

6351-52, 6361-62 Seminar in Industrial Organization (3, 3, 3) 6351-52—Survey of the organization of industry in the American economy, with emphasis on the empirical and analytical techniques used in investigating structure, conduct and performance. 6361-62—Public Policy in the United States with respect to industrial structure and business conduct; examination, appraisal and proposals for change.

ECONOMICS OF CENTRALLY PLANNED ECONOMIES

5310 Economic Systems (3) Study and appraisal of underlying theories and operation of capitalism, socialism, communism, and other economic systems.

5331 Theory and Practice of Economic Planning (3) Leading issues in imperative and indicative planning. Prereq: Consent of instructor. May be repeated with consent of department.

ECONOMICS OF LABOR AND MANPOWER


5410 Seminar in Labor Manpower Economics (3) Intensive examination of the major topics contained in the labor-manpower economics literature. Emphasis on problems, analysis and possible solutions. Prereq: Consent of instructor.

5420 Seminar in Wage and Employment Theory (3) An examination of current and past theories of wage and employment determination. Prereq: 5410, equivalent or consent of instructor.

6411-12, 6421-22 Seminar in Labor Economics (3, 3, 3) Selected labor problems chosen for their current interest of continuing significance—development and application of problems and techniques.

Finance


Associate Professors: A. B. Biscoe, Jr., Ph.D. Florida; R. A. Bohn, Ph.D. Washington; J. C. Gelder, Ph.D. George Washington; W. C. Goosby, Ph.D. Wisconsin (Milwaukee); J. H. Lord, D.B.A. Indiana; R. E. Shires, Ph.D. California (Los Angeles); D. L. Stevens, Ph.D. Michigan State.

Assistant Professors: A. L. Auxier, Ph.D. Iowa; H. S. Banton, M.S. Auburn; D. L. Johnson, Ph.D. Illinois (Champaign-Urbana); R. A. Weir, Ph.D. North Carolina.

5000 Thesis

5003 Non-Thesis Graduation Completion (3) 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.

6000 Doctoral Research and Dissertation

FINANCE AND INVESTMENTS

5050 Survey of Finance Functions in Business (3) The scope and nature of managerial finance: financial analysis, planning and control; financial investment decisions; financial structure and the cost of capital; internal and external long-term financing; and working capital management. Prereq: Principles of economics and fundamentals of financial accounting. (Available only as stated on page 35.)

5110 Theory of Financial Management (3) Financial decision making in the firm with the objective of maximizing shareholder wealth. Decision areas include the investment decision, capital costs and the financing decision, and the dividend decision of the firm. Prereq: Statistics. Probability theory.

5120 Quantitative Techniques in Financial Management (3) An introduction to the applications of mathematics, probability, and statistics in financial models building and testing in finance. Prereq: 5110 and Statistics 5311 or equivalent.

5130 Financial Administration (3) Cases and
readings within the firm; refined techniques of analysis; optimal financing decisions; capital cost measurement; utilization of capital market fundamentals; corporate financial theory. Prereq: 5110.

5140 Seminar: Managerial Finance (3) Applications of theory and quantitative techniques to the solution of current problems in managerial finance. Prereq: 5120 or 5130.

5240-30 Investments (3, 3) The investment decision process; factors influencing portfolio policies and security prices; financial statement analysis; and stock-price valuation models. Must be taken in sequence. Prereq: Economics 5060 or equivalent.


INSURANCE

5110 Theory of Risk Management (3) (For students with no background in risk and insurance, a study of the theory of risk management and of manageable risks facing the individual and the firm. Analysis of risk management techniques with emphasis on insurance as a tool.)

5210 Seminar in Insurance (3) Analysis and discussion of current developments and problems in the fields of life, health, property, liability and social insurance. Emphasis is on vital social issues touching upon the insurance mechanism and philosophy. Prereq: Consent of instructor.

REAL ESTATE AND URBAN DEVELOPMENT

4900 Aspects of Urban Environment (4) An interdisciplinary course in urban problems. Prereq: Consent of instructor. (Same as Architecture 4900, Political Science 4900, Psychology 4900.) S/N only.


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

5130 Housing and Urban Land Markets (3) Analysis of the housing demand and 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 decision making. Case method is utilized. Prereq: 5120 or consent of instructor.

Industrial and Personnel Management

Professors:
A. H. Kealy (Head), M.B.A., Pennsylvania; R. W. Balderston, Ph.D., Stanford; H. W. Henry, Ph.D., Michigan; J. M. Larsen, Ph.D., Purdue; S. K. Reed, Ph.D., Edinburg; S. C. Vance, Ph.D., Pennsylvania; G. H. Whitlock, Ph.D., Tennessee.

Associate Professors:
R. D. Arvey, Ph.D., Minnesota; F. A. Chamblin, M.B.A., Indiana; H. D. Dewhirst, Ph.D., Texas.

1 William B. Stokely, Professor of Management.
2 Alumni Distinctive Service Professor.

GOVERNMENTAL FINANCIAL ADMINISTRATION

5210-20 Public Finance (3, 3) Role of the public sector and the problem of social balance, collective and quas LCollective goods and their financing under alternative tax programs. Must be taken in sequence. Prereq: Economics 5060 or equivalent.


INSURANCE

5110 Theory of Risk Management (3) (For students with no background in risk and insurance, a study of the theory of risk management and of manageable risks facing the individual and the firm. Analysis of risk management techniques with emphasis on insurance as a tool.)

5210 Seminar in Insurance (3) Analysis and discussion of current developments and problems in the fields of life, health, property, liability and social insurance. Emphasis is on vital social issues touching upon the insurance mechanism and philosophy. Prereq: Consent of instructor.

REAL ESTATE AND URBAN DEVELOPMENT

4900 Aspects of Urban Environment (4) An interdisciplinary course in urban problems. Pre- req: Consent of instructor. (Same as Architecture 4900, Political Science 4900, Psychology 4900.) S/N only.


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

5130 Housing and Urban Land Markets (3) Analysis of the housing demand and 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 decision making. Case method is utilized. Prereq: 5120 or consent of instructor.

Industrial and Personnel Management

Professors:
A. H. Kealy (Head), M.B.A., Pennsylvania; R. W. Balderston, Ph.D., Stanford; H. W. Henry, Ph.D., Michigan; J. M. Larsen, Ph.D., Purdue; S. K. Reed, Ph.D., Edinburg; S. C. Vance, Ph.D., Pennsylvania; G. H. Whitlock, Ph.D., Tennessee.

Associate Professors:
R. D. Arvey, Ph.D., Minnesota; F. A. Chamblin, M.B.A., Indiana; H. D. Dewhirst, Ph.D., Texas.

1 William B. Stokely, Professor of Management.
2 Alumni Distinctive Service Professor.

GOVERNMENTAL FINANCIAL ADMINISTRATION

5210-20 Public Finance (3, 3) Role of the public sector and the problem of social balance, collective and quas LCollective goods and their financing under alternative tax programs. Must be taken in sequence. Prereq: Economics 5060 or equivalent.


INSURANCE

5110 Theory of Risk Management (3) (For students with no background in risk and insurance, a study of the theory of risk management and of manageable risks facing the individual and the firm. Analysis of risk management techniques with emphasis on insurance as a tool.)

5210 Seminar in Insurance (3) Analysis and discussion of current developments and problems in the fields of life, health, property, liability and social insurance. Emphasis is on vital social issues touching upon the insurance mechanism and philosophy. Prereq: Consent of instructor.

REAL ESTATE AND URBAN DEVELOPMENT

4900 Aspects of Urban Environment (4) An interdisciplinary course in urban problems. Pre- req: Consent of instructor. (Same as Architecture 4900, Political Science 4900, Psychology 4900.) S/N only.


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

5130 Housing and Urban Land Markets (3) Analysis of the housing demand and 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 decision making. Case method is utilized. Prereq: 5120 or consent of instructor.

Industrial and Personnel Management

Professors:
A. H. Kealy (Head), M.B.A., Pennsylvania; R. W. Balderston, Ph.D., Stanford; H. W. Henry, Ph.D., Michigan; J. M. Larsen, Ph.D., Purdue; S. K. Reed, Ph.D., Edinburg; S. C. Vance, Ph.D., Pennsylvania; G. H. Whitlock, Ph.D., Tennessee.

Associate Professors:
R. D. Arvey, Ph.D., Minnesota; F. A. Chamblin, M.B.A., Indiana; H. D. Dewhirst, Ph.D., Texas.
Management Science

MAJOR DEGREES
Management Science
M.S., Ph.D.

Associate Professors:
C. E. Bell (Chairman), Ph.D. Yale;
R. S. Garfinkel, 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, Industrial Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; D. H. Pikes, Industrial Engineering; C. C. Thigpen, Statistics.

MASTER OF SCIENCE 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 for 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 widespread application of management science technology, 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>Quarter Hours</th>
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<tbody>
<tr>
<td>Management Science 5310-20-30-40</td>
</tr>
<tr>
<td>Applied Concentration Area</td>
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<tr>
<td>Statistics 5110</td>
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<tr>
<td>Statistics elective (5000-level or above)</td>
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<tr>
<td>Mathematics (4000-level or above)</td>
</tr>
<tr>
<td>Electives selected from mathematics, statistics, computer science, and/or management science</td>
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<tr>
<td>Electives in any area approved by advisor</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

A thesis option is available which substitutes nine hours of thesis credit for the following 12 hours of course work: Management Science 5340, one three-hour course in the applied concentration area and six hours of electives in any area. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student's first quarter and must approve all courses on a quarter-by-quarter basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. For example, an undergraduate mathematics major with a strong background may be allowed to take six 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 additional courses to fulfill the six-hour mathematics requirement. The total course load will remain 48 hours for all non-thesis students and 45 hours for all thesis students; however, the number of hours of electives can be reasonably expected to vary between six and 18 as a function of prior background.

MBA CONCENTRATION
Management Science 5310-20-30-30 forms the nucleus of a 12 to 18 hour concentration in Management Science for MBA students. See pages 34-35 for further MBA details.

DOCTORAL PROGRAM
The Ph.D. program in Management Science is designed to prepare students for management positions, research, and teaching related to the application of mathematical tools in the administration of complex systems. Three primary objectives of the program are:

1) to provide, through management science course work, a thorough knowledge of common Management Science/Operations Research mathematical models and their uses;
2) to provide sufficient advanced study in an applied concentration area to qualify the graduate for a joint faculty position in the concentration area as well as in management science. The candidate may choose from the business functional areas (accounting, finance, marketing, production management, and transportation and logistics) or other disciplines, e.g., forestry, ecology, and public administration;
3) to develop in the student, through course work in mathematics, statistics, and computer science, a high degree of mathematical maturity which will serve the graduate well throughout a life-long career, whether in management, research, or teaching.

Degree Requirements. General University requirements for the doctoral degree are stated on page 20.

Course Work. A minimum of 72 quarter hours of course work taken for graduate credit (exclusive of thesis or dissertation) is required. The candidate must complete a minimum of 36 quarter hours at The University of Tennessee, Knoxville, at least nine of which must be at the 6000 level. Entering students who have completed graduate studies in applicable fields will be granted course credits for work which is equivalent to required courses in the program.

The program includes approximately 24 to 30 quarter hours of course work in the applied concentration area.

Qualifying Examinations. The student must demonstrate mastery of probability theory and statistical inference (Statistics 5110-20-30) by passing a written qualifying examination or by presenting other evidence of mastery of the material satisfactory to the faculty.

Mastery of 18 quarter hours in mathematics courses must be demonstrated by passing a written qualifying examination or by presenting other evidence of mastery of the material satisfactory to the faculty. Topics normally include matrix methods (Mathematics/Computer Science 5563-5564) and real analysis (Mathematics 4510-20-30). Other options may be approved.

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 a written preliminary 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 minimum 72 hours of course work, normally is completed in the third year of the program.

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.

5000 Thesis
5002 Non-Thesis Graduation Completion (3) 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 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.


5340 Application of Management Science Methods (3). Application of methods from 5310-20-30 to large-scale management problems. 5350 may be taken concurrently.

5510 Topics in Optimization (3) In-depth study of one of the following: linear programming, dynamic programming, non-linear programming, integer programming, large scale programming, optimization theory (convex analysis, optimality conditions, Lagrangean and other dual approaches). Prereq: Consent of instructor; course prerequisites vary, topic may be repeated. Maximum 9 hrs.

5610 Markovian Decision Models (3) Formula- tion and analysis of Markov Chain models; Markov Chain models which incorporate decision-making application through policy iteration. Stochastic dynamic programming models in continuous time. Prereq: 5350.

5620 Queuing Models (3) Application and mathematical analysis of models of congestion. Basic birth-death process models, other Markovian models; non-Markovian models for systems with general service or arrival patterns, priority customers or other complicating as-
sumptions; queues in series. Prereq: 5330 or Mathematics 4750-60.

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

5910 Management Science Problems (1-3) 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) A semester research practice to enhance the professional development of doctoral students. Includes investigation of existing mathematical models for production processes and opportunities for original research.

5810 Special Topics (3) Prereq: 5310-20-30 and consent of instructor. May be repeated. Maximum 9 hrs.

6910-20-30 Management Science Seminar (1-3, 1-3, 1-3) Subjects selected from current management science literature.

Marketing and Transportation
G. N. Dicer (Head), D.B.A. Indiana

Marketing


5002 Non-Thesis Graduation Completion (3) 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.

5050 Survey of Marketing (3) Analysis of the marketing system and its institutions, functions, and marketing problems. Current trends and developments. (Available only as stated on page 35.)

5200 Marketing Management (3) Management of the basic marketing functions. Case problems and marketing decision simulation. Prereq: 5050 or equivalent.

5220 Promotion Management and Strategy (3) Assessment of communications theories and concepts useful to firms in achieving promotional goals, planning, implementing, and evaluating the firm's promotional program. Social and economic role of persuasive communication. Prereq: 5200 or equivalent.

5300 Analysis and Design of Marketing Systems (3) A macroinstitutional approach to the marketing system. Conceptual framework for examining marketing agency and channel interrelations, public policy, cost and efficiency, and innovation in marketing from the viewpoint of the decision maker. Prereq: 5200 or equivalent.

5500 Marketing Research (3) Investigation and solution of problems; application of research methods to functional areas of marketing. Research concepts, methods, and techniques. Prereq: Statistics 5311 or equivalent and 5200 or equivalent.

5310 Quantitative Techniques in Marketing Analysis (3) An introduction to quantitative techniques to marketing problems. Models for decision making and strategy formulation. Prereq: 5300.

5350 Buyer Behavior Analysis for Marketing (3) Buyer behavior analysis and emphasis on the implications for marketing analysis and executive action. Marketing and the behavioral sciences. Prereq: 5200 or equivalent.

5410 Marketing Strategy (3) Components of marketing strategy and the philosophy underlying the formulation of the marketing mix. Consideration of alternative strategies, coordination and control of marketing activities. Prereq: 5300 and 5350.

5450 International Marketing Management (3) Development and management of international marketing programs. Problems involved in marketing goods and services in foreign markets. Political, cultural, and economic conditions in different countries. Prereq: 5200 or equivalent.

5910 Research in Marketing (3) Directed research on a subject of mutual interest to student and staff member. Prereq: 5200 and 5300.

6000 Doctoral Research and Dissertation

5110 Seminar in Buyer Behavior Research (3) An examination of the behavior of individuals and groups in their roles as buyers of economic goods and services. Prereq: 5300 or Statistics 5312 or the equivalent, and Industrial Management 5610-20.

6210 Seminar in Marketing Models and Model Building (3) Examination of the nature, components, construction, and use of models for the analysis of marketing decisions and processes. Prereq: 9 hrs of graduate marketing.

6310 Seminar in Contemporary Marketing Issues (3) An examination of the fundamental nature of the marketing process, and analysis of several topics of current interest in marketing. Specific topic areas will vary with each course offering. Prereq: 9 hrs of graduate marketing, including 5300 and 6110.

Transportation and Logistics


5002 Non-Thesis Graduation Completion (3) 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.

5050 Survey of Transportation and Logistics (3) An examination of the nature of the marketing process, and analysis of several topics of current interest in marketing. Specific topic areas will vary with each course offering. Prereq: 9 hrs of graduate marketing, including 5300 and 6110.
5120 Management and the Pricing Problem
(3) A critical analysis of the application of economic theory and regulatory restraints to the pricing of carrier services.

5130 Transportation Management Problems
(3) An analysis of significant transportation problem areas with a consideration of proposed solutions.

5210 Business Logistics (3) Development of concepts to guide the analysis and design of logistics systems. Scope and importance of transportation and spatial decisions in the business firm and the total system. Emphasis on top management integration of physical distribution operations with marketing, production, and other decision areas.


5510 Urban Transportation Policy (3) A study of the movement of people, goods and information in urbanized areas with special emphasis on the formulation of national, state and local policies toward the firms providing these services.

5910 Transportation Law and Carrier Liability
(3) Legal rights and responsibilities of carriers and users. Procedures before regulatory agencies and analysis of the regulatory statutes with appropriate agency and court decisions.

5920 Current Topics in Transportation and Logistics (3) A seminar designed to study, in depth, a current policy or problem area in transportation or logistics. The topic selected will be announced prior to each offering.

5990 Research in Transportation and Business Logistics (3) Directed independent research on a subject of mutual interest to student and faculty member. Prereq: 12 hrs in transportation.

6000 Doctoral Research and Dissertation

6110 Seminar in National Transportation Policy (3) A critical analysis of contemporary national transportation policy issues. Prereq: 5110.

6210 Seminar in Transportation and Logistics Models (3) Analysis of the current quantitative methodologies used in transportation and logistics research. Prereq: Statistics 5311-12, Management Science 5100.

6220 Transportation and Logistical Systems—Analysis and Simulation (3) Directed independent research, analysis, and simulation of a transportation or logistics system. Prereq: 6210.

Office Administration

Professor:
G. A. Wagener (Head), M.S. Indiana.

Associate Professors:

Assistant Professors:

4310 Business Letter Writing (3) Modern business letters; types of letters studied; principles applied by solving letterwriting problems.

4320 Business Report Writing (3) Report writing, tabular and graphic presentation, basic instruction in formal research reports and thesis writing, sources of business information.


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.


5312 Statistical Methods (3) Significance testing, applications of the Chi-square statistic, analysis of variance, least squares and linear regression. Prereq: 5311.

5420 Intermediate Analysis of Variance (3) Design models; factorial, split-plot, and nested designs; covariance analysis. Prereq: 5312 or equivalent.

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 T^2; multivariate analysis of variance and covariance. Prereq: One year's course work in 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: 5060.

6210 Stochastic Processes II (3) Special analysis, time series, linear and nonlinear systems. Prereq: 5210.
College of Communications

Donald G. Hileman, Dean
James A. Crook, Assistant Dean for
Undergraduate Studies
Jerry R. Lynn, Associate Dean for
Graduate Studies
Jack B. Haskins, Director,
Communications Research Center

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 Departments of Journalism and the Broadcast Education Association.

A graduate student in the College of Communications whose grade point average, not including incomplete grades, is below 3.0 at any time after the end of 12 hours of graduate credit shall be placed on probation. A student on probation shall be dropped from the program unless his or her cumulative graduate 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 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 Associate Dean for Graduate Studies of the College of Communications upon recommendation of the student's faculty committee.

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 print or broadcast media, (2) knowledge of mass media advertising and management, (3) an understanding of the social role of the press, or (4) preparation for teaching communications.

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.

Applicants must meet admission requirements of the University Graduate School. Those lacking approved credits in communications (advertising, broadcasting, and journalism) must complete at least 15 prerequisite or supplemental hours of courses offered by the College of Communications and approved by the major advisor.

In addition, the following minimal requirements normally are specified for admission to potential candidate status in the Master of Science program in the College of Communications: a) an undergraduate B average, b) an above average verbal aptitude score on the Graduate Record Examination, and c) such other evidence of qualifications as may be required by the Graduate Studies Committee. Students are admitted to the program only for summer and fall quarters each year. Applications for the graduate program, including all necessary materials that are not received at least six weeks before registration 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 degree program has two options: the thesis option* requires 45 hours of approved graduate work:

- 24 hours of approved courses in the major, including Communications 5100, 5120, 5140, and 6100, at least 9 hours in one concentration area (advertising, broadcasting, journalism), and at least 15 hours at the 5000 level;
- 9 hours of thesis work;
- at least 12 hours in a minor** area approved by the major advisor, at least six of which must be at the 5000 level.

(If a candidate submits evidence of record that he/she has satisfied the objectives of thesis research, the student may then petition to be exempt from the thesis and to substitute 9 hours of 5000-level communications courses approved by the committee.)

After the student completes the formal program of courses and research, the student must pass an oral examination conducted by his/her graduate committee.

The non-thesis* option requires completion of 45 hours of approved graduate work:

- 33 hours of approved courses in communications, including Communications 5100, 5120, and 5140, at least 12 hours in one concentration area (advertising, broadcasting, journalism), and at least 15 hours at the 5000 level;
- at least 12 hours in a minor** area approved by the major advisor, at least six of which must be at the 5000 level;
- completion of an approved communications project (no more than one inde-

* The student must declare which option he/she will pursue upon completion of the core curricula (5100, 5140, 6100).
** Minor: Students who hold a bachelor's degree in advertising, broadcasting, or journalism must minor outside the College of Communications.
pendent study-type course directly related to the project may be taken as part of the 45-hour program);
—after completion of formal course program and project, the student must pass a 3-4 hour comprehensive written 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 in the related social and behavioral sciences. The program is flexible and will accommodate a wide variety of career goals in communications.

For the Master's degree, it is not required for entry into or completion of the doctoral program. Program planning, however, will permit the Master's degree to be earned if desired. Students lacking academic or professional experience in communications will be required to take prerequisite courses. In general, however, the program may be completed within three academic years of full-time study beyond the Bachelor's degree.

The following minimal requirements are normally required for admission to full potential candidate status: (a) a 3.0 (4.0 system) grade point average in undergraduate studies, or 3.5 for graduate work if applicant holds a Master's degree; (b) above the 50th percentile in verbal and quantitative aptitude on the Graduate Record Examination; (c) completion of the California Psychological Inventory; (d) endorsement by at least three former teachers or professional colleagues chosen by the Graduate Studies Committee; (e) a statement of the applicant's goals and reasons for pursuing the doctorate. Personal interviews with members of the Graduate Studies Committee may be required. Professional experience in some field of communications is a highly desirable criterion for admission.

The following program represents work normally required for an individual with only the Bachelor's degree and no technical competence: (a) prerequisite courses offered by the College of Communications and approved by the major advisor for applicants lacking the necessary academic and/or professional background; (b) core curriculum: 33 hours of course work; (c) primary concentration in communications: 15-18 hours of course work; (d) secondary concentration in a cognate minor subject normally outside communications: 12 hours of course work; (e) technical competence area in either teaching, research, or administration: 15-18 hours of course work and, for those who lack appropriate professional experience, an internship the equivalent of 9 credit hours; (f) research tool: 12 hours of course work, e.g., statistics, foreign language, or computer science; (g) dissertation: 36 hours of Communications 6000.

The following courses represent the required core curriculum (beyond the Bachelor's degree):
Communications 5100, Introduction to Graduate Studies
Communications 5140, Communications Theory
Communications 5210, Research Methods
Communications 6100, Seminar in Communications Theory
Communications 6200, Seminar in Communications Topics
One of the following: Communications 6300, Survey Research Methods in Communications; 6310, Experimental Research Methods in Communications; 6320, Seminar in Historical Research Methods in 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. Industrial Personnel Management 5110-20, 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.

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; D. W. Holt, Ph.D. Northwestern; J. R. Lynn, Ph.D. Southern Illinois.

Associate Professors:


5000 Thesis

5002 Non-Thesis Graduation Completion (3)

Required for the non-thesis option. May be repeated but may not be used toward degree requirements. May be repeated. S/NC only.

5100 Introduction to Graduate Studies (3)

Scope and methods study in communications. Information sources, literature review methods, scholarly style, thesis and dissertation requirements, and procedures, overview of traditional and behavioral research methods.

5120 Research Methods (3) Communications research strategy and methodology. Scientific process, bases for derivation and verification of hypotheses, and methods of designing research in communications.

5130 Advanced Principles of Mass Communications (3)

A pro-seminar covering all phases of mass communications including the history, development and current status of the communication industry, the principles of broadcasting, and the principles of advertising.

5140 Communications Theory (3)

Analysis of contemporary theories of human communication emphasizing similarities and differences of communication processes in interpersonal, intrapersonal, and mass communication systems. (Same as Speech and Theatre 5140.)

5150 Seminar in Communications Issues (3)

Examination of contemporary topics in communications. May be repeated. Maximum 6 hrs. Prereq: 5100 and 5140, or consent of instructor.

5970 Independent Study (3)

Reading, research, or projects on special topics in mass communication. On an individual basis, under faculty direction, with consent. May be repeated.

6000 Doctoral Research and Dissertation

6100 Seminar in Communications Theory (3)

An intensive study of selected theories and research methods and supporting research data dealing with source, message, media, receiver, or situational variables in the process of communication. Prereq: 5140. Recommended: 5100.

6200 Seminar in Communication Topics (3)

Intensive analysis of special issues and problems in human communication. Repeatable; each form will cover a specific professional area, e.g., international communication, public service communication, political communication. Prereq: 5120. Recommended: 5140.

6300 Survey Research Methods in Communications (3)

Survey methods applied to opinion and communications media research problems. Planning, sampling, and questionnaire construction, data gathering (personal, mail, and telephone), data processing and interpretation. Attitude measurement and message pre-testing 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 multi-factor experimental designs. Laboratory and field experiment situations. Prereq: 5120 or instructor's permission. Basic statistics course either before or concurrent.

6320 Seminar in Historical Research Methods in Communications (3)


Advertising

Professors:

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

Professor: D. W. Holt (Head), Ph.D. Northwestern.
Associate Professors: H. H. Howard, Ph.D. Ohio; I. G. Simpson, M.B. Sylva.
Assistant Professors: F. A. Lesté, M.A. Tennessee; M. K. Sidel, Ph.D. Northwestern.

3360 Television and Radio Advertising (3) Principles and practices underlying successful radio, television advertising; emphasis on media research, rate structure, program planning, creativitv, instruction in television commercials.

3650 Radio-Television Writing (3) Theory and technique of writing all types of broadcasting scripts except news and dramas. Special emphasis on literature, musical scripts, radio talks, and promotion material. Emphasis on commercials.

4010 Speech for Broadcasting (3) Fundamentals of today's broadcast conditions as they affect the broadcast writer. Emphasis on interpretation of General American Speech, Italian, German, and French pronunciation. Prereq: Strongly recommended but not mandatory, Public Speaking.

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

4610 Broadcast News Operation (3) Theory and practice of radio and television news gathering, interviewing, and dramatic production. Emphasis on off-air production. 2 hrs lecture and 1 lab. Prereq: Radio-Television News and Television Film News or consent of instructor.

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

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

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

5510-20-30 Creative Projects (3, 3, 3) For students having specialized broadcasting interests or those who wish to extend directed study in creative writing or production projects.

5610 Public Affairs Broadcasting (3) Study of the news and public affairs function in broadcasting stations and networks, including management, economics, personnel utilization, sources of program materials, ethical and legal aspects. Prerequisite: Consent of instructor.

5620 Broadcast Law and Regulations (3) Sociopolitical control of broadcasting; effects of law, regulations, and public pressures upon station policies. Prerequisite: Consent of instructor, particularly the press conference, interviews, and news specials. Prereq: Radio-Television News or consent of instructor.

5670 Broadcast Documentary Writing (3) Study of the role of the documentary in radio and television. Research, writing, and critique of documentary broadcasts.

5680 Broadcast Program Development (3) Planning basic program structures for broadcast stations. Historical trends in program development, and program development as related to audience requirements, governmental policy, and competitive conditions. Individual studies of program development on both the local station and network levels. Prereq: Introduction to Broadcasting or consent of instructor.

5970 Independent Study (3)

School of Journalism

Professors: H. C. Cade (Director), Ph.D. Iowa; J. B. Haskins, Ph.D. Minnesota; H. H. Howard, Ph.D. Ohio; I. G. Simpson, M.B. Sylva.

Associate Professors: J. A. Crook, Ph.D. Iowa State; G. A. Everett, Ph.D. Southern Illinois; J. C. Tucker, Director, Columbia University; J. A. Crook, Ph.D. Iowa State; G. A. Everett, Ph.D. Southern Illinois.

Assistant Professors: J. A. Crook, Ph.D. Iowa State; G. A. Everett, Ph.D. Southern Illinois; J. C. Tucker, Director, Columbia University; J. A. Crook, Ph.D. Iowa State; G. A. Everett, Ph.D. Southern Illinois.

4420 Newspaper Management (3) Daily and weekly newspaper business operations. Current developments in newspaper management.


4520 Newspaper Advertising (3) Preparing layouts. Lecture and labs. Prerequisite: Advertising Principles, advertising sales, including case studies in sales development, pricing, and other problem areas of sales management. Prerequisite: Consent of instructor.

4530 Broadcast Law and Regulations (3) Sociopolitical control of broadcasting; effects of law, regulations, and public pressures upon station policies. Prerequisite: Consent of instructor, particularly the press conference, interviews, and news specials. Prerequisite: Radio-Television News or consent of instructor.

4610 Public Affairs Broadcasting (3) Study of the news and public affairs function in broadcasting stations and networks, including management, economics, personnel utilization, sources of program materials, ethical and legal aspects. Prerequisite: Consent of instructor.

4670 Radio-Television Management (3) Business policies of networks and stations. Departmental functions, cost and income figures, sales techniques, promotion, advertising agencies, and governmental regulations. Specialized lectures by commercial broadcasters. Prerequisite: Introduction to Broadcasting or consent of instructor.

4680 Broadcast Sales Management (3) Problems and practices of television and radio sales, including case studies in sales development, pricing, and other problem areas of sales management. Prerequisite: Introduction to Broadcasting or consent of instructor.

5210 Government and the Press (3) Historic and current problems in the relations of executive, legislative, and regulatory segments of the government and the press. Prerequisite: Communication History or consent of instructor.

5250 Public Opinion and Mass Media (3) Students will consider the nature of public opinion with emphasis on the role of the press in its formation, and how the press in turn is influenced by public opinion. Prerequisite: Consent of instructor.

5510-20-30 Writing and Editing Projects (3, 3, 3)}
3) A course serving students with specialized writing or editing interests, such as agriculture, politics, labor, finance, science, for technical as well as general publications. Prereq: Reporting or Editing for Mass Media.

5560 Magazine Article Writing (3) Techniques of writing the in-depth article for mass circulation magazines. Methods of 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) Detailed examination of the 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 Productions (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) A seminar examining the role of mass media in national and international development. Communications and change in the 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 Master of Education degree, the Specialist in Education degree, and the Doctor of Education and Doctor of Philosophy degrees.

MASTER 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 instructional methodology. Educational services include a wide list of activities such as in-service educational programs, consultant services, educational 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.
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.

Arct and Music Education

Charles H. Ball, Head

Art Education

MAJOR

DEGREE

Art Education

M.S.

Professor:

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

Associate Professor:

H. N. Hull, Ed.S. Peabody.

Assistant Professor:

J. P. Watkins, M.S. Tennessee.

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

The thesis option requires 45 quarter hours as follows:

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

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

1. Art Education 5210, 5310, 5320, and electives
   21 hrs
2. Education C & I 5800, and electives
   9 hrs
3. Minor (selected with committee)
   9 hrs
4. Electives
   6 hrs

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

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

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

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

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

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

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

4450-60-70 Problems in Art Teaching (3, 3, 3)
   Prereq: Consent of instructor.

5000 Thesis

5002 Non-Thesis Graduation Completion
   (3) 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.

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

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

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

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

Music Education

MAJOR

DEGREE

Music Education

M.S.

Professors:

C. H. Ball (Head), Ph.D. Peabody;

Associate Professors:


Assistant Professor:

W. H. McDaniel, M.S. Tennessee.

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 hrs), the music education major (18 hrs), minor areas in music (9 hrs), and professional education (9 hrs). Required courses: Music Education 5000, 5210, 5220, 5230, Education 5710.

Requirements for non-thesis option:

1. Minimum of 51 quarter hours of course work with a minimum of 26 hours of the 5000 level.

2. Evidence of ability to understand and interpret research through completion of:
   A. Educational Statistics 5610 or the equivalent.
   B. Music Education 5710.

C. Satisfactory performance of research activities in required courses in music education listed below.

3. Curriculum design:

   With the exception of the required courses listed below, with approval of the student's advisor, courses may be selected as described more fully below. This provides the flexibility necessary for the student to pursue in some depth specialized interests and needs in the following areas of music teaching: Elementary; Secondary (Junior and Senior High); Vocal (Choral); Instrumental (Band and Orchestra); and Supervision.

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

   (2) A minor: at least 15 quarter hours in music.

   (3) 9 quarter hours in professional education, including Educational Statistics 5610 and Educational Psychology 4760 or equivalents and a three-hour elective.

4. Specific course requirements:

   A. Music Education Foundation (15 quarter hours)
      (1) One seminar (3 hours)
      (2) 5210, Psychological Foundations of Music

   B. Music Education
      (3) 5240, Evaluation Procedure in Music Education
      (4) 5250, The Role of Music in Education
      (5) 5710, Research in Music Education

   C. Music
      Six quarter hours in applied music (piano; voice; a band or orchestra instrument; or theory and composition).

   D. Education (limited elective of 6 quarter hours)

   Education 4760, Advanced Child Study; or 5050, Learning and Development in Children; 5320, Advanced Educational Psychology; or other appropriate course in educational psychology with three hours credit.

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

B. Music: 9 credit hours from courses at the 3000-, 4000-, or 5000-levels. No courses required in the undergraduate curriculum may be included.

C. Education: 3 credit hours, elected from other departments in Education.

D. Evaluation (in addition to routine examinations in courses):
   A. Written comprehensive examination in major and minor fields.
   B. The student shall elect one of the evaluation procedures below (with approval of advisor and committee):
      1. Oral examinations in major and minor fields.
      2. A public recital in principal instrument, piano or voice.
      3. The presentation in public performance of an original musical composition(s) accepted by the committee as music suitable for 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.

4110 The Administration and Organization of Recreational Music Programs (3) Purpose of music in recreation; scope of activities, organizational procedures, resources, and coordination required in community music programs.

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

4450 Music in Special Education (3) The role and application of classroom music activities in the educational and rehabilitational programs of atypical children. Study of the uses and values of specific activities with emotionally disturbed, brain-injured, speech defective, physically disabled, and mentally retarded children. For majors in Special Education. Prereq: Consent in the Primary, Intermediate, and Upper Grades.

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

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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.

5150 Studies in Secondary School Music (3) Development of understandings regarding growth patterns and processes through music experiences; cultural and community influences on secondary school music; problems in the administration and teaching of music in the secondary school; and relationship of music with the humanities in the curriculum. Sequel to Teaching Music in Junior and Senior High Schools.

5210 Psychological Foundations of Music (2) Perception; function; aesthetics; talent, measurement; implications for teaching theory and practice. A review of classic and current experimental studies. Prereq: Consent of instructor.

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

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

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

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


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

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

5350-60-70 Special Problems in Music Education (3, 3, 3) Individual identification and study of current problems in music education at all levels of instruction and in the various specialized areas of the music curriculum. Prereq: 5310, or the equivalent and consent of instructor.

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

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

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


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

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

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

Continuing and Higher Education MAJOR DEGREE

Adult Education M.S.

Thesis

5002 Non-Thesis Graduation Completion (3) 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.

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

5110 Seminar in College Teaching (3) Efficacy of college teaching; testing and measurement; recent research in college instruction; major problems and issues in higher education. Preparation of candidates for the M.A.C.T. degree. S/NC only.

5330 Theory and Research in Human Learning (3) (Same as Ed. Psy. 5330)

5360-70 Problems in Continuing and Higher Education (3, 3) Independent study of problems and special institutes.

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

5450 Instruction in Higher Education (3) Problems, procedures, and techniques.
Graduate programs are designed to improve scholarship and educational competence in a number of areas leading to the Master of Science degree, the Specialist in Education degree in Curriculum and Instruction, or the Doctor of Education degree.

**MASTER’S PROGRAM**

For the Master of Science degree, thesis and non-thesis options are available in the following majors: curriculum, elementary education, English education, foreign language education, instructional materials, mathematics education, science education, or social science education. The non-thesis option requires the completion of 51 quarter hours of course work.

**SPECIALIST PROGRAM**

The Educational Specialist degree program in the Department of Curriculum and Instruction will encompass concentrations in the following areas:

- Curriculum
- Elementary education
- Foreign language education
- Instructional materials (media)
- 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 his Master’s work may be credited to the 90 hour Ed.S. requirement. (45 hours of 5000-level courses are required.) The program must also include the following:

1. A minimum of 12 hours taken in one of the eight areas listed above.
2. A minimum of 12 hours taken within the College of Education in areas other than the student’s major area.
3. A minimum of 12 hours taken outside of the College of Education.
4. A minimum of nine 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.

**DOCTORAL PROGRAM**

The doctoral major in Curriculum and Instruction may include emphasis upon the following fields: comparative education, curriculum, educational philosophy, educational research methodology, educational psychology, educational planning, foreign language education, mathematics education, science education, social science education.

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

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### Master of Science in Foreign Language Education

- **Core Courses:**
  - Research Methods
  - Language Theory
  - Advanced Language Pedagogy

- **Electives:**
  - 12 credits in Advanced Language Pedagogy

**Admission Requirements:**
- Bachelor’s degree in a related field
- Minimum GPA of 3.0

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### Master of Science in Mathematics Education

- **Core Courses:**
  - Research Methods
  - Curriculum Development
  - Advanced Mathematics Pedagogy

- **Electives:**
  - 12 credits in Advanced Mathematics Pedagogy

**Admission Requirements:**
- Bachelor’s degree in a related field
- Minimum GPA of 3.0

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### Doctoral Program in Educational Psychology

- **Core Courses:**
  - Research Methods
  - Advanced Educational Psychology
  - Comparative Education

- **Electives:**
  - 12 credits in Advanced Educational Psychology

**Admission Requirements:**
- Bachelor’s degree in a related field
- Minimum GPA of 3.5

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### Doctoral Program in Instructional Technology

- **Core Courses:**
  - Research Methods
  - Advanced Instructional Technology
  - Educational Technology Standards

- **Electives:**
  - 12 credits in Advanced Instructional Technology

**Admission Requirements:**
- Bachelor’s degree in a related field
- Minimum GPA of 3.5

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### Doctoral Program in Educational Administration

- **Core Courses:**
  - Research Methods
  - Advanced Educational Administration
  - Educational Policy

- **Electives:**
  - 12 credits in Advanced Educational Administration

**Admission Requirements:**
- Bachelor’s degree in a related field
- Minimum GPA of 3.5
54 College of Education

ting characteristics of the Junior High and Middle School curriculums.

4350-60-70 Problems in Teaching English (3, 3, 3)

4351-61-71 Problems in Teaching Mathematics (3, 3, 3)

4352-62-72 Problems in Teaching Social Studies (3, 3, 3)

4353-63-73 Problems in Teaching Science (3, 3, 3)

4354-64-74 Problems in Teaching Language Arts (3, 3, 3)

4355-65-75 Problems in Teaching General Curriculum (3, 3, 3)

4356-66-76 Problems in Instructional Materials (3, 3, 3)

4357-67-77 Problems in Teaching Foreign Languages (3, 3, 3)

4359-69-79 Problems in Teaching Conservation (3, 3, 3)

4380-90-400 Problems in the Improvement of Education (3, 3, 3)

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

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

4460 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: 4450 or permission of instructor.

4530 Home and School Relations (3) Study of need for and techniques which can develop closer relationship between the home and school at both elementary and secondary level.

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 Audiolingual Methods and Techniques (3) Selection, operation, and use of equipment and materials. (Same as Lib. and Inf. Sci. 4750 and Voc-Tech. Ed. 4750.)

4840 Introduction to Data Processing in Education (3) Analysis of current activities in the field of Educational Data Processing. The emphasis is placed 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 programming. 2 hrs and 1 lab. Prereq: Psychology 3210, Educational Psychology 3730, or consent of Instructor. (Same as Psychology 4560.)

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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 Seminar in Elementary School Language Arts (3) Analysis of current curricular issues related to elementary school language arts education. Emphasis on individual student presentations, projects, and investigations. Prereq: At least one year of teaching experience (K-9), or consent of instructor.

5100 History of European Education (3) Ancient Greece to the development of national school systems.

5110 History of Education (3) Foundations for American education.


5140 Comparative Philosophies of Education (3) Analysis of the philosophical concepts of the major philosophic schools of thought. Prereq: 4260 or equivalent.

5141 Pragmatism in Education (3) Consideration of the effects the American pragmatist tradition has had on contemporary education and practice. Prereq: At least one course in history or philosophy of education.

5142 Existentialism in Education (3) An examination of the literature of existentialism as a school of thought and its influence in education. Prereq: At least one course in history or philosophy of education.

5143 Supervised Readings in Philosophy or Early Childhood Education (3) Prereq: At least 9 hrs in philosophy or early childhood education. (Same as Psychology 5143.)

5150-60-70 Seminar (1, 1, 1) Educational literature.

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

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

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

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

5230 Diagnosis and Remediation of Arithmetic Difficulties (3) Study of student's problems in learning arithmetic concepts with emphasis on tools and strategies for the diagnostic teaching of arithmetic. Prereq: 5290 or 5825, or consent of Instructor.

5240 Creative Thinking and Expression in the Elementary School (3) Designed to give students the opportunity to examine the development of creative potential across the academic curriculum of the 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 the language arts program, grades 1-8. Prereq: Undergraduate course in Elementary Language Arts in the Elementary School or consent of instructor.

5281 Teaching Social Studies in the Elementary School (3) Recent trends, issues, and research findings. Credit cannot be received for both 5281 and 5970.

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

5283 Programs and Materials in Teaching Elementary Science (3) In-depth analysis of new and innovative science program materials, as well as instructional strategies inherent in teaching 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, project, and investigations. Prereq: Teaching Science in the Elementary School or 5282 or equivalent, or consent of Instructor. At least one year teaching experience (K-9).

5290 The Teaching of Mathematics in the Elementary School (3, 3) Trends, issues, and research in content and method for the mathematics program, grades 1-8. Prereq: Teaching Mathematics in the Elementary School and 9 hrs Structure of the Number System or consent of instructor.

5291 Programs and Materials in Elementary School Language Arts (3) Examination of programs and special instructional aids associated with the language arts. Prereq: 5282 or equivalent, or consent of instructor.

5292 Seminar in Research and Theory in Teaching Mathematics in the Elementary School (3) Examination of the processes and development of current research and their application to the teaching of mathematics. Prereq: Teaching Arithmetic in the Elementary School or equivalent, consent of instructor, and one year of teaching experience.

5362 Psychology of Reading (3) Presents a deeper understanding of the reading act, a more accurate insight into the relationship between learning theory and reading, and a greater knowledge of the role of reading in the child's overall intellectual development. Prereq: An undergraduate reading course or consent of instructor.

5364 Programs and Materials for Reading Instruction (3) Developing a rationale for the examination, selection, and use of materials in the reading program. Special emphasis on distinguishing between approaches and materials for teaching reading. Prereq: Teaching of Reading in the Elementary School or 4500 or consent of instructor.

5365 Trends and Issues in Teaching Reading (3) A critical analysis of new programs, materials, innovations, and developments in reading. Prereq: An undergraduate course in reading or consent of instructor.

5366 Teaching Reading to the Linguistically Different Learner (3) Language characteristics and special reading problems pertaining to the linguistically different learner. Prereq: Undergraduate reading course, 4300 or 4301 or consent of instructor.

5350 Curriculum Development and Evaluation (3)

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

5355 Mathematics Laboratories in Elementary School (K-8) (3) Designed for elementary school teachers dealing with activities oriented to mathematics laboratory materials and pedagogical strategies. Theoretical considerations and development of classroom materials for the 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.
Developmental and corrective reading needs. Pre-requisite: 5838.

590 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) Study and production of syllabi, courses of study, source units, and other materials.

5580 Curriculum Planning and Development (3)

5510 Educational Statistics (3)

5520 Problems in Direction and Supervision of Student Teaching (3)

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

5640 Newer Trends in Elementary Education (3) Trends in classroom procedures, equipment, and materials of instruction; problems involving improvement of instruction.

5650-60 Curriculum Laboratory for Elementary Schools (3) Study and production of syllabi, courses of study, source units, and other materials.

5670 Curriculum Laboratory for Early Childhood Education (3)

5691 Production and Use of Audiovisual Materials (3) Practical graphics, adapted to the needs of children. Production of picture packages, transparencies, slides, and lettering. Prerequisite: L.I.S. 4750 or equivalent. (Same as L.I.S. 5691.)

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

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

5800 Seminar in Cooperative Curriculum Research: Action research procedures and their application to programs.

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

5825 Teaching Mathematics in the Middle and Junior High School (3) Study and discussion of problems related to teaching mathematics in middle and junior high schools. Emphasis on understanding structure of mathematical concepts as well as strategies, methods, and materials for teaching. Materials suitable for individualized instruction, mathematical laboratories, and independent study are considered. Opportunities for individual projects. Prerequisite: Teaching Arithmetic in Elementary Schools or Teaching of Math, Grades 7-12, or equivalent.

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

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

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

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

5843 Seminar in Early Childhood Education (3) Analysis of research dealing with various aspects of early childhood education (kindergarten-grade 3) with emphasis on application to programs and methods of instruction. Prerequisite: 5710 or 5850 or equivalent.

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

5845 Social Studies and Science in Early Childhood Education (3) Systematic examination of integrative approaches to and substantive classification systems of the content areas of social studies and science for the early childhood years. Emphasis on selection of appropriate social studies and science content and approaches for the young child. Prerequisite: Teaching Social Studies and Science in the Elementary School or equivalent.

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

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

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

5901 Seminar in the Teaching of English in the Secondary School (3)

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) To acquaint the English teacher with the nature of mass media and their importance to American education and life.

5905 Teaching English in the Community/Junior College (3) Emphasis upon gaining a thorough understanding of the communicative needs of community/junior college students and the objectives, strategies, and materials for meeting these needs.

5906 Teaching Poetry in Grades 7-12 (3) A study of the materials and strategies for teaching poetry.

5907 Teaching Drama in Grades 7-12 (3) A study of strategies and materials for teaching drama in the classroom.

5908 Developing Speaking and Listening Skills in Grades 7-12 (3) A study of strategies and materials for teaching speaking and listening.

5909 Instructional Theory and Design (3) Course is designed for those individuals at the Masters and Doctoral levels who have interest in intensive study of the 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 5911.)

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

5950 The Function of the Thinking Process in Education (3) Analysis of the thinking process for the purpose of tracing its implications for educational theory and practice.

5960 The Teaching of Natural Science (3) Emphasis on teaching strategies, testing and evaluation techniques, and professional guidelines for program planning in science.

5961 Seminar in Science and Environmental Education (3) Comprehensive studies of recent developments in science education of concern to classroom instruction. Particular emphasis on the interrelationships of environmental factors on science education.

5970 The Teaching of the Social Studies (3)

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

6000 Doctoral Research and Dissertation

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

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

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

6031 Seminar in Reading and Language Arts (3) A critical review of topics new to the broad area of language arts. Two topics each term chosen by the need and the instructor(s). Prerequisites: Two 5000-level course in reading and one 5000-level course in language arts.

6040 Seminar in Curriculum and Instruction (3) Required three quarters. S/N/NC only.

6060 Advanced Study of Methodology in the Elementary Schools (3) (Completion of 5840) Consideration will be given to recent and current literature in the field and to sound educational practices in the teaching of children. Prerequisite: 5840 or consent of instructor.

6070 Advanced Seminar in International Education (3) Analysis of selected problems: polit-
tical factors in the creation of educational policy, social stratification and its bearing on education in elite and mass societies, relation of education to manpower planning and technological change, and others.

6080 Advanced Seminar in Philosophy of Edu-
cation (3) A critical study of some selected philosophical issues in education. Prereq: At least 2 courses in history or philosophy of education.

6081 Phenomenology and Education (3) A

critical study of some selected philosophical

issues in education. Prereq: At least 2 courses in history or philosophy of education.

6082 Philosophical Analysis and Education (3) The philosophical analysis of the language and concepts used in educational research and writing. Prereq: At least 2 courses in history or philosophy of education.

6150 Education as Social Policy (3) Educa-
tion as an instrument of national or cultural

well-being; problems faced by society in shap-
ing an educational program; comparisons of
education in this country and in other nations.

6210 Seminar in Elementary School Social

Studies Research (3) Survey of current re-
search in elementary social studies; the status of research in the field; needed research-re-
lated research from other fields. Prereq: An

undergraduate course and one graduate course in social studies, or equivalent.

6230 Programs for Curriculum Improvement (3)

6250 Seminar in History of Education (3) May

be repeated with consent of instructor.

6282 Advanced Studies in Elementary School

Science (3) A critical analysis of current re-
search in the field of elementary school sci-
cence. Prereq: An undergraduate course and one graduate course in science, or equiv-
calent.

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

6400 The Dynamics of Educational Change (3) Causes of the 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 Advanced Studies in Elementary School

Language Arts (3) Critical research analysis of some selected issues in elementary school language arts. Prereq: 5260 or equivalent and consent of instructor.

6710 Advanced Educational Statistics (3)

6720 Interpretation of Data (3) Types of data

found in published materials in education; principles of sound interpretation.

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

6731 Studies in Curriculum Theory and the

Structure of Knowledge (3) Analysis of major curriculum theories, models, and designs; structures of knowledge and structures of dis-
ciplines 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 the College of Education; evaluation of workshop approaches to instructional education and instructional im-
provement.

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

6830 Studies in Mathematics Education (3)

Reading and study related to historical trends

and issues in mathematics education in the

United States for the purpose of providing a

broad perspective on current curricular prob-
lems and future trends. Prereq: 5560 or con-
sent of instructor.

6850 Principles of Educational Leadership (3)

Conflicting concepts, with application to major

problems in instruction, supervision, and ad-
ministration.

Educational Administration and

Supervision

MAJOR

EDUCATIONAL ADMINISTRATION AND SUPERVISION

DEGREES

Educational Administration

and Supervision

M.S., Ed.S.

and Ed.D.

Professors:


Associate Professors:


Assistant Professor:

P. M. Husein, 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. (Specialist in Education) degree and which provides advanced preparation for applicants judged to be potentially competent school administrators.

5000 Thesis

5002 Non-Thesis Graduation Completion (3)

Required 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.

5100 Internship in Educational Administration (3) May be repeated with consent of depart-
m ent. Maximum 6 hrs.

5130 Introduction to Educational Administra-
tion (3)

5180-90-200 Educational Specialist Research

and Thesis (3, 3, 3)

5220 Philosophy and Theory in Educational Adminstration (3)

1 Distinguished Service Professor.
Educational Psychology and Guidance

MAJORS

College Student Personnel  M.S.
Educational Psychology  Ed.D.
Educational Psychology and Guidance  Ed.D.

DEGREES

Guidance  M.S.

Professors:
L. M. DaRidder (Head), Ph.D. Michigan;
S. C. Dietz, Ed.D. Arizona State;
W. M. Holbert, Ph.D. Texas;
E. W. McClain, Ph.D. Texas;
W. A. Poppen, Ph.D. Ohio State;
E. W. Schoch, Ed.D. Florida;
G. L. Thompson, Ph.D. Ohio State;
R. L. Williams, Ph.D. George Peabody.

Associate Professors:
K. L. Davis, Ed.D. Georgia;
D. J. Dickson, Ed.D. Oklahoma State;
S. W. Huck, Ph.D. Northwestern;
S. B. Lord, Ph.D. Indiana.

Assistant Professors:
C. R. Comeaux, Ed.D. Arizona;
J. W. Edgerly, Ed.D. Tennessee;
R. W. George, Ed.D. Tennessee;
M. A. Hector, Ph.D. Michigan State;
D. C. Johnson, Ph.D. Oregon;
L. M. Kindfiel, Ed.D. Tennessee;
M. C. McNight, Jr., Ph.D. Florida State;
J. H. Miller, Ed.D. Auburn;

K. Seabrook, Ph.D. Florida;
B. M. Williams, Ph.D. Arizona State.

Graduate programs (thesis or non-thesis option) lead to the Master of Science degree with a major in guidance, college student personnel, or educational psychology, to the Specialist in Education degree, and to the Doctor of Education degree. Appropriate courses taken in this department and in the Department of Psychology will satisfy requirements for certification as a school psychologist.

Write the department for information concerning the program requirements. Primary admission dates are February, May and July.

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

4130 Mental Health (3)

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

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

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

4460 Standardized Testing (3) Use and interpretation of standardized group instruments in the assessment of intelligence, aptitude, achievement, vocational interests and personality adjustment.

4450 The Construction of Classroom Tests (3) Concerned with teacher-made classroom tests: instructional objectives, principles of test construction, item analysis, evaluation of a test's reliability and validity, the interpretation of test scores, the relationship between testing and grading.

4760 Advanced Child Study (3) Prereq: 3 hrs in Child Study, Adolescence or consent of instructor.

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

4890 Differential Psychology (3) Nature and sources of individual differences in behavioral characteristics, including racial, ethnic, socio-economic, sex, and other groups.

4910 Diagnostic and Corrective Teaching (3)

5000 Thesis

5602 Non-Thesis Graduation Completion (3) 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.
Development, and learning of children and adolescents; prevention, identification, and remediation of learning problems.

Group Approaches with Students (3) Knowledge and skills appropriate to functioning effectively in counseling; psychological and parent education.

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

Field Work in School Psychology (2) Supervision of on-the-job training in school psychology for students admitted to a master's level program in school psychology. May be repeated. Maximum 6 hrs. S/NC only.

Developmental Psychology (3) (Same as Psychology 5100.)

Psychology of Women (3) Examination of past and current educational and psychological theory and practice with special attention to assumptions and practice in regard to women's social context in which various theories were developed and current theories and research focusing on women and/or sex differences. Prereq: 4130 or basic course in personality theory.

Seminar in Current Issues in School Psychology (1, 1, 1)

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

Psychic Training in School Psychology I (2, 2, 2) (Same as Psychology 5149-50-50.) S/NC only.

Educational Specialist Research and Thesis (3, 3, 3)

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

Interpreting Published Articles: Research Design (3) For students not conducting their own research projects; interpret and evaluate statistical tables and statistical tests as reported in journals. Prereq: 5210 or consent of instructor.

Field Work in School Psychology: Level I (2)

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

Theory and Research in Human Learning (3) Influence upon school practice. Prereq: Consent of Instructor. (Same as Cont. and Higher Educ. 5330.)

Current Developments in Human Learning (3)

Group Dynamics (3) Principles of group dynamics as they apply to a variety of educational practices in administrative, supervisory, and instructional aspects of the school program. (Same as Psychology 5340.)

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

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

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

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

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

Career Development: Theory and Research (3)

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

Career Development: Workshop (1-6) Primarily designed for in-service training of school personnel. Developments, problems, and programs and trends related to career development. May be repeated. Maximum 6 hrs.

Student Appraisal (3) Gathering, interpreting, and using data for development of guidance programs and individual counseling. Prereq: Ed. D. or equivalent or consent of instructor.

Counseling Theories and Techniques (3) Interviewing and counseling procedures; dynamic factors; interpretation of diagnostic materials. Prereq: 4130, 4640 or consent of instructor. (Same as Psychology 5890.)

Pre-Practicum (3) Didactic experiences and counseling simulations in a learning laboratory. Coreq: 5890.

Problems in Lieu of Thesis (3, 3, 3)

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

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

Consultation in Human Development Settings (3, 3, 3) (Same as Psychology 5590-60-70.)

Psychology in School Psychology II (2, 2, 2) S/NC only. (Same as Psychology 5595-60-67-79.)

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

Practicum in College Student Personnel (3) Prereq: 5550-60-70 or consent of instructor.

Doctoral Research and Dissertation

Seminar in Educational Psychology and Guidance Required 3 quarters.

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

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

Field Work in School Psychology: Level II (2) (Same as Psych. 6519.)

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

Seminar in Advanced Educational Psychology (3, 3, 3) Prereq: 5930-30; to be taken during final year of doctoral program.

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

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

Problems in Educational Psychology and Guidance (3, 3, 3) S/NC only.

Seminar in Counseling (3) Prereq: 5690 or consent of instructor.

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.

Teaching Practicum in Educational Psychology and Guidance (3, 3, 3) Acceptance in doctoral program and consent of instructor.

Counseling Supervision (3) May be repeated with consent of advisor. Prereq: 5940, 5940, 6810, 6841. S/NC only.

Special Education and Rehabilitation

MAJORS

Degree Requirements

Special Education M.S.

Vocational Rehabilitation Counseling M.S.

Graduate Faculty


Assistant Professors:


Lecturers:

H. L. Byrd, Jr., M.S. Tennessee; S. W. Mulkey, M.S. Tennessee; E. O. Reese, B.S. Memphis State.
An experience program for regular teachers, special teachers, and rehabilitation personnel may be planned to meet the needs of exceptional children and adults in relationship to the program of general and special education. Specialized courses may be distributed over the several areas with emphasis in an area of special interests or need. Facilities are available for continuous observation and participation in direct relationships with handicapped children and adults who are hospitalized, homebound, or in residential schools, special classes, or regular classes.

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

Programs lead to the Master of Science degree in Special Education or an area of specialization with 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.

MULTIPLE DISABILITIES

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

4150 Education of Hospitalized and Homebound Children (3) School and home responsibilities for physical care and social relationships, educational adjustment, vocational needs, and cooperation with related service resources.

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

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

DISABILITY EVALUATION

5700 Disability Evaluation: Issues, Processes and Programs (4) Evolution of the philosophy and programs of disability insurance under Social Security; study of disability claims actions; the case evaluation process; principles of evidence; Prereq: Admission to program in Disability Evaluation or consent of instructor.

5710-20 Medical Aspects of Disability Evaluation (4, 4) Study of the nature and effect of impairments, the criteria by which they should be evaluated for disability insurance purposes; emphasis on the study of written medical reports for the purpose of demonstrating evidence of medical conditions, approximating the course of the medical condition, and deriving loss of function. Prereq: Admission to program in Disability Evaluation or consent of instructor.

5730 Vocational Assessment in Disability Evaluation (3) Theory and techniques of vocational assessment; use of resource materials; study of the criteria for vocational assessment of disability insurance claims under Social Security; on-site job analysis and case file vocabularies. Prereq: Admission to program in Disability Evaluation or consent of instructor.

5740 Problems/Practicum in Work Evaluation (3) Theory and techniques of work evaluation; application of principles to disability insurance claims evaluation criteria; practical experience in designing, conducting, and reporting work evaluation procedures in a workshop setting. Prereq: 5730 or consent of instructor.

5750 Principles and Problems of Disability Evaluation (3) Seminar; individual identification and analysis of principles and problems of disability evaluation; emphasis on problems of disability evaluation process or structures; emphasis on innovation, exploration of alternatives, and sharing experience within the group. Prereq: 5730 or consent of instructor.

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

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

EDUCATION OF THE ACoustically Handicapped


4190 Speech Development of the Hearing Impaired (3) Anatomy and physiology of the speech system. Relationship of hearing to speech development. Theories and techniques of speech development and improvement for hearing impaired children. Prereq: Audiology 3050. (Same as Audiology and Speech Pathology 4190.)

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

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

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

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

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 the assessment of hearing loss; interpretation of audiograms; selection and use of hearing aids; relation of audiologic services to medical and other rehabilitation disciplines. Observations and practicum.

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

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

4290 The Teaching of Reading to Hearing Impaired Children (3) Reading readiness activities, development of reading concepts, and specialized materials for curricula in teaching reading. Prereq: 4210 or consent of instructor.

4870 Student Teaching of Acoustically Handicapped Children (3) S/NC only.

4871 Practicum with Acoustically Handicapped Children (6) S/NC only.

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

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

5220 Linguistics in the Education of the Auditory Impaired (3) Seminar and development in linguistics related to auditory impaired.

5240 Seminar in Language Remediation for the Hearing Impaired (3) Projects and discussion will pertain to teaching and communicative development in educational methodologies and to research pertaining to teaching language to the hearing impaired. Topics will include research and materials current in the use of various sign language systems and their adaptations. Emphasis will be placed on approaches which accommodate and assist the integration of hearing impaired children in the regular classroom.

5250 Seminar on Educational Implications of Language Deficiency (3) Readings, discussion, and projects will pertain to the impact of language deficiency on educational programming for the variety of children whose educational handicap may be defined in terms of language deficiency.

5310-20 Manual Communication (2, 2, 2) Acquisition of basic and advanced skills in fingerspelled and signed forms of communication. Emphasis is placed on application and producing prototypical media materials related to the hearing impaired. The topics will include research and materials current in the use of various sign language systems and their adaptations. Emphasis will be placed on approaches which accommodate and assist the integration of hearing impaired children in the regular classroom.

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 prototypical media materials specifically designed to meet the needs of handicapped learners. Enrollment limited to persons holding major responsibilities for media in a program for the handicapped or similar setting. Prereq: 4410 or equivalent. (For Summer Media Institute only.)

5490 Educational and Vocational Guidance of the Deaf and the Hard of Hearing (3) Evaluation, test interpretation, diagnostic and guidance; social and personal adjustment; occupational opportunities.

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

5820 Curriculum Development Applied to Programs for the Hearing Impaired (3) Analysis of current curricula in order to adapt them for hearing impaired individuals. Appli-
cution of new curriculum options in the educational model for instruction and practice in basic helping skills necessary for a rehabilitation counselor.


5191-50 Internship in Rehabilitation (9, 9)

5192 Psycho-Social Aspects of Disability (3) Medical aspects and psychological impact of major disabilities; rehabilitation processes including implications of family and community.

5193-40 Seminar in Rehabilitation (3, 3)

5195-60 Internship in Rehabilitation (9, 9)

519620 Practicum in Residential Settings Serving Children with Learning and Behavior Problems (6) Academic tutoring in a teacher/ aide capacity within regular classrooms. Particular emphasis and practice in individualizing instruction for learning and behavior problem children within the regular classroom setting. Discussion and evaluation of relevant methods and materials unique to each teaching situation. Prereq: 4610 and 4620 or consent of instructor.

4924 Student Teaching of the Emotionally Disturbed (9) Individual tutoring and classroom observation and teaching. Prereq or Coreq: Student Teaching Grades 1-12. S/NC only.

EDUCATION OF THE MENTALLY RETARDED

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

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

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

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

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

4922 Student Teaching of the Educable Mentally Retarded (9) Observation and supervised practicum. S/NC only.

5111 Psychology of Mental Retardation (3) Intellectual, emotional and social characteristics and actions of the mentally retarded in the classroom and in other social settings. Prereq: 5110.

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

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

EDUCATION OF THE VISUALLY HANDICAPPED

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

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

4923 Student Teaching of the Partially Seeing (3) S/NC only.

SCHOOL SPEECH AND HEARING THERAPY

4630 The Public School Speech and Hearing Program (3) Organization, administration, and procedures.

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

4924 Student Teaching of the Emotionally Disturbed (9) Individual tutoring and classroom observation and teaching. Prereq or Coreq: Student Teaching Grades 1-12. S/NC only.
5403 Resource Teachers for the Handicapped
(3) To help students acquire the skill to main-
tain mildly handicapped children in regular public education environments; includes job de-
scriptions and expectations, interpersonal
relationships, assessments of abilities, modifi-
cations of curriculum content, and applied teach-
ing methodologies.

5450-69-70 Experience in Teaching and Super-
vision of Exceptional Children (1-6, 1-6, 1-6)

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

5550-69-70 Problems in the Education of Ex-
ceptional Children (3, 3, 3)

5620 Counseling Parents of Exceptional Chil-
dren (3) Interpreting exceptionalities (handi-
capped and gifted) to parents and helping in
the understanding and acceptance of the child
in the school/home.

5630 Psychology of the Exceptional Child (3)
Survey of the entire field of exceptional chil-
dren, their characteristics, needs, and scope of
each group. Educational provisions, importance of
public attitude. Social guidance and per-
sonality development. Consideration of voca-
tional problems. Opportunity to expand study
upon a particular group of exceptional chil-
dren.

5830 Seminar: Issues and Theories in the Edu-
cation of the Exceptional Child (3) Current
and future trends in the education of the excep-
tional child, application of philosophical approaches to
the understanding and acceptance of the child
in the school/home.

5970 Juvenile Delinquency and the School
(3) Responsibilities of the school in studying
sources of maladjustment; the school function in
correcting children’s welfare; curricular adjustments; directed study of
socially maladjusted children, their environ-
ment, and programs for meeting their needs.

Vocational-Technical
Education

MAJORS

DEGREES

Agricultural Education

M.S., M.A.C.T.

Business Education

M.S., M.A.C.T.

Distributive Education

M.S., M.A.C.T.

Home Economics Education

M.S.

Industrial Education

M.S.

Vocational-Technical Education

Ed.S., Ed.D.

DOCTORIAL PROGRAM

Each vocational service area (agri-
cultural education, business education,
distributive education, home economics
education, and industrial education) offers
similar programs, i.e., Master’s degree. Both thesis and non-thesis
options are available. Details regarding
the Master’s program of each of the service areas may be obtained from the chairman of the different services. The M.A.C.T. is
also available in the business education area.

SPECIALIST PROGRAM

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

The comprehensive Ed.D. program in Vocational-Technical Education is de-
signed to provide for achieving profes-
sional objectives, developing needed
competencies, and gaining desirable experiences and understanding of voca-
tional-technical areas.

The Vocational-Technical Education
doc toral curriculum consists of the fol-
lowing: professional core, 15
quarter hours; area of concentration—
basic, 3 hours; service area, 18 hours;
occupational-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 Audiovisual Methods and Techniques (3)
(Same as Curriculum and Instruction 4750.)

5002 Non-Thesis Graduation Completion (3)
Required for the non-thesis student not other-
wise registered during any quarter when such a
student uses university facilities and/or fac-
tory time before 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) Development of voca-
tional and technical education in the public schools through an analysis of social forces, legislation and organizational models.

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

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

5180-90-200 Educational Specialist Research
and Thesis (3, 3, 3) Selection, analysis and
reporting of a problem necessitating original
investigation which will be beneficial to the
investigator and which is of interest to the vocational-technical field.

5250 Issues and Trends in Vocational-Technical
Education (3) An examination of issues, trends, problems, and innovations in voca-
tional-technical education.

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

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

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

5310 Supervision of Vocational-Technical
Education (3) Preparation for the M.A.C.T.
and M.A.C.T. roles and functions of supervi-
sors.

5850-60-70 Problems in Vocational-Technical
Education (1-4, 1-6, 1-6) May be repeated.
Maximum 9 hrs.

6000 Doctoral Research and Dissertation

6210 Curriculum Planning in Vocational-Tech-
nical Education (3) Prereq: Curr. and Inst. 5410 or equivalent.

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

6250 Evaluation of Vocational-Technical Edu-
cation Programs (3)

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

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

Agricultural Education

4510-20-30 Problems in Agri-business Educa-
tion (1-4, 1-6, 1-6) May be repeated. Maximum
9 hrs.

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

5000 Thesis

5002 Non-Thesis Graduation Completion (3)
Required 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.
5011-21-31 Problems in Lieu of Thesis (3, 3, 3)
5110-20-30 Current Literature (1, 1, 1)

5320-30 Agricultural Education in Off-Farm Agricultural Occupations (3, 3, 3) Principles and procedures for developing occupational experience programs; course planning and teaching procedures. Prereq: Student Teaching in Agric. Ed. 9 hrs.

5340 Agricultural Education for First-Year Teachers (3) Assistance in adjustment to situation in which employed; group meetings in selected centers and visits by instructor. Prereq: Student Teaching in Agric. Ed. 9 hrs.

5470 Adult Education in Agriculture (3)

5480 Supervision of Student Teaching in Agricultural Education (3)

5490 Supervised Occupational Experience in Agriculture (3) Prereq: Student Teaching in Agric. Ed. 9 hrs.

5620 Teaching Agricultural Mechanization in Vocational Agriculture (3) Prereq: Student Teaching in Agric. Ed. 9 hrs.

5750-60-70 Special Problems in Agricultural Education (3, 3, 3)

Business Education

4230 Curriculum Construction in Business Education (3) Aims, principles, practices and problems involved in the construction of business curricula for the various types of educational institutions in which business subjects are taught.

4610-20-30 Problems in Business Education (3, 3, 3)

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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, 2)

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

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

5612-22-32 Problems in Business Education: Shorthand (3, 3, 3)

5613-23-33 Problems in Business Education: Bookkeeping and Accounting (3, 3, 3)

5614-24 Problems in Business Education: Clerical Practice (3)

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

5617 Problems in Business Education: Business Law (3)

5618-28-38 Problems in Business Education: Administration (3, 3, 3)

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

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

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

6410 Higher Education for Business (3)

Distributive Education

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

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

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

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

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

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

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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) Prereq: 4510 or equivalent. Operation of a distributive education program and the work of the city or county supervisor. Understanding and appreciating problems from the high school principal's and the department head's point of view. Trends in distributive education, including supervision, teacher-coordinator qualifications, the changing curriculum.

5120 Organizing and Teaching Adult Distributive Education (3) Planning, organizing, promoting, teaching, and evaluating continuing education programs in distributive education: utilization of trade associations, employment agencies, business groups, and advisory committees in implementation.

5210-20-30 Special Problems in Distributive Education (3, 3, 3) Individual research, conferences, and/or workshops in teaching and supervising high school, post-secondary, and adult programs.

5516-26-36 Problems in Distributive Education: Retailing (3, 3, 3)

Home Economics Education

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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 Home-Making 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.


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

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

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

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

5510 Supervision of Home Economics in the Public Schools (3) For teachers with successful experience in vocational home economics who are preparing for supervisory positions in vocational education. Program planning, organization, and administration. Field contacts with urban and rural programs.

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

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

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

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

Industrial Education

5110 History and Philosophy of Industrial Education (3)

5210-20-30 Part-Time Programs in Cooperative Industrial Training (3, 3, 3) Principles of organization, methods and materials.

5310 Shop Organization and Management (3)

3220-30 Materials and Methods for Shop and Related-Subjects Teachers (3, 3)

3340 School Shop Safety (3)

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

4110 Foremanship Training by the Conference Method (3)
5120-30 Job Analysis (3, 3) Principles, practice, instructional methods.
5310-20 Curriculum Building in Trade and Industrial Subjects (3, 3) Prereq or coreq: 4120.
5450-11-12 Seminar in Industrial Education (3, 3, 3) Educational innovations, current events, problems, and other topics associated with the field of industrial education.
5450-21-22 New Developments in Industrial Education (3, 3, 3) Developments, pressing problems, and recent trends in the field of industrial education as presented by a coordinating instructor in conjunction with knowledgeable resource personnel.
4621 Special Topics in Drafting (3) Industrial practices in specialized areas of drafting selected for the individual student. Prereq: 9 hrs drafting.
4671 Materials and Processes (3) Organic and inorganic materials and processes used to produce finished products. Content, curriculum, and techniques of laboratory operation. Prereq: Consent of instructor.
4682 Power and Energy (3) Development, control, transmission, conversion, interrelationship of power sources; content, curriculum, and techniques of laboratory operation. Prereq: Consent of instructor.
5000 Thesis
5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only.
5110-20-30 Administration and Supervision of Industrial Education (3, 3, 3) Principles of vocational education; relationships with general education, Business Industry Labor Organizations; special problems in administering and supervising various types of schools and classes under the federal vocational education act.
5140 Organization and Operation of Area Vocational-Technical Schools (3) Understanding of the area vocational-technical school concept; administration and supervision of vocational and technical education programs in area schools. (Same as Bus. Ed. 5140.)
5210-20-30 Special Problems in Industrial Education (3, 3, 3)
5310 Methods of Research in Industrial Education (3)
5410 Improving Teachers in Service (3) Problems of coordination in part-time and apprenticeship 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 the teaching of specialized skills and technical related information.
5510-20-30 Seminar in Industrial Technical Education (3, 3, 3) Ramifications of vocational and technical innovation in trade and industry in relation to an increasingly technically oriented society. Prereq: B.S. in Industrial Education and teaching experience.
5540 New Developments in Industrial Technical Education (3) Prereq: B.S. in Industrial Education plus teaching experience.

School of Health, Physical Education and Recreation

Madge M. Phillips, Director

Graduate programs are available to students preparing for (1) teaching and research positions in colleges, high schools and elementary schools; (2) administrative and supervisory work in adult and youth 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.

MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: physical education, recreation, safety education, and school health education. Forty-five quarter hours are required for the M.S. Approximately 23 quarter hours of work selected from courses numbered 5000 and above are included in the M.S. requirement. Course selection shall be made according to each student's professional interests in health, physical education, safety, or recreation with the approval of the major professor. Non-thesis options are available in all M.S. degree programs. A three-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, occupational health, environmental health, industrial safety, and health planning. Fifty-four quarter hours are required for the M.P.H. degree. One full quarter of field practice is required. During field practice, no student shall hold a full-time job except by special permission of the division chairman. Students may be placed in all parts of this country.

DOCTORAL PROGRAMS

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

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

The basic requirements for admission are:

a. A minimum of 40 (physical education) or 50 (health education) quarter hours selected from the following sciences with each area represented: sociology, zoology, physiology, anatomy, psychology, and physical science; also microbiology and anthropology for health education.
b. Submission of satisfactory scores on the aptitude section of the Graduate Record Examination is required for all doctoral and specialist programs.
c. A superior grade point average.
d. Submission of satisfactory references relating to training, employment, and character.
e. Evidence of successful teaching or potential for success in the major area of study.

Graduate Assistantships

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

Assistantships are made available by local schools, agencies, and the School of Health, Physical Education, and Recreation in return for part-time services rendered. The services may consist of teaching physical education classes, teaching health classes, teaching safety classes, leading recreational activities, supervising recreation field work students, and/or directing or helping to manage extracurricular programs. Students interested in these opportunities should file their applications before February 1. Letters should be addressed to: The School of Health, Physical Education, and Recreation, The University of Tennessee, Knoxville, Tennessee 37916.

Public Health Traineeships

A few Public Health Traineeships are offered for Master of Public Health candidates majoring 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 Education
Safety Education and Service
School Health Education

DEGREES

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

Professors:
R. H. Kirk (Chairman), H.S.D. Indiana; W. J. Huffman, Ed.D. Illinois; R. Kent, Ph.D.

Associate Professors:
I. J. Ahmed, D.D.S. Saint Louis; C. B. Hamilton, Dr. P.H. Oklahoma; J. Gorski, Dr. P.H. U.C.L.A.

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

Lecturers:
M. Duffy, M.D. Pennsylvania; H. P. Hopkins, Ph.D. North Carolina; S. King, M.D. Emory; C. P. McCammon, M.D. Temple.

The Health and Safety Division offers the following degree programs:

Master of Public Health degree with a major in Public Health Education. (Option in Community Health Education accredited by American Public Health Association.) Options with specialization in Health-Planning-Administrative or Environmental-Occupational Health and Safety are available.

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

Educational Specialist degree in Safety Education and Service.

Doctor of Education degree in Health Education.

Doctor of Philosophy degree in Health Education.

Public Health

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

3210 First Aid and Emergency Care (4) Theory and practice of first aid and emergency care. Instruction in medical self-help. Course leads to Red Cross Certification in Advanced First Aid and Emergency Care. (Applicant must be at least 18 years of age for certification. Same as School Health 3212.)

3310 Communicable and Non-communicable Diseases (3) Modern concepts of diseases; etiology of common communicable and chronic disease problems including prevention and control. Prereq.: 1 year of biological science and 1 course in bacteriology.

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

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

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

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

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

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

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

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

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

4700-10-20 Field Practice in Public Health (3, 5, 3) Field practice in public health under supervision of public health professional. S/NC only.

4730 Workshop in Public Health Education (3-6) For teachers, 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.

4800-50-60 Problems in Public Health Education (1, 1, 1) Individual identification and study of current problems in public health education. Extensive reading of literature required.

5020 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5010-20-30 Workshop in Public Health (3-4, 3-4, 3-4) Designed to deal with specific public health problems in a short or an extended period of time.

5070-80-90 Field Practice and Seminar in Public Health Education (5, 5, 5) On-the-job field practice under professional and academic guidance in public health or school health education. Seminars scheduled around experiences. S/NC only.

5110 Environmental Health (5) Varied environmental factors within the general framework of air, food, water, shelter, transportation as they affect man’s survival, prevention of disease, performance and enjoyment. Lecture, demonstrations, field practice. Prereq: Consent of instructor.


5140 Ergonomics and Work in Occupational Health and Safety (3) Study of elements of ergonomics and work as they relate to improvement of occupational health and safety. Lecture, demonstration, laboratory and field practice. Prereq: Consent of instructor.

5210 The Ecosystem of Public Health Education (5) Investigates living and non-living environments, groups and communities therein, and factors influencing upon or intervening in health status. Understandings of human development, behavior, and learning in terms of health education are explored. 4 hrs and 2 labs.

5220 Health and Sickness in the Focus of Public Health Education (2) Formulation of models of positive health within the life cycle and within the context of types of sickness afflicting individuals and groups. 1 hr and 2 labs.

5410 Epidemiology (3) The study of the incidence and prevalence of disease in man.

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

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 the use of communication techniques and materials in community health education. 3 hrs and 2 labs.

5540 Factors in Problem Solving for Community Health (5) Test skills in communications and group process en 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) An overview of health organizations and agencies in the community prefects exploration of conflicting theories and divergent styles of practical community planning and development. Laboratory to delineate a community near the campus and to practice. 2 hrs and 4 labs.

5560 Functions and Roles of the Public Health Educator (3) Professional scene 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 planning sessions. 1 two-hr lecture-seminar session per week.

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

5705-95 Advanced Professional Health Education (3-5) Theory and practice in selected areas.

5705 Health Planning I (3-5)

5710 Health Planning II (3-5)

5715 Health Planning III (3-5)

5730 Dental Health Education (3-5)

5735 Emergency Medical Services (3-5)
5745 Family Health Unit (3-5)
5750 Health and Medical Care Legislation and Law (3-5)
5755 Health Facilities Administration (3-5)
5760 Health Services Administration (3-5)
5785 Occupational Health Unit (3-5)
5790 Self-Care Unit (3-5)
5795 The Training of Paramedical Personnel (3-5)


6000 Doctoral Research and Dissertation

6030 Critical Analysis of Writing and Research in Health Education (3) (Same as School Health Ed. 6050.)

6050-60 Seminar in Health Education (3, 3) (Same as School Health Ed. 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 the principles, practices, and procedures in general safety. Covers safety problems in school, traffic, recreation, industry, home, and other public areas.


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

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

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

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

5000 Thesis

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

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

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

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

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

5720-30-40 Graduate Workshop in Safety (3-6, 3-6, 3-6) Deals with specific safety problems. Designed especially to explore 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) Designed to allow the student opportunities for engaging in field experience to the end that a significant problem in that experience will be identified, researched, and reported on in acceptable form.

School Health

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

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

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

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

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

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

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

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


5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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.


5510 Curriculum Construction in School Health Instruction (3) An analysis of school health instruction programs in the elementary and secondary schools. Stresses the planning and construction of health curricula to meet the needs, interests, and abilities of pupils.

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

5530 School Health Program Surveys (3) Stresses the techniques and standards used in making a survey of a total school health program; examines the relative contribution of health instruction, health services, and healthful environment as each contributes to the well being of individual students. Includes a survey of an existing school health program.

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

5850-40 Workshop in School Health Education (3, 3) Designed for graduate students, in-service teachers, and other health professionals. Emphasis in any workshop to be placed 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 School Health Ed. 6050.)

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

Division of Physical Education

MAJOR DEGREES

Physical Education

M.S., Ed.D.

Professors: A. C. Ackerman, M.D., Tennessee; G. F. Brady (Emeritus), Ph.D., Iowa; E. C. Capen, Ph.D., Iowa; B. D. Franks, Ph.D., Illinois; A. L. Kozer, Ph.D., Michigan; H. J. Montoye, Ph.D., Illinois; E. K. Capen, Ph.D., Michigan; H. J. Montoye, Ph.D., Iowa; B. A. Plotnicki, Ph.D., Michigan; H. B. Watson, Ph.D., Iowa; B. A. Plotnicki, Ph.D., Michigan; H. G. Welch, Ph.D., Florida.

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

The Physical Education Division offers the following degree programs: Bachelor of Science degree in Physical Education (thesis and non-thesis programs), Doctor of Education degree in Physical Education.

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

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

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

3310 Tests and Measurements in Physical Education (3) Study of elementary statistics related to measurement. Critical examination of tests used to evaluate strength, sport skills, and physical fitness.

3430 Adaptive Physical Education Laboratory (1) Practical work, including student teaching, supervised, 411-412.

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

3889 Social Recreation (3) Theory and practice in social recreation for camps, community centers, clubs, and schools. Course includes folklore, dance, and leadership techniques. Prereq: 3100 or 4150 and 3910.

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

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

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

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

4110 Adaptive Physical Education (3) Classification and diagnosis of 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) 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 activity for these levels.

5210 Principles and Philosophy of Physical Education (3)

5220 Readings in Physical Education (3) A 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) Mechanical analysis of basic motor skills, emphasizing application of these skills to physical education and athletics.

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

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

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

5510 Selected Topics in Anatomy (3) Intensive study of various systems of the human body. Prereq: 4060. May be repeated with consent of instructor. S/NC only.

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

5580 Physical Activity and Health (3) Research evidence of the relationship of physical exercise to the following: longevity, weight control, cardiovascular diseases, low back pain and other disorders, mental health, growth, and aging. Applications for the maintenance of health will be emphasized. Prereq: Course in physiology or consent of instructor. 8 lectures per week. (Same as Public Health 5580.)

5600 Applied Physiology (3) Principles of physiology with special emphasis on the application of physiological findings to practical problems related to human function. Prereq: one year General Chemistry, or consent of instructor.

5610 Advanced Exercise Physiology (4) Principles of energy transfer in man with special emphasis on the integration of organ systems in adapting to the requirements of muscular exercise. Prereq: Zoology 4940 or equivalent. Recommended: Chemistry, physics, and mathematics. 3 hrs and 1 lab.

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

5650 Scientific Bases for Physical Education (3) Physiological, psychological, and sociological foundations.

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

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 the literature related to physical education. May be repeated with consent of the instructor. S/NC only.

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

6410 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: Consent of instructor. S/NC only.

6510-20 Issues and Problems in Physical Education (1, 1) Critical examination and evaluation of current issues and problems in the area of physical education.

6610 Seminar in Exercise Physiology (2) Prereq: 5510. May be repeated with consent of the instructor. S/NC only.

6640 Research Participation in Applied Physiology (1-6) Advanced research techniques are studied under supervision of a faculty member whose research area coincides with interests of the student. Prereq: Consent of instructor. May be repeated with consent of instructor. S/NC only.

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

Division of Recreation

MAJOR

RECREATION

M.S.

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

Assistant Professors: P. A. Borovik, M.S. Tennessee; C. J. Johnson, M.S.; M. T. Lesse; E. B. Krick, Ph.D. Indiana.

The Recreation Division offers the following degree program: Master of Science degree in Recreation (thesis and non-thesis programs)

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

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

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

3889 Social Recreation (3) (Same as Physical Education 3889.)

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

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

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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.
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 Leisure Service Delivery Systems (3) An in-depth study of the various systems—public, private, and commercial—involving in the provision of leisure services for the community at large. Prereq: Consent of instructor.

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

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

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

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

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

OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEO TAPE-ELECTROWRITER

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

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

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

YEAR-IN-JAPAN M.S. PROGRAM

This is a unique program for 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 excepting 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 make a beginning at Japanese language study. At the option of the department, up to six 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 insofar as funds available will permit.

The Station may also make special arrangements with any person or company to study any technical question within the capacity of its resources, and to report the results exclusively to the company requesting the study. In such case, the whole expense will be carried by the parties requesting the investigation.

Engineering Administration

MAJOR
Engineering Administration

DEGREE
M.S.

Committee:
H. L. Loveless, Chairman
J. F. Bailey
F. A. Chamblin
D. W. Cravens
G. E. Nichols
W. G. Sullivan
R. L. Young

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, manufacturing, etc. where both technical and non-technical factors exert significant influence on the success of a given activity. The program does not provide the opportunity for in-depth study of any of the traditional areas of business administration, and students with such interests are advised to consider graduate programs available in the College of Business Administration. To be admitted to the Graduate School as a potential candidate for a Master’s degree with a major in Engineering Administration, the applicant must submit reasonable evidence of ability to pursue graduate studies at an acceptable level of performance. In general, the applicant should have graduated from a recognized undergraduate institution in engineering with a satisfactory grade point average. In addition, applicants must satisfy one of the following experience requirements: (1) at least two years of engineering experience after graduation if a full-time student or (2) current employment. 

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 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, Industrial Management 5190 and Transportation 5210.

3. General Electives, 9 hours of graduate credit chosen from computer science, economics, engineering, management science, mathematics, psychology, statistics, and from other program-related disciplines. These electives shall not include courses in business administration, other than economics, management science and statistics.

The program requirement totals 51 hours of graduate course 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 5090 (or 2110), Computer Science 3150, Industrial Engineering 4520, and Statistics 3450 or their equivalents. None of these prerequisites may be counted as part of the 51 hours of credit offered for the degree. These course prerequisites will be waived upon presentation of evidence of competency in the course subjects. Other prerequisite courses may be required, depending upon the student's background and the electives chosen.

5002 Non-Thesis Graduation Completion (3)

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

5900 Project Engineering Administration (3)

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

Departments of Instruction

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

Chemical and Metallurgical Engineering

MAJORS

| Chemical Engineering                | M.S., Ph.D |
| Metallurgical Engineering           | M.S., Ph.D |
| Polymer Engineering                 | M.S., Ph.D |

Professors: H. E. Johnson (Head), D. Eng. Yale; D. C. Bogue, Ph.D. Delaware; B. S. Boul, 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; D. L. Culberson, Ph.D. Texas; J. M. Holmes, Ph.D. Tennessee; H. W. Hau, Ph.D. Wisconsin; S. H. Huy, Ph.D. Cincinnati; C. J. McManigle, Ph.D. Kentucky; G. Y. Moore, Ph.D. Louisiana State; B. F. Oliver, Ph.D. Pennsylvania State; J. A. Parsons, Ph.D. Northwestern; J. W. Prados, Ph.D. Tennessee; J. W. D. Spurlin, Ph.D. Tennessee; E. F. Stansbury, Ph.D. Cincinnati; C. O. Thomas, Ph.D. Tennessee; R. A. Van Dermeer, Ph.D. Illinois Institute of Technology; J. S. Watson, Ph.D. Tennessee; J. L. White, Ph.D. Delaware; M. A. Wright, Ph.D. Wales.

Associate Professors: W. T. Becker, Ph.D. Illinois; J. F. Fellers, Ph.D. Akron; G. C. Frazier, Ph.D. Johns Hopkins

Assistant Professors: D. D. Brun, Ph.D. Houston; P. J. Meschke, Ph.D. Pennsylvania.


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 Poly. Engr. 4920, 5110, 5230, 5310 and 5510.*

2. One or two minors or collateral work;

* Alumni Distinguished Service Professor.

** May be taken by students with significant experience in polymer research.

* Space Institute, Tallahassee.

College of Engineering 69

DOCTORAL CANDIDATES

To be admitted to the Graduate School must have graduated from a recognized undergraduate institution in engineering with a satisfactory grade point average. In addition, applicants must satisfy one of the following experience requirements: (1) at least two years of engineering experience after graduation if a full-time student or (2) current employment. Applicants must register for Chemet Engineering 5110 every quarter offered.

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

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 at approximately 36 quarter hours, at least 12 of which must be in 6000 series courses. The polymer engineering major must include Poly. Engr. 4920, 5110, 5210, 5230, 5310, 5510 and Chem. 5140.

2. Supporting courses in related scientific and engineering fields amounting to approximately 36 quarter hours, subject to approval by the student's faculty committee. These related fields will normally include chemistry, mathematics, physics, and civil, electrical, industrial, mechanical or nuclear 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 in the department. Resident students must register for Chemet Engineering 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, Russian.

PROGRAM OPTIONS IN POLYMER SCIENCE AND ENGINEERING

M.S. and Ph.D. degrees with specialization in polymer science and engineering are possible through two routes—one in the department (through chemical or metallurgical engineering) with an engineering emphasis and a second in a joint program with the Chemistry department having a chemical emphasis. The specialization program in this department requires for the M.S. degree, a thesis in the field, completion of Poly. Engr. 4910, 4920, 5110, 5310, and either 5230 or 5210 plus active participation in the Polymer Seminar. The Ph.D. candidate must meet the above requirements, pass a
special written examination in polymer science and engineering, and complete an additional academic program to be specified by the student's committee. M.S. and Ph.D. degrees in the joint specialization program with the chemistry department require a thesis or dissertation in the field. Chemical and metallurgical engineering departmental requirements include completion of Poly. Engr. 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

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

Chemical Engineering

3410 Flow of Fluids (4) Differential and overall momentum balances, mechanical energy balances; flow in tubes, piping systems, and packed beds; meting devices, pumps. Prereq: Elementary Linear Algebra and Calculus of Several Variables, and Mass and Energy Relations 1 and 2 lab.

3420 Heat Transfer (4) Differential and overall energy balances; steady and unsteady state heat conduction in simple geometries; heat transmission in fluids and heat exchangers; convection and boiling; radiation. Prereq: 3410, Thermodynamics of Phase Equilibrium. 3 hrs. and 1 lab.

3440 Stagewise Operations (3) Analytical and graphical methods applied to stage-wise separatory operations. Prereq: Thermodynamics of Phase Equilibrium.

3450 Diffusional Operations (3) Diffusion, simultaneous heat and mass transfer; applications including humidification, gas absorption, extraction. Prereq: 3420.

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

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

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

4120 Probabilistic Chemical Engineering Systems (3) Experiment designs, simulation of systems, predictive techniques, and analysis of networks in the process industries. Prereq: 4110.

4130 Introduction to Optimization (3) Principles and applications of various optimization techniques to statistical process design; unconstrained optimization, equality constrained optimization, inequality constrained optimization, and linear and non-linear programming. Prereq: Differential Equations.


4420 Process Design and Economic Analysis (3) Development of basic information on a process into an integrated plant design considering mass and energy balances, product specifications, equipment characteristics, capital investment, operating costs and economic merit. Prereq: 4410, 4590.

4430 Special Problems in Design and Economics (1, 1, 1) Continuing extension of 4420 for student participation in the A.I. Ch.E. annual contest problem; other advanced design projects. Prereq: 4420. Project.

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

4530 Chemical Engineering Reaction Kinetics (3) Chemical reaction rates in closed and flow systems; interpretation of laboratory and pilot plant data; reactor design. Prereq: 3420, Chemistry 3430, Thermodynamics of Chemical Equilibrium.

5460 Fluid-Solid Operations (3) Heat and mass transport in fixed and fluidized beds; applications include absorption, ion exchange, crystallization, and drying. Prereq: 3410, Thermodynamics of Phase Equilibrium. 3 hrs. and 1 lab.

5640 Fluid Flow (3) Analysis of flow of single- and multiphase systems, emphasizing analytical and numerical methods. Prereq: 5130, 5140, or consent of instructor.

5730 Mass and Energy Flow in Biological Systems (3) Basic physicochemical and organizational principles applicable to biological systems. Derivations of general equations of bio-mass and energy transfer. Thermodynamics of transport and equilibrium in biological systems. Discussion of Volterra's equation and biological clocks, etc. Prereq: Consent of instructor.

5740 Introduction to Transport Phenomena in Biological Systems (3) Application of principles of transport phenomena to biological systems. Transfer of chemical energy and various cellular active transports; structure and rheology of physiological fluids, membrane and interfacial phenomena; analysis and design of artificial organs. Prereq: 3440, 3450 or consent of instructor.

5750 Microbiological Process Engineering (3) Application of chemical engineering principles and design concepts to microbiological processes. Feed-back control; control of chemical and food processing and pharmaceutical processes. Prereq: 3440, 3450 or consent of instructor.

5760 Principles of Biochemical Separation (3) Fundamental aspects and similarities of modern biochemical separation methods; classroom demonstrations, design of production and analytical systems. Prereq: Consent of instructor.

5781-82-83 Topics in Biotechnology (3, 3, 3) Problems of current interest in biotechnology. Prereq: Consent of instructor.

5810-20-30 Special Problems in Chemical Engineering (3, 3, 3) Chemical engineering problems related to recent developments in industrial practice. Prereq: Consent of instructor.

5900 Thesis

5111 Chemical Engineering Analysis (3) Mathematical formulation and solution of differential equations arising in chemical engineering, especially those of heat and mass transfer. Linear and non-linear methods, classical solution techniques, conformal mapping. Prereq: Differential Equations.

5120 Heat Convection (3) Analysis of heat

connection in fluids under viscous and turbulent flow conditions; analytical and numerical approaches; simultaneous diffusion of momentum and heat. Prereq: 5111.

5130 Methods of Optimization (3) Principles and applications of various mathematical programing techniques to chemical process design and control; variational method, maximum principle, dynamic programming, and geometric programming. Prereq: 4410, 4590.

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

5250 Chemical Process Industry Economics (3) Analysis of the economic components of chemical processes, of the internal economics of the chemical enterprise, and of decision making for investment in capital facilities. Prereq: 4120-30, 4410.

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

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

5410-20-30 Research and Design in Chemical Engineering (3, 3, 3) Selected directional operations on the study of chemical engineering problems. Prereq: 3440-50.

5420 Process Design and Economic Analysis (3) Low, medium, and high pressure processes for conversion of fossil fuel raw materials and products, specialized characterization of physical properties of fossil fuel raw materials and products, and of processes for conversion of fossil fuel raw materials into products needed in industrial energy, industrial raw material and consumer markets. Prereq: 3440.

5430 Chemical Engineering Reaction Kinetics (3) Chemical reaction rates in closed and flow systems; interpretation of laboratory and pilot plant data; reactor design. Prereq: 3420, Chemistry 3430, Thermodynamics of Chemical Equilibrium.

5440 Fluid-Solid Operations (3) Heat and mass transport in fixed and fluidized beds; applications include absorption, ion exchange, crystallization, and drying. Prereq: 3410, Thermodynamics of Phase Equilibrium. 3 hrs. and 1 lab.

5450 Fluid Flow (3) Analysis of flow of single- and multiphase systems, emphasizing analytical and numerical methods. Prereq: 5130, 5140, or consent of instructor.

5460 Fluid Flow (3) Analysis of flow of single- and multiphase systems, emphasizing analytical and numerical methods. Prereq: 5130, 5140, or consent of instructor.

5470 Microbiological Process Engineering (3) Application of chemical engineering principles and design concepts to microbiological processes. Feed-back control; control of chemical and food processing and pharmaceutical processes. Prereq: 3440, 3450 or consent of instructor.

5480 Principles of Biochemical Separation (3) Fundamental aspects and similarities of modern biochemical separation methods; classroom demonstrations, design of production and analytical systems. Prereq: Consent of instructor.

5490-82-83 Topics in Biotechnology (3, 3, 3) Problems of current interest in biotechnology. Prereq: Consent of instructor.

5500 Thesis

5511 Chemical Engineering Analysis (3) Mathematical formulation and solution of differential equations arising in chemical engineering, especially those of heat and mass transfer. Linear and non-linear methods, classical solution techniques, conformal mapping. Prereq: Differential Equations.

5520 Heat Convection (3) Analysis of heat

connection in fluids under viscous and turbulent flow conditions; analytical and numerical approaches; simultaneous diffusion of momentum and heat. Prereq: 5111.

5530 Methods of Optimization (3) Principles and applications of various mathematical programing techniques to chemical process design and control; variational method, maximum principle, dynamic programming, and geometric programming. Prereq: 4410, 4590.

5540 Process Dynamics (3) Generalized analysis of recycle operations, steady state simulation and optimization of typical processes.

5550 Chemical Process Industry Economics (3) Analysis of the economic components of chemical processes, of the internal economics of the chemical enterprise, and of decision making for investment in capital facilities. Prereq: 4120-30, 4410.

5560 Thermodynamics of Heterogeneous Equilibrium (3) Phase rule; equilibria between phases; composition relationship between phases; ideal and non-ideal solutions. Prereq: Thermodynamics.

5570 Statistical Thermodynamics (3) Basic principles and statistical mechanics and application to evaluation of thermophysical properties. Prereq: 5310.

5580 Research and Design in Chemical Engineering (3, 3, 3) Selected directional operations on the study of chemical engineering problems. Prereq: 3440-50.

5590 Process Design and Economic Analysis (3) Low, medium, and high pressure processes for conversion of fossil fuel raw materials and products, specialized characterization of physical properties of fossil fuel raw materials and products, and of processes for conversion of fossil fuel raw materials into products needed in industrial energy, industrial raw material and consumer markets. Prereq: 3440.

5600 Thesis

6610 Special Topics in Chemical Engineering (3) A variable-content course on special topics of current interest to chemical engineers. Prereq: Consent of instructor.

5290 Biomedical Engineering: Discrete Systems (3) Study of the behavior of biological or medical systems. Emphasis on formulation of problems and methods of solution. Typical applications include stability of jets and formation of emulsions, Benard instability, Maragoni turbulence. Prereq: 5810 and 5620 or equivalent.

6510 Applied Chemical Reaction Kinetics (3) Chemical reactions in both gas and liquid phases as well as heterogeneous catalysis, catalyst effectiveness and the role of transport in kinetics. Emphasis is on development of a phenomenological description although mechanisms of reactions are discussed. Prereq: 5510.

5520 Catalytic Reactor Design (3) Principles of kinetics, heat and mass transfer applied to the design and analysis of heterogeneous catalytic reactors. Prereq: 5620.

5610 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 and correlation of models by specification of composition, control of electrical and magnetic properties with service performance. Suggested for mechanical, civil, and industrial engineering students.

5530 Materials Behavior and Chemical Process Systems: Discrete Systems (3) Comprehensive study of the microstructure of solids with mechanical, physical, and chemical properties of engineering significance. 3 hrs and 1 lab.

3120 Engineering Materials I (4) An introductory course in the fundamental aspects of materials technology, including materials of construction and fabrication, structural and thermal treatment; correlation of resultant properties with service performance. Suggested for mechanical, civil, and industrial engineering students.


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

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

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


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

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

4510-20 X-Ray Diffraction and Crystallography (3, 3) Lecture and laboratory work in crystallography, X-rays, properties of single crystals, and polycrystalline materials, kinetics and mechanisms of crystal growth; solidification, precipitation, spinodal decomposition. Prereq: Math 4610.

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

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

4730 Mechanical Metallurgy I (3) Elastic behavior. Description of stress, strain, and elastic constitutive relations. 3 hrs or 2 hrs and 1 lab.

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

4750 Casting and Welding (3) Principles and processes of casting and welding: Heat transfer, solidification, segregation, gas-metal and slag-metal interactions, thermal stresses, associated stresses. Prereq: 3230. 3 hrs or 2 hrs and 1 lab.

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

5000 Thesis

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

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

5130 Plastic Deformation II (3) Plastic deformation of polycrystalline materials; theoretical and experimental observations relating to the geometrically necessary dislocation description of dislocation and point defects and cold work.

5150 Phase Transformations I (3) A survey of crystallographic and phase transformations relating to phase transformations by nucleation and growth; solidification, precipitation, spinodal decomposition. Prereq: 5140.


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

5310 Solidification and Crystal Growth I (3) Solute redistribution, thermodynamic considerations, kinetic, convection, and fluid effects on the solid to liquid transition. Prereq: Math 4590.

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

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

5540-50 Electron Microscopy I and II (3, 3) Kinematic and dynamical diffraction theories are developed and their application to electron diffraction patterns and contrast effect in transmission electron microscopy are discussed. Special attention will be given to advanced applications such as plastic deformation, fracture, precipitation, and phase transformations. Prereq: 4610-20.

5610-20 Radiation Effects on Materials (3, 3) The interaction of radiation with solid matter, radiation-induced changes in physical and mechanical properties, theory and experiment.

College of Engineering 71
The effect of radiation on solid state reactions. Phenomena associated with the use of engineering materials in radiation environments. Prereq: Math 4840, Physics 3730 or consent of instructor.

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

5810-20-30 Special Topics in Metallurgy (3, 3, 3) Lectures and recitation on more recent advances in metallurgy and related fields.

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

5910-20-30 Metallurgical Thermodynamics (3, 3, 3) Application of thermodynamic and physicochemical methods to metals and metalurgical reactions. Relation of theory and experiment to the structure of liquid and solid solutions, and to alloy systems.

6000 Doctoral Research and Dissertation

6110-20-30 Theoretical Metallurgy (3, 3, 3) Study of those phases of solid state physics applicable to metallurgy: lattice, electron mobility, introduction to quantum theory, specific heats, electron theory, electrical and thermal conductivity, magnetic properties. Prereq: alloy formation. Prereq: 4610 or Physics 3720; Math 4550 and consent of instructor.

6210-20-30 Rate Process in Metallurgy (3, 3, 3) Theoretical and practical considerations of rate processes in solids such as diffusion, recrystallization and grain growth, and phase transformations.


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

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

6820 Mechanical and Physical Properties of Crystals II (3) Continuation of Metallurgical Engineering 6610 with emphasis on transport phenomena and irreversible thermodynamics. Prereq: 6810 or consent of instructor.

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

Polymer Engineering

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

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

4930 Principles of Fiber and Textile Engineering (3) Chemical and crystalline structure of important fibers; means for melt and dry spinning of man-made fibers; drawing and texturizing; preparation of yarn; dyeing; weaving and knitting; PERFORMANCE OF ELASTIC PROPERTIES. PREREQ: Senior standing in engineering or science.

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

5000 Thesis

5110 Structural Characterization of Polymers (3) Experimental methods of determining the nature of transition and configurational characteristics of polymers most pertinent to plastics, fibers, and rubber applications. Methods of determination of tacticity, crystalline structure, orientation, and morphology, etc., including x-ray diffraction, nuclear magnetic resonance, and electron microscopy.

5210 Non-Newtonian Fluid Mechanics (3) Tensors and generalized equations of motion; survey of non-Newtonian technology. Prereq: 4920 or Fluid Mechanics. (Same as Engr. Sci. and Mech. 5200.)

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

5240 Yarn and Fabric Mechanics (3) Mechanical behavior of single fibers, deformation mechanisms of continuous filament yarns, researches of fabric, deformation mechanics of woven and knit fabrics.

5510 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 Science (3) Laboratory course in methods of characterization of polymers: includes gel permeation chromatography, intrinsic viscosity, spectral analysis, measurement of melt flow properties, calorimetry, and dynamic mechanical measurements. Coreq: 5310.

5710 Phase Transformations in Polymer Systems (3) Analysis of nucleation and growth of phases in polymeric compositions, and their deformation behavior. Prereq: 4910 or equivalent. (Same as Chem. 5150-60-70.)

6000 Doctoral Research and Dissertation.

6110 Optical Properties of Polymers (3) Maxwell's equations, the electromagnetic equation of light, optical properties of isotropic and anisotropic dielectrics 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 methods of crystal structure determination; Patterson and Fourier functions; helical nets and Bessei function techniques; levels of order, thermal expansions, defects, order-disorder transitions and paracrystallinity. Experimental methods including precision and Weissenberg photographs of single crystal and powder polymers with applications to synthetic and biological macromolecules.

6210 Advanced Continuum Mechanics (3) A survey of the theoretical foundations of continuum mechanics, with special emphasis on comparing the classical mechanics of fluids and of elastic solids; classification and comparison of polymer constitutive equations selected applications, especially in fluid viscoelasticity. Prereq: 5210 or Engr. Sci. & Mech. 5410 or Math 5640 or consent of instructor. (Same as Engr. Sci. & Mech. 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 Polymers (3) Based on researches with an emphasis on developing constitutive equations for the yielding behavior of solid polymers, failure analysis and selected generation of elastic and plastic mechanisms of solid polymers. Relation of microscopic properties to molecular structure.

6610 Advanced Industrial Polymer Chemistry (3) In-depth treatment of chemical and properties of new polymer engineering materials; highly integrated engineering and chemical approach is used. Prereq: Consent of instructor.

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

Civil Engineering

MAJORS

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

Environmental Engineering M.E., M.S.

Emeritus Professors:


Professors:


Northwestern University:

Associate Professors:


*On leave.

DEGREES


MASTER OF SCIENCE PROGRAM
Graduate programs in civil engineering and in environmental engineering leading to the degree of Master of Science are offered to graduates of recognized undergraduate curricula.

Departmental requirements provide that for a major in Civil Engineering, the Bachelor's degree must be in civil engineering, or certain undergraduate prerequisite courses must be taken before admission to candidacy for the Master of Science in Civil Engineering.

CIVIL ENGINEERING
The Department of Civil Engineering offers two options for the Master of Science degree in Civil Engineering.

Option I:
1. A minimum of 45 quarter hours, including at least nine hours of thesis, is required.

Option II:
2. A minimum of 48 quarter hours, including a three-quarter-hour special problem, is required. The special problem will culminate in a written report which must be approved by the student's major professor.

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

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

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

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

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

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

Specific departmental requirements for the Ph.D. degree include the following:
1. A minimum of 108 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 36 quarter hours credit in Doctoral Research and Dissertation will be required.
2. A minimum of 36 quarter hours of graduate courses in the Civil Engineering department, exclusive of thesis or dissertation credit, at least nine hours of which must be 6000-level courses.
3. Supporting courses in related sciences and engineering fields, amounting to approximately 36 quarter hours, subject to approval by the student's faculty committee. These related fields will normally include such subspecialties as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 12 quarter hours of mathematics will be required beyond the civil engineering undergraduate requirements.
4. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.
5. Upon completion of at least one-half of all course work, each student must pass a 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 foundations and floor slabs, footings, and retaining walls. Prereq: Concrete Design and Deflections and Statistically Indeterminate Structures.
4230 Legal and Ethical Aspects of Engineering (3) Legal principles underlying engineering work: laws of contracts, torts, agency, real property; problems of professional registration and ethics.
4240 Structural Design (3) Plastic theory, eccentric connections, industrial building design, timber design, and reinforced concrete design; stress analysis; design of framed structures. Prereq: Design of Framed Structures and Deflections and Statically Indeterminate Structures.
4260 Photogrammetry (3) Methods of plotting maps from aerial photographs; stereoscopic plotting instruments; applications. Prereq: Surveys, or Forestry Summer Camp for forestry majors.
4270 Analysis of Framed Structures (3) Maximum stresses due to moving loads; uses of influence lines; lateral forces due to earthquake and wind; analysis of portals, building frames and space frames.
4340 Construction Methods and Equipment (3) Fundamental aspects of equipment and selection of equipment; production rates, balancing of equipment, and cost estimates.
4510-20 Advanced Structural Design (3, 3) Plastic design in steel in 4510; design of typical short span highway bridges in 4520. Prereq: Design of Framed Structures for 4510; and Concrete Design for 4520.
4530 Cost Comparison in Design and Construction (3) The cost of engineering and construction. The cost comparison of alternate designs with emphasis on applications to civil engineering problems. Prereq: Concrete Design, Design of Framed Structures.
4540 Computer Utilization (3) Computer use, the economic justification, and the extent of its use by industry. The utilization of computers for the solution of civil engineering problems. Prereq: Design of Framed Structures.
4550 Engineering Behavior of Soils (3) Plastic and elastic behavior of soils, determination and use of engineering properties of in-situ soils. Prereq: 5220 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 modifying soils and additives. Prereq: Physical Properties of Soils. 2 hrs and 1 lab.
4620 Airport Planning and Design I (3) Emphasis on airport master planning. Included for consideration on the air side; runway configuration, capacity, geometries and lighting; on the land side are included terminal layout and design, and ground access systems and parking. Prereq: Transportation Planning and Transportation Engineering.
4640 Traffic Engineering (3) Study of the characteristics of the driver, vehicle, and roadway and their interrelationship; traffic studies; basic considerations of traffic circulation and control; elements of urban transportation planning studies.
4660 Airport Planning and Design II (3) Integration and application of the principles of airport master planning for the purpose of site selection and design of an airport facility through a comprehensive team project; also includes environmental evaluation of design. Prereq: 4620. 1 hr and 2 labs.
4710 Portland Cement Concrete Mix Design
ministration of Engineering Projects (3, 3) Fac-
tors of risk; studies: planning and design of
construction projects. Prereq: Materials of
Construction. 2 hrs and 1 lab.
4850 Elementary Structural Matrix Methods
(4) (Same as Engr. Sci. 4850 and Arch. 4850.)
5000 Thesis
5002 Non-Thesis Graduation Completion (2)
Required 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.
5110-20 Statically Indeterminate Structures (3,
3) Deflections of beams and trusses; analysis
by force methods and by slope-deflection in
5110: analysis by moment distribution and
other displacement methods, secondary
stresses in 5120.
5140 Statically Indeterminate Structures (3)
Analysis of curves, beams and space frames.
Prereq: 5110 and 5120.
5150 Matrix Formulation of Structural Prob-
lems (3) Review of matrix algebra, vectors,
statistical mechanics, composition and fea-
tibility analysis of plane trusses, general mem-
bers and structures composed of general mem-
bers. Prereq: 4540 or consent of instructor.
5160 Analysis and Design of Plate Structures
(3) Fundamental theories of bending and buck-
ing of plates; practical application of theories
in analysis and design of bridge and building
floors and structural plate components. Pre-
req: 5110.
5170 Introduction to Structural Dynamics (3)
Analysis of free and forced vibrations, and
transient response of structures having many
degrees of freedom; elastic-plastic behavior
considered for structural systems; approximate
design methods developed. Prereq: 5120, 5150.
5180 Finite Element Structural Analysis (3)
Application of the finite element method to
structural analysis; plane stress, plane strain,
asymmetrical, and three-dimensional elements;
used in 5150 and 5270. Prereq: Math 5820 or 5860. (Same as Engr. Mech. 5180.)
5220 Pavement Design (3) Characteristics of
pavement loads; theory of pavement design;
design criteria, construction, and mainte-
5240 Advanced Properties of Materials: Ce-
ment and Concrete (3) Permeability and dura-
bility; volume changes and creep; elastic and
thermal properties of concrete, special types
of concrete; causes of failure. Prereq: 4710.
5250 Advanced Properties of Materials: Bi-
luminous Substances and Mixes (3) Service-
able materials: construction and mainte-
nance; other uses of asphalt products. Prereq: 4720.
5270 Planning and Transportation (3) Methods
for prediction, control, and operation of trans-
ation elements of comprehensive develop-
ment plans. Analysis of relationships between various transportation
modes; methods of construction and other
community features. (Same as Planning 5270.)
5310 Engineering Practice (3) Valuation and
feasibility studies; depreciation and useful life;
engineering economics.
5320-30 Engineering Practice Applied to Ad-

5890 Traffic Accident Reconstruction (3) The
importance of traffic accident data col-
collection and analysis is discussed as a basis
of designing accident prevention or control
programs. Emphasis is on examining the many
contributing factors to an accident. Proximate
and secondary accident causes will be dis-
cussed; they may need to be road improvement
measures. Prereq: 4640 or 5810 or consent of in-
structor.
5900 Special Problems in Civil Engineering
(1-9) Study of a civil engineering topic to fulfill
the special problem requirement in the min-
thesis program. EnROLLMENT limited to civil engineering students who have completed the thesis program. May
be repeated. Maximum 9 hrs. S/N only.
5910-20-30 Special Topics (3, 3, 3) Analysis
and design of certain civil engineering struc-
tures not included in other courses such as
arches, long span and movable bridges, com-
plicated trusses, etc.
6000 Doctoral Research and Dissertation
6610 Behavior of Steel Bridges and Buildings
(3) Behavior, analysis, and design of plate
girders, columns and composite members sub-
jected to static and dynamic loading. Prereq:
5170 and 5610.
6740 Behavior of Reinforced Concrete Beams
and Frames (3) Ultimate strength and behavior of
reinforced concrete members; relation between
research results and current specifications for
design. Prereq: Design of Framed Structures
5730 Prestressed Concrete (3) Properties of
prestressing materials and anchorages; methods
of analysis and design; properties of prestres-
sing; analysis and design of members and con-
tinuous structures.
5740 Behavior of Reinforced Concrete Mem-
bers (3) Ultimate strength and behavior of re-
inforced concrete members; relation between
research results and current specifications for
design. Prereq: 4120.
5800 Urban Systems: Engineering and Man-
agement (3) The study and management of
the urban systems in general such as water,
sewerage, refuse collection, etc. Prereq:
Graduat-
ing standing or consent of instructor.
5810 Traffic Engineering-Characteristics (3)
Theoretical and practical considerations of the
characteristics of the driver-vehicle-roadway
system; level-of-service concept of capacity.
Coreq: Sociology 3450 or 5111. 1 hr and 2
hr lab.
5820 Traffic Engineering-Operations (3) Fixed-
time and volume-density controllers; progres-
sion systems; one-way operations; reversible
flows; systems of computerized and possible
researched networks; legal aspects of operational
controls. Prereq: 5810. 2 hrs and one 2-hr lab.
5840 Geometric Design (3) Advanced theory
and procedures for geometric design of high-
ways. Prereq: Highway Engineering I.
5850 Functional Design of City Streets and
Urban Freeways (3) The effect of street systems
upon urban growth and development; classi-
fication and function of streets; design fea-
tures, including cross-section, intersections,
utility considerations, parking, effect of mass
transportation; channelization; marketing; light-
ing; the freeway, frontage road, surface street
system. Prereq: Consent of instructor.
5860 Urban Transportation Planning (3) The
use of various models for the prediction of traffic
flows and vehicular flow; land use planning;
practical problems. Prereq: 5860.
5870 Public Transit Planning (3) The
planning process and procedures for the study of
person movement by mass transit and taxicab tran-
sit. Also includes the nature of public transit;
its various roles; the public service and the com-
"nity's need; user preferences; modal split;
and the total social, political, eco-
omic and financial impacts of public transit.
Prereq: Highway Engineering I or graduate
standing.
6880 Planning Models for Transportation Sys-
tems I (3) An analytical analysis of modal gen-
eration employing mathematical, statistical,
and computer science techniques. Also an
introduction to modal split, trip distribution,
and trip assignment will be made. These
statistical procedures are integrated into the
urban transportation planning process. State-
of-the-art and new modeling techniques are
investigated. Prereq: 5560 or 5270, Math 5150 and Stat. 3450.
6890 Planning Models for Transportation Sys-
tems II (3) An analytical analysis of modal split,
trip distribution, and trip assignment. Mathematical, statistical, and computer science techniques are used in the modelling process.
These models are integrated for use in the
urban transportation planning process. Prereq:
5870.
6910-20-30 Special Topics in Civil Engineer-
ing (3, 3, 3) Selected advanced problems of cur-
rent interest in civil engineering. Prereq: Con-
sent 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 man's interaction with the air, water, and land environment in which he has taken the role of engineering in environmental control.


4150 Urban Water Management (3) Introduction to urban water modeling; evaluation of optimum urban water policies; formulation of system constraints and analysis of decision-making process; management of storm water for beneficial use. Prereq: 3000 and Elementary Hydrology.

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: Consent of instructor.

4220 Water Resources Engineering Development (3) Prereq: Resource development; single or multipurpose planning; economics in alternate decisions; principal water values; multiphase evaluation procedures for water and resource projects; Tennessee water laws; principal topics of current interest. Prereq: Consent of Instructor.

4330 Hydrologic Design (3) Application of frequency and regression analysis to hydrologic design of water resource systems; steadystate surface runoff and streamflow modeling; urban peak runoff design using kinematic wave theory; evaluation of effects of land use changes on streamflow and quality. Prereq: Elementary Hydrology.


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

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

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

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

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

5000 Thesis

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise eligible for graduation. May not be used toward degree requirements. May be repeated for credit. Prereq: Consent of instructor.

5150 Water and Urban Warfare (3) Evaluation of social, environmental, and economic impact on planning and management of urban water systems. Emphasis upon conflict and choice, reconciliation of competing needs, and development values, measurement of social well-being and quality of life parameters. Procedures for analyzing multi-objective policy alternatives with selected case studies. Prereq: Consent of instructor.

5160 Planning and Utilities (3) Planning for adequate water supply, sewage waste disposal in the urban environment. The impact of utility patterns on area development, and the flowing water; utility, service policies. Not for civil engineering majors. (Same as Planning 5160 and Water Res. Development 5160.)

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

5210 Advanced Water Resources Engineering (3) Complex problems encountered in water resources engineering such as water hammer, surgery, damping, soil erosion, etc. Analysis of such problems preliminary to design of complex water resources structures.


5232 Sediment Transportation (3) Sediment properties and transport measurements; bed loads and suspended load movement; erosion, scour, transportation and deposition of sediments by flow phenomena of reservoirs and related topics. Prereq: 5230.

5234 Flood Damage Reduction (3) Survey of national, regional, 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 approaches; floodplain management; case studies. Prereq: Consent of instructor.

5261 Basic Principles of Remote Sensing (3) Introduction to the applications of remote sensing in agriculture, engineering, forestry, meteorology, civil engineering, resource management; properties of electromagnetic radiation including wave theory, physical and geometrical optics, propagation of EM radiation and matter; current data handling technology. Prereq: Consent of instructor.

5262 Remote Sensing Data Acquisition (3) Theory of active and passive sensors, their areas of special application and limitation; including the Earth Resources Satellite Communications (ERSAT) planning. Prereq: 5261 or consent of instructor.


5301 Stormwater Modeling (3) Interpretation of hydrologic data using mathematical techniques. Hydrologic components are analyzed as linear and non-linear systems and integrated into mathematical models using simulated response. Methods are presented for optimizing model parameters with illustrative examples. Prereq: Consent of instructor.

5302 Stormwater Modeling II (3) Continuous streamflow records are interpreted using methods of systems analysis, including flow frequency and time series analysis. Hydrologic design of water resources systems using streamflow data. Analytical techniques including autoregressive and fractional gaussian noise models. Prereq: Consent of instructor.

5310 Groundwater Transport Processes (3) Dynamics of flow in porous media with emphasis on phreatic, unsaturated, and saturated flow phenomena. Analytical solutions of flow equations, Dupuit approximation, analog and numerical methods, Hele-Shaw, and graphical solutions. Prereq: Fluid Mechanics or consent of instructor.

5330 Descriptive Hydrology (3) Occurrence and description of elements of the hydrologic cycle, their effects on earth and its relation to man. Not for civil engineering majors. (Same as Water Res. Development 5330.)

5501 Water and Wastewater Treatment Theory I (3) Theory of unit operations employed in sanitary engineering. Prereq: 5200.

5502 Water and Wastewater Treatment Theory II (3) Theory of physical, chemical, and biological processes employed in sanitary engineering. Prereq: 5501.

5513 Advanced Water and Waste Treatment Systems (3) Prereq: 5501. Focus centers on the relationship between environmental engineering and natural system behavior by focusing on eutrophication and the limiting nutrient concept in relation to the subject and its translation into law and wastewater engineering practice. Course conduct is in the seminar—open discussion format which actively involves all student participants. Prereq: Graduating or consent of instructor.

5551 Water Quality Management (3) Water quality control objectives, methods, and philosophies; water quality criteria; effect of various uses on water quality; receiving water characteristics and impact; regulatory standards; economic considerations. Prereq: 3000 or consent of instructor.

5551 Aquatic Environment Pollution (3) A study of the effects resulting from agricultural, municipal, and industrial pollution upon the environment; its effects on earth and its relation to man. Not for civil engineering majors. Prereq: 5551.

5582 Microbiology for Sanitary Engineers (3) A study of microorganisms and microbiological processes which are significant in sanitary engineering, including basic microbiology, detection and identification, enzymes, metabolic reactions, and growth; aerobic and anaerobic biological treatment processes. Prereq: Graduating or consent of instructor.


5600 Solid Waste Systems (3) Magnitude and characteristics of the solid waste problem; methods for the collection and disposal of solid wastes, including sanitary landfill, incineration, composting, and recycling. Prereq: Graduate engineering major or consent of instructor.

5610 Solid Waste Disposal (3) Engineering design course in solid waste disposal. Problems in the areas of landfill design and costing, College of Engineering 75

5700 Planning and Air Pollution Control (3) The relationship between air pollution, area development, and urban growth. Social, economic, and political processes involved in air pollution control. Prereq: 5700 and Fluid Mechanics.


5720 Air Pollution Particle Collection Theory (3) The mechanics of particles suspended in a gaseous medium including particle motion, coagulation, and aerodynamic capture of particles. Prereq: 4700 and Fluid Mechanics.

5730 Air Pollution Control Device Design (3) Design and evaluation of systems used to control the emission of gaseous and particle pollutants. Computer-aided design of specific devices and systems. Prereq: 5720.

5740 Dynamical and Physical Meteorology (3) Fundamental physical principles of the atmospheric sciences are developed. Specific topics include atmospheric energetics, general circulation, turbulence, and convective heat transfer. Prereq: 5730. Offered even years.

5800 Advanced Theory in Environmental Engineering (3) Advanced theory in environmental engineering. Prereq: Consent of instructor. May be repeated. Offered odd years.

5900 Special Topics in Environmental Engineering (3) Specialized topics in environmental engineering. Prereq: Consent of instructor. May be repeated. Offered odd years.

5950 Industrial Waste Treatability and Process Control (6) Sources and characteristics of industrial wastes; treatment alternatives related to ultimate disposal. Techniques and processes used in chemical, biological, and physical treatment processes. Prereq: 5950 or equivalent. Offered even years.


6500 Industrial Waste Treatability and Process Control (6) Sources and characteristics of industrial wastes; treatment alternatives related to ultimate disposal. Techniques and processes used in chemical, biological, and physical treatment processes. Prereq: 5950 or equivalent. Offered even years.

6620 Advanced Theory and Applications in Water Resource Dynamics (3) Advanced theory and applications in water resource dynamics. Prereq: 5950 or equivalent. Offered odd years.

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ELECTRICAL ENGINEERING

MAJOR

DEGREES

Electrical Engineering

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

Professors:

Associate Professors:
A. E. Bishop, Ph.D. Clemson; R. C. Gonzalez, Ph.D. Florida; E. L. Hell, Ph.D. Missouri; H. M. Loring, Ph.D. Nebraska; R. E. Perl, Ph.D. Auburn, P.E.; M. O. Pace, Ph.D. Georgia Institute of Technology; D. Rosenberg, Ph.D. New York; H. M. Sojui (Emeritus), M.S. Columbia, P.E.; F. M. Sholner, Ph.D. Tennessee, P.E.; F. W. Symonds, Ph.D. Nottingham (UK).

Assistant Professors:

MASTER OF SCIENCE PROGRAM

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

Specific departmental requirements include:
1. Electrical Engineering 5070-80 and 5710. Elect. Eng. 5710 is normally available in both fall and spring quarters. Students electing courses such as 5650-60, 5720-30, or 5750-60 which require 5710 as a prerequisite should register for 5710 in the fall quarter.
2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics 4710, 4550, and 4250, or 4510-20-30. Other approved 4000-5000 level mathematics courses must be substituted for any of the above course material covered in undergraduate work.
3. An additional 18 quarter hours of 5000-level work in electrical engineering or nine quarter hours of 5000-level work in electrical engineering and nine quarter hours in another approved area.
4. Master's thesis, totaling 9 quarter hours or more.
5. A final oral examination covering the thesis and related course work.

MASTER OF ENGINEERING PROGRAM

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

Specific degree requirements which must be met include:
1. Electrical Engineering 5070-80 and 5710.
2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics 4710, 4550, and 4250, or 4510-20-30. Other approved 4000-5000 level mathematics courses must be substituted for any of the above course material covered in undergraduate work.
3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in electrical engineering and 9 quarter hours in another approved area.
4. Master's thesis, totaling 9 quarter hours or more.
5. A final oral examination covering the thesis and related course work.

A minimum of one-third of the program must be in engineering design, and one-third in one of, or a combination of, advanced math, computer sciences, basic sciences, or engineering sciences.

DOCTORAL PROGRAM

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

Specific departmental requirements for the Ph.D. degree include the following:
1. A minimum of 72 quarter hours of course work excluding thesis, research, and dissertation credit.
2. A minimum of 36 quarter hours credit in doctoral dissertation.
3. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.
4. Satisfactory performance on both a written and an oral preliminary examination.
5. Participation in departmental seminars.

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

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

b. A minimum of 12 quarter hours of 6000-level course work. At least three quarter hours of this work must be in an area other than the student's major area.

c. A minimum of 18 hours of mathematics at the 4000-level or above. Mathematics (or Physics) 5610-20-30 is usually required.

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.

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

3010 Transient Analysis (3) Analysis of transient response of networks and systems; Laplace transform method and classical differential equation methods for system analysis; complex frequency concept and pole-zero concepts; applications to engineering problems. Prereq: Circuits III.


3050 Basic Field Theory (3) Forces between charges, electric and magnetic fields, Gauss' law, divergence, potential and line integrals, material bodies, polarization, magnetic circuits, Maxwell's equations, dynamic potentials, and wave relations. Prereq: Multivariable calculus and linear algebra.

3060 Propagation I (3) Plane waves, reflection, guided waves, transmission lines, standing waves, impedance, and impedance matching, graphical methods, rectangular wave guides. Prereq: 3050, 4 labs.

3080 Energy Conversion (3) Magnetic circuits, transformer theory and operation, principles of electromechanical energy conversion with emphasis on input-output characteristics; steady-state analysis of induction motors and d.c. machinery. Prereq: 3040, 4 labs.

3090 Energy System Operation (3) Synchronous machines, and transformers as power system elements; power system representations, per unit calculation, symmetrical components, and fault studies. Prereq: 3060, 4 labs.


3110 Basic Electrical Engineering-Circuits and Fields (3) For non-electrical engineering majors. 4 labs.

3120 Basic Electrical Engineering-Electronics (3) For non-electrical engineering majors. Prereq: 3110. 4 labs.

3130 Basic Electrical Engineering-Machinary (3) For non-electrical engineering majors. Prereq: 3110. 4 labs.

3140 Logic Design of Digital Systems (3) Introduction to boolean algebra and design of combinational circuits. Present state and flipflop characteristics. Design of clocked sequential circuits and other systems containing memory. Introduction to minicomputer architecture and system components to include basic structure and function of Arithmetic, Storage, Instruction/Output, and Control Systems. Instruction set capabilities and machine language programming. Prereq: 3010, Computer Science 3160, 4 labs.

3190 Plasma I (3) Engineering applications of physical electronics, plasma effects and devices. Topics include: plasma sources, plasma and plasma light sources, laser operation and applications (electro-optics), and MHD control of thermonuclear and other techniques used in advanced power production. Prereq: Fundamentals of Physics: Electricity, Waves and Optics, Modern Physics, 4 labs.

3270 Linear Systems Analysis (3) Review of steady-state and transient response; load-fluctuations; characteristics of diodes; rectifiers and diode switches. Prereq: Circuits III, 3540 concurrently. 4 labs.

3280 Electronics II—Basic Electronic Devices (3) Characteristics and equivalent circuits of vacuum tubes and transistors with application to amplifier and control circuits. Prereq: 3810. 4 labs.

3920 Direct Electric Energy Conversion (3) Basic principles, typical devices and applications for the production of electrical energy by thermostatic effects, thermionic conversion, magnetohydrodynamics, solar cells, and fuel cells. Laboratory demonstrations. Prereq: 3050, 3190, 3810, and ME 3530.

4080 Microwave Circuits and Electronics (3) Circuits represented by wave shattering, isolators, gyrators, couplers, microwave vacuum diodes and diode detectors, active filters, attenuators, parametric amplifiers, power generator semiconductors, varactor semiconductors. Prereq: 3060, 4 labs.

4090 Propagation (3) Metal tube, dielectric rod, and stripline waveguides. Waveguide resonators and other loading components. Design of structures utilized for microwave power transmission and microwave waveguides. Prereq: Microwave waveguide. Prereq: 3060. 4 labs.

4100 Digital Communication Systems (3) Principles of pulse and digital communication systems. Design and implementation of pulse amplitude, frequency, and phase modulation methods. Quantization, coding, and pulse code modulation.


4630 Digital System Organization and Design (3) Considers system organization of digital systems including minicomputer and microprocessor architectures and comparisons. Characteristics of ALU and CPU structures, storage elements, I/O devices, etc. Prereq: 3180. 4 labs.

4650 Bioelectronic Instrumentation (3) History and origin of bioelectro potentials, transducers, amplifier requirements, recording systems, and noise problems.

4680 Electronic Power Amplifiers (3) Transistor and vacuum-tube power amplifiers; distortion, thermal considerations; r.f. power amplifiers; regulators. Prereq: 3830. 4 labs.

4690 Communications Electronics (3) Oscillation, modulation and demodulation; basic communication systems. Prereq: 3830. 3 labs.

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

4710 Integrated Circuits (3) Processing and fabrication of active and passive components for monolithic and hybrid circuits. The design of bipolar, metal-silicon, and hybrid circuits packaging, reliability, and large scale integration. Prereq: 3920.

4780 Synchronous Machines (3) Development of theory and mathematical treatment. Applications to analysis of steady state and transient operation. Excitation and governor control.


4800 Hardware-Software Interface in Minicomputer and Microprocessor System Design (3) Presents minicomputer and microprocessor interface design systems. Prereq: 3830. 4 labs.

4810 Discrete-Data Systems (3) Introduction to the analysis and design of discrete data communication systems. Real-time digital signal processing techniques, application of digital computers in closed-loop feedback systems.

4820 Introduction to Pattern Recognition (3) Robust pattern recognition techniques for the work of artificial intelligence. Principal topics dealing with the design of learning and adaptive machines. Typical applications of pattern recognition to problems of practical significance. Computer simulation and elementary pattern recognition problems. Prereq: Either 3180 and 3830, or Statistics 3450 and Introduction to Computer Science.


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

4910-20-30 Special Electrical Engineering Problems (3, 3, 3) Problems in electrical engineering involving library or laboratory research.

5000 Thesis

5640-56-60 Electrical Engineering Research (3, 3, 3)

5670-60 Modern Transform Methods (3, 3) Laplace transforms, Fourier transforms, and other continuous transforms. Z-transform, difference equations and distributed parameter systems.


5170 Bioengineering Systems I Models, Systems Analysis and Simulation (3) Modeling techniques applied to biological systems. Systems properties of resistance, impedance, and storage are investigated. Analog and digital simulation of biological systems. Prereq: 4370 or consent of instructor.

5180 Bioengineering Systems II Bioelectric Phenomena (3) A study of the electrical phenomena associated with biological systems both as stimuli and responses. Quantitative theories in neurophysiology and electrocardiography are investigated. Coreq: 4550 or consent of instructor.

5190 Bioengineering Systems III Instrumentation and Analysis (3) An investigation of the process by which information is gathered and transmitted from a biological system under test and the process by which this information is treated, as to signal analysis and modeling, in order to maximize the yield of meaningful information about the original biological system. Prereq: 4660 or consent of instructor.

5200 Advanced Electrical Machinery (3, 3) Fundamentals of electromechanical energy conversion; application in conventional devices. Differential equations for rotating machines. Park's equation and the two-axis model; with emphasis on the transient behavior of isolated and interconnected rotating machines. Prereq: 4780 or equivalent.

5230 Advanced Electrical Machinery Applications (3) Linear motors; pole amplitude modulation; other means of variable frequency operation. Prereq: 5210.

5240-50-60 Control Systems (3, 3, 3) Analysis and design of continuous and digital control systems using classical and modern techniques. Discussed are feedback theory; system modeling; stability analysis; system response analysis; design of feedback systems; system compensation; etc. Emphasis is placed on the engineering aspects of control systems. Coreq: 3070 or equivalent.

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


5330 Engineering of Fusion (3) Materials in a thermal confinement environment and magnetic field production. Divertor Design. Blankets and Breeding of Tritium. Radiological Safety. Cost of Controlled Fusion Power. Prereq: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.


5390 Application of Quantum Electronic Devices (3) Coherence properties of laser radiation and "best-frequency" experiments. Use of lasers in communication systems. Specific application examples: plasma diagnostics, Raman emission spectroscopy, optical harmonic generation, holography, metal-working, and biological applications.
medical uses. Prereq: 5340 and Math 4710 or equivalent.

5370 Advanced Direct Electrical Energy Conversion I (3) Theory, latest devices and applications for production of electrical energy by the solid state means of thermoelectric and photovoltaic effects. Prereq: 4202 or ME 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. Emphasis is placed on the gaseous means of thermionic, magnetohydrodynamic, and electro-gas-dynamic effects. Prereq: 4202 or ME 4150, or equivalent, or consent of instructor.

5390 Advanced Direct Electrical Energy Conversion III (3) Prereq: 5370 and 5380, or equivalent.

5410 Power System Networks (3) Sequence impedances for transmission lines, machines, and transformers. Formation of system network characterization such as a transient, a steady state, and a constant state. Computer methods are emphasized. Graduate standing or consent of instructor.

5420 Fault and Load Flow Studies (3) Analysis of a power system under both shunt and series compensations. Computer methods for fault studies are included. The load flow problem is formulated with computer methods emphasized. Prereq: 5410 or consent of instructor.


5440 Distribution Systems (3) Electric power distribution to the premises of a residence to utility systems. System growth and planning, concepts of regulation and classification. Prereq: 4140, 4220, 4430 or equivalent.

5460 Selected Topics in Power Systems (3) Courses will be offered to meet special needs of students. Possible topics: (1) power systems reliability, (2) interconnected system theory, (3) power plant operation, (4) electrical transients in power systems, and (5) power system relaying. Prereq: Consent of instructor may be repeated with consent of department.

5510-20-30 Linear Active Circuits (3, 3, 3) Analysis and design of linear amplifiers; includes a mathematical treatment of active devices and structures. Includes the circuits, sources of distortion, wide-band and pulse amplifiers, and a detailed treatment of feedback amplifiers utilizing pole-zero and root-locus techniques. Types include audio, video, pulse, driver, operational, and distributed amplifiers. Coreq: Math 4510 or 4710.

5570-80-90 Electronic Switching Circuits (3, 3, 3) Switching circuits using active devices; includes clipping circuits, clamping circuits, comparator circuits, logic circuits, multivibra tors, negative-resistance circuits, time-base generators, blocking oscillators, gates, counting and timing circuits, synchronizing circuits and circuits for frequency division. Emphasis is placed on the transient response and high-speed operation. Coreq: Math 4510 or 4710.


5615-25 Introduction to Switching Theory and Logic Design (3, 3) Boolean algebra and applications. Combinational switching circuits. Sequential machines. Information structures and sub-systems. For computer science majors and those without prior experience in hardware and logic design. Prereq: Elementary linear algebra, basic concepts of sets and of real variables. Includes a laboratory (4 labs/quarter).


5650-60 Electronic Communication Systems (3, 3) Theory of information transmission in communications systems; mathematical treatment of modulation and demodulation in analog and pulse-type systems. Bandwidth requirements, noise, system performance in noise. All modern systems are considered and compared with emphasis on digital data systems. Prereq: 5610-25-35.

5670-90 Introduction to Pattern Recognition (3, 3) (Same as Computer Science 5840-50).

5690 Introduction to Artificial Intelligence (3) (Same as Computer Science 5210).

5710 Random Process Theory for Engineers (3) Probability and random variables as approaches by set theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral analysis as applied to response of systems to random signals.


5740 Digital Processing of Signals (3) Analysis of discrete signals; sampling theorem and its implication; frequency domain design of digital filters; quantization effects; processing of digital signals; discrete Fourier transform. Prereq: 4910.


5770 System Identification (3) Presentation of various identification schemes including deterministic, stochastic, and hierarchial methods. This course has particular applications in all areas of engineering and science. Prereq: Consent of instructor.

5800 Power Transmission Lines (3) New and unconventional power transmission systems. Transmission line parameters for overhead and underground lines. Corona and radio interference problems in the design of high voltage transmission. Incidence of high voltage transmission insulation and coordination and protection. Design procedures for high voltage transmission. Prereq: 4410-20-30 or equivalent.

5810-20 Electromagnetic Fields (3, 3) Vector analysis of electromagnetic fields, special relativity, plane waves, reflections, waves in anisotropic media, guided waves, rectangular and cylindrical waveguides, and the transmission of waves through current elements. Coreq: Math 4510 or 4710.

5830 Linear Antennas and Antenna Arrays (3) The Hertzian dipole, linear antennas, impedance, loop antennas, receiving antennas, linear arrays. Prereq: 5820.

5840 Aperture Antennas (3) Huygens principle, equivalent currents, Fourier transform and the concept of spatial harmonics, lens and reflector antennas. Prereq: 5820.

5850 Microwave Electronics (3) Space charge waves on electron beams, coupling between beams and space-charge waves, klystrons, magnetrons, traveling wave amplifiers and backward wave oscillators. Prereq: 5820.

5860 Electromagnetic Wave Propagation (3) Supplementary studies in wave propagation in isolation and applications of waves, ferrite, media, transmitted power, stored energies, propagating and non-propagating modes, orthogonality properties, bounded and radiation conditions, sources. Prereq: 5820.

5870 Introductory Microwave Networks (3) Circuit equivalents for n-port, junctions, obstacles, loading and fillings. One way and two way devices, directional devices, parameter measurements, reflection charts. Prereq: 5810. Coreq: 5820.

5840-50 Advanced Small Computer Systems (3, 3) Real-time applications, memory and CPU organization, interface software, and peripheral devices of minicomputer and microprocessor system are studied. Courses are project-oriented and supported by hardware and software interface design. Prereq: 4850 or consent of the instructor.

5890-50 Advanced Direct Electrical Energy Conversion I (3, 3) Theory, latest devices and applications for production of electrical energy by deterministic inputs; treatment of discrete-data, non-stationary and nonlinear systems. Prereq: 5080-70-80 or equivalent.

5250 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: 5080 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.

6270-80-90 Special Topics in Control Systems Theory (3, 3, 3) Advanced problems of current interest continuing developments of new developments as found in current literature. Prereq: 5240-50-60 and consent of instructor.


6550-10 Electrical Conduction in Gases and Plasma Physics (3, 3) (Same as Physics 6560-10).


6560 Advanced Antenna Theory (3) Theory of the cylindrical dipole. Hallen's equation, King's integral equation, variational techniques, terminal impedance, and mutual impedance between several dipoles. Prereq: 5610-20 and Math 4920 and 4550.
6660 Electromagnetic Diffraction and Scattering (3) Diffraction of electromagnetic waves by spheres and cylinders, the ground wave propagation problem, introduction to modern approximate methods, creeping waves. Prereq: 5810-20 and Math 4250 and 4550.


6760 Coding Theory (3) Presentation of the mathematical structure of algebraic and probabilistic codes. Included are coding metrics and bounds, linear codes, linear feedback shift registers, convolutional codes, burst-error-correcting codes and decoding methods. Prereq: 5090 or consent of instructor.


Note: All of these courses will not be offered during any one year.

**Engineering Science and Mechanics**

**MAJOR**

**DEGREES**

**Engineering Science**

M.S., Ph.D.

Professors:

W. T. Snyder (Head), Ph.D. Northwestern;

E. H. Reisman, Ph.D. North Carolina State;

J. H. Everett, Ph.D. Iowa State, P.E.;

G. W. Lee, Ph.D. Illinois Institute of Technology;


Associate Professors:

J. E. Akin, Ph.D. Virginia Polytechnic Institute, P.E.; A. J. Baker, Ph.D. New York;

B. D. Dwyer, Ph.D. Illinois, P.E.; T. G. Carter, Ph.D. Illinois, P.E.; D. A. Hobson, B.S.


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

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

In Plan I a minimum of 45 quarter hours, including the thesis, is required. In Plan II a minimum of 48 hours is required. The requirements include the following:

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<th>Hours</th>
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<th>Plan I</th>
<th>Plan II</th>
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<td>9</td>
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<td>18</td>
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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.)

Thesis

*Engineering courses under Plan II may include advanced laboratory work or special problem work, for example E.S. & M. 5910 or analogous courses in other departments.*

A final examination is required under both plans, covering graduate course work and the thesis (if any).
null
to reliability concepts. Characteristics of fail-
5420 Reliability Engineering (3) Introduction
5360 Statistical Methods in Industrial Engi-
design. Topics include the system model, analy-
req or coreq : Statistics 3450.
interpretation of data collected in the applica-
their properties . Methods for the analysis and
5600 Human Factors Engineering (3) Study of
decision making under conditions of incomplete
control and system design. Prereq: 4590 and Computer Science 3150.
5850 Dynamic System Simulation (3) Develop-
5860 Industrial Systems Engineering (3) State
variable methods for analysis and design of con-
current interest. Topics will cover those not covered in other
5910-20-30 Special Topics in Industrial Engi-
neering (3, 3, 3) Special problems for students who are qualified to do individual or group research projects. Prereq: Consent of instruc-
tor. May be repeated. Maximum 9 hrs.
5620 Operations Research Models in Engi-
neering Economy Decisions (3) Review of tra-
tional capital planning and budgeting tech-
iques. Analysis and application of operations research approaches and techniques with emphasis on mathemat-
ical methods, search methods, constrained
5770 Game Theory and Random Processes
5730 Dynamic Programming (3) Techniques
5720 Queuing Models, Inventory, and Simula-
tion (3) Waiting line models and the analysis of
inventory systems. Development of simula-
tion methods and computer simulations applied
to inventory and waiting line problems. The
theory of networks and maximal flow with ap-
plication to transportation and trans-shipment and transportation
problems. Prereq: 5700 and 5360.
5800 Industrial Systems Engineering (3) State
variable methods for analysis and design of con-
pacting as appropriate evaluation criteria are considered. Prereq: 5520, 5710.
5760 Nonlinear Programming (3) Development of
optimization techniques for static and dy-
namic nonlinear systems. Prereq: 5710. Topics include vari-
problems with emphasis on mathematical pro-
gramming and computer simulation. Inter-
relation of these techniques. May be used as a
choice of appropriate evaluation criteria are considered. Prereq: 5520, 5710.
5740 Advanced Topics in Optimization of Dy-
namic Systems (3) Advanced topics in multi-
Stage, dynamic programming. Decision making under certainty and under risk will be considered. Prereq: 5710.
5730 Dynamic Programming (3) Techniques
for solving multistage optimization problems as a sequence of single-stage optimization prob-
problems. Emphasis will be given to apply-
ing optimization theory to solve nonlinear optimization problems. Topics include vari-
metric methods, search methods, constrained
programming and penalty function
methods. Prereq: 5700.
5650 Advanced Economic Analysis (3) Additional topics in operations research including
capital budgeting problems. Various techniques. Emphasis will be given to apply-
ing optimization theory to solve nonlinear optimization problems. Topics include vari-
programming and penalty function
methods. Prereq: 5700.
5770 Game Theory and Random Processes
5720 Queuing Models, Inventory, and Simula-
tion (3) Waiting line models and the analysis of
inventory systems. Development of simula-
tion methods and computer simulations applied
to inventory and waiting line problems. The
theory of networks and maximal flow with ap-
plication to transportation and trans-shipment and transportation
problems. Prereq: 5700 and 5360.
5800 Industrial Systems Engineering (3) State
variable methods for analysis and design of con-
current interest. Topics will cover those not covered in other
5910-20-30 Special Topics in Industrial Engi-
neering (3, 3, 3) Special problems for students who are qualified to do individual or group research projects. Prereq: Consent of instruc-
tor. May be repeated. Maximum 9 hrs.

Mechanical and Aerospace Engineering
GRADUATE STUDY PROGRAMS

Graduate programs with specializations in mechanical engineering or aerospace engineering are available which lead to the degrees of Master of Engineering, Master of Science, and Doctor of Philosophy. In addition to the general policies and requirements of the Graduate School each student must satisfactorily complete a program of study which has been approved by the student’s committee. 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 OF SCIENCE PROGRAMS

Entrance into the Master of Science programs is available to qualified graduates of recognized undergraduate curricula in mechanical or aerospace engineering and to qualified graduates of other curricula who satisfy the necessary prerequisites. 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. 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 (4000-level or above) in mathematics.
   2. A minimum of nine quarter hours of credit in the student’s major department.
   3. Participation in the departmental seminar programs.
   4. Submission and defense of a written thesis which demonstrates the ability to conduct research and report on an independent investigation.
   5. Passing a final examination on all work submitted for the degree.

II. The Course Option

Normally, this program is restricted to those students who have had significant engineering work experience. The evaluation of the work experience and the final selection of the student’s program of study is left to the student’s committee. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
   1. A minimum of 45 quarter hours of course work which includes at least 27 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally nine quarter hours of course work (4000-level or above) in mathematics. No more than three quarter hours of engineering course work may be below the 5000 level.
   2. Participation in the departmental seminar program.
   3. Passing a comprehensive written final examination on all course work submitted for the degree. The student’s committee will be of sufficient size to include all the study areas reflected in the course program.

III. 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 nine quarter hours of course work (4000-level or above) in mathematics.
   2. A minimum of nine quarter hours credit in Selected Engineering Problems (5900). A written report must be presented for each problem investigated.
   3. Participation in the departmental seminar program.
   4. Passing a comprehensive written final examination on all course work submitted for the degree and an oral examination on all work (including problems) submitted for the degree.

DOCTORAL PROGRAM

Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds. The student must satisfactorily complete an approved program of study which normally includes:
   1. A minimum of 72 quarter hours credit beyond the Bachelor’s degree, exclusive of credit for the M.S. thesis or problems.
   2. A minimum of 36 quarter hours of credit in doctoral dissertation.
   3. A minimum of 18 quarter hours in mathematics in courses numbered 4000 or above.
   4. A minimum of 36 quarter hours in mechanical and/or aerospace engineering courses numbered 5000 and above, with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis, problems or dissertation credit.
   5. Participation in the departmental seminar program.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

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

Mechanical Engineering

3000 Energy—An Overview (4)

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

3110 Applied Engineering Thermodynamics (3)

Energy and laws governing energy transformations; thermodynamic properties; applications to engineering problems. Prereq: College physics and calculus.

3311 Engineering Thermodynamics (3)

Energy and laws governing energy transformations; thermodynamic properties.

3330 Engineering Thermodynamics (3)

Properties of gases and mixtures; chemical reactions; equilibrium; applications to mechanical engineering problems.

3410 Fluid Flow (3)

Development of continuity, momentum and energy principles for fluid systems; applications to mechanical and aerospace engineering problems.

3440 Heat Transfer (3)

Heat transfer processes, heat conduction, thermal radiation.

3520-30-40 Thermal Sciences (3, 3, 3)

Fundamental principles of thermodynamics and transport phenomena as applied to engineering design. To be taken in sequence.

3610 Mechanics of Machinery—Kinematics (3)

Machine motions, graphical and analytical methods; instantaneous centers; velocities; accelerations.

3620 Mechanics of Machinery—Dynamics (3)

Newton’s laws; work, energy, impact; single degree vibratory systems.

3630 Mechanics of Machinery—Vibrations (3)

Free and forced vibrations of single and multiple degree vibratory systems. Balancing of machinery.

3650 Introduction to Machine Design (3)

Ductile brittle behavior of materials under static and cyclic loading. Stress concentration, design factors and theories of failure. Changes
in material behavior in processing and fabrication. 2 hrs and 1 2-hr lab.

3660 Manufacturing Processes (3) Selection of metallic and nonmetallic materials 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.

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

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

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

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

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

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

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

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

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

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

4621 Manufacturing Processes (3) Comparison of machining methods; plastics production; metalurgy.

4632 Tool Design (3) Principles underlying tool and fixture design, design of high-volume production tools and molds, work holding fixtures.


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

4625 Manufacturing Process Engineering I (3) Production of precision dimensional analysis of size and form; true position tolerance theory; tolerance analysis; and workplace control for production to tolerance.

4631 Energy Methods in Mechanical Design (3) Application of strain energy principles in complex beams and structures.

4632 Application of Lagrangian Mechanics in Vibration Problems (3) Generalized coordinates and multiple degree of freedom vibrating systems.

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

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

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

4680 Machine Elements (3) Application of strength and properties of materials, design factors, theory of failure to design of cam gears, brakes and clutches, selection of chains and belting.

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

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

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

4730 Thermal Environmental Systems (3) Design of heating ventilation and air conditioning systems.

4810 Internal Combustion Engines (3) Thermo-chemical phenomena in internal combustion and propulsion engines. Combustion, detonation, equilibrium; dissociation. Analysis of internal combustion engines using ideal and real fluids.

4830 Propulsion Systems (3) Design of propulsion engine and supporting systems.

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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.


5120 Convection Heat Transfer (3) Equations of viscous fluid flow, energy equation, convection analysis of internal and external flows including the effects of variable heat flux, surface temperature, and fluid properties. Prereq: 5310 or equivalent.


5140 Phase Change Heat Transfer (3) Prereq: 5120.

5210 Classical Thermodynamics (3) A thorough study of thermodynamic principles with emphasis on First and Second Law analyses, equilibrium criteria, and the thermodynamics of phase relationships. Prereq: Undergraduate thermodynamics.


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

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

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

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


5540-20-30 Experimental Stress Analysis (3, 3, 3) Theory of elasticity; experimental methods; photoelasticity, strain gages, lacquer coatings.

5560-50-60 Advanced Machine Design (3, 3, 3) Design of bearings, gears, shafting, lubrication.

5570-80-90 Dynamics of Machinery (3, 3, 3) Dynamics of machinery; vibrations; balancing; fly-wheels and governors.

5710 Metal Machining (3) Analytical approach to the mechanics of machining. Detailed treatment of basic phenomena, chip formation, friction and wear. Prereq: Undergraduate metallurgy and materials behavior, and heat transfer.


5840-50-60 Turbo-machinery Systems (3, 3, 3) Theory and practice of design, development and systems integration of turbo-engine components. Prereq: First year graduate standing and consent of instructor.

5870 Dynamic Modeling and Simulation (3) Methods of modeling physical systems including mechanical, thermal, hydraulic, pneumatic and electro-mechanical systems. Techniques for experimentally determining system parameters. Analog and digital computer simulation techniques. Prereq: Undergraduate dynamics, heat transfer, and fluid mechanics.

5900 Selected Engineering Problems (3-9) Selected problems in mechanical engineering to fulfill the requirement of the Problems Program. Examination is required to pass the Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.
Aerospace Engineering

4250 Propulsion (3) Principles of propulsion devices; turbojet, ramjet, and rocket engines.

4260 System Design (3) Synthesis of aerospace system. Design report on the system.

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

4510 Aircraft Performance (3) Introduction to aircraft and wing characteristics, drag; propulsion; static performance and maneuvering; theory and design of control surfaces; stability.

4910 Selected Topics in Aerospace Science (3) Current topics in aerospace science; topics in science and engineering required for an understanding of the several areas of aerospace science.

5000 Thesis

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

5110 Fundamentals of Aerodynamics (3) Kinematics and dynamics of perfect fluids; potential flow about a body; conformal mapping; hodographs. Prereq: 4220 or ME 5310, Math 4250.

5120 Experimental Methods in Fluid Mechanics (3) A study of experimental techniques with laboratory experiments; hot wire anemometry and turbulence measurements; flow visualization, wind tunnel tests (supersonic and subsonic), water table experiments, super sonic flow measurements, boundary-layer measurements. Prereq: 4210-20-30 or ME 5310.

5150-60-70 Air Vehicle Aerodynamics and Performance (3, 3, 3) Application of aerodynamics to air vehicles to provide estimates of performance, stability, and control characteristics including wind tunnel tests (supersonic and subsonic), heat transfer, boundary-layer separation, and boundary layer measurements. Prereq: 4220.

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

5240 Dynamics of Viscous Fluids (3) Equations of motion of viscous fluids; laminar and turbulent flow; transition; separation; boundary layer theories; exact and approximate solutions. Prereq: ME 5310 or equivalent.

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

5250 Selected Topics in Aerodynamics (3) Further study of thermo-fluidic, supersonic and hypersonic flow theories.

5270-40-90 Aerospace Ground Test Facilities (3, 3, 3) Atmospheric models and similarity considerations. Aerodynamic test facilities including wind tunnels, shock tubes, hotshot and ballistic ranges; propulsion test facilities for air breathing and rocket engines. Space environment; photovoltaic considerations of space environmental test facilities. Prereq: 5240, ME 5130 and 8230.

5310 Magnetohydrodynamics (3) Review of electromagnetism; fluid flow; chemical kinetics, thermodynamic and thermal properties of gas plasmas; governing equations and applications. Prereq: 4220 and Math 4710.

5340-50 Atmospheric Entry (3, 3) Motion and heating along ballistic and lifting trajectories; dynamic stability; heat protection systems. Prereq: 5220. Recommended: 5240.


5540-50 Aerospace Vehicle Stability and Control (3, 3) Introduction to aircraft stability and control. Static and dynamic stability, control; structural, and aerodynamic characteristics. Coupled modes. Motion with free and fixed control surfaces throughout the flight speed range. Automatic stability and control. Application to missiles. Prereq: 4230 and 5530.

5560 Vertical or Short Take-Off and Landing (VTOL) Aircraft (3) Dynamic stability and control of rotary wing, tilt wing, vectored lift and jet vertical riser type aircraft and control of case. Development of the structural and aerodynamic vehicle. Design and development of flight control and transition flight modes. Simulation facility development and flight testing. High lift airfoils, Automatic control systems. Prereq: 5550.

5570 Aerospace Vehicle Flutter and Vibration (3) Introduction to aeroelastic phenomena. Development of the structural and aerodynamic model. Stability criteria for airflow operating on an oscillating and rotating system and three-dimensional flutter of wings, control surfaces, and engines. Derivation of flight speed range. Prereq: 4220 and 5530.


5610 Applied Acoustics (3) Energy flow in acoustics, general equations of sound propagation in a nonhomogeneous moving medium; sound waves due to turbulence, vertical sound, pseudo sound, propagation and absorption of sound in ducts, instrumentation and measuring techniques. Prereq: Consent of instructor.

5620 Aeroacoustics I (3) Special topics and recent research results in the field of aeroacoustics. Topics cover noise from air-machinery, jet noise, and general theoretical developments, as well as empirical experiments.

5810 Aviation Systems: An Overview (3) Aviation systems, present and future, analyzed with emphasis upon the systems approach. Consideration of the socio-economic base, aerospace and propulsion technology, meteorology, air traffic control, airport-community interface and technological trends and developments pertinent to the present status and future development of air transportation. For non-aerospace and non-mechanical engineering majors only. Prereq: Aircraft Propulsion & Performance.

5820 Air Vehicles (3) Current capabilities and future requirements for air transport vehicles. Consideration of parameters significant for air vehicle type selection. Integration of the air vehicle into the aviation system. For non-aerospace and non-mechanical engineering majors only. Prereq: 5810.

5900 Selected Engineering Problems (3-9) Selected problems in aerospace engineering to furnish the requirement of the Problems Program. Enrollment limited to students in the Problems Program. Prereq: Consent of advisor. May be repeated.

5950 Seminars (1) Discussions on all phases of aerospace engineering, including reports on
current research at The University of Tennessee, Knoxville. May be repeated. S/N only.

5990 Special Topics in Aerospace Engineering Credit to be arranged; 3 hrs maximum each quarter.

6000 Doctoral Research and Dissertation


6320 Magnetochemistry II (3) Continuum magnetochemical equations. Alfvén and shock waves, exact solutions for magnetochemistry channel flows, one-dimensional model of channel flow, thermal, magnetochemical boundary layer. Prereq: 6310, Math 5620.

6330 Magnetodynamics II (3) Engineering applications of magnetodynamics with particular emphasis on propulsion and power generation. Prereq: 6320, Math 5630.

6410 Physical Gasdynamics (3) The fundamentals of high-speed, high temperature flow of a gas from the molecular point of view; models of simple kinetic theory; equilibrium properties of gases and gas mixtures as obtained from steady-state kinetic theory of chemical thermodynamics; and statistical mechanics. Prereq: 5220 and ME 5220.

6420 Physical Gases and Dynamics (3) Continuation of 6410; flows of gas mixtures in local thermodynamic and chemical equilibrium; physical and chemical basis of rate equations; flow with vibrational and chemical nonequilibrium. Prereq: 6410.

6610 Advanced Boundary Layer Theory (3) Derivation and critical review of the governing equations. Asymptotic solutions; similarity solutions; boundary layer transformations. Approximate integral methods to include compressibility and heat transfer. Application of laminar and attached and separated flows; shock-wave-boundary layer interaction. Prereq: 5220, ME 5510, and Physics 5620.

6690 Advanced Topics in Gasdynamics (3) Selected advanced topics in gas dynamics. The selection of topics will be based on the particular interests of the students registering for the course. Representative topics may include non-equilibrium transport phenomena, radiation gas dynamics, non-equilibrium gasdynamic flows, advanced kinetic theory, perturbation techniques. Prereq: Consent of instructor.

Nuclear Engineering

MAJOR

Nuclear Engineering

DEGREES

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

Professors:

P. F. Pasqua (Head), Ph.D. Northwestern, P.E.; W. H. Jordan, Ph.D., California Institute of Technology; P. R. Kasen, Ph.D., Minnesota; T. W. Kerlin, Ph.D. Tennessee; J. J. Mott, Ph.D. Missouri; J. C. Robinson, Ph.D. Tennessee; P. N. Stevens, Ph.D. Northwestern, P.E.

Associate Professors:

H. L. Dedds, Ph.D. Tennessee; J. B. Passefield, Ph.D. Georgia Institute of Technology; H. G. Roland, Ph.D. Tennessee; O. L. Smith, Ph.D. Missouri.

Assistant Professor:

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

MASTER OF SCIENCE PROGRAM

A graduate program leading to a degree of Master of Science is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary background courses before he/she enters the program.

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

1. A major consisting of a minimum of 18 quarter hours of graduate courses in nuclear engineering.

2. A minor of 9 quarter hours in mathematics.


4. Final examination covering the thesis and graduate course work.

An alternate program is available for the Master of Science degree which involves engineering practice rather than a thesis. The student must complete a program of study which includes the following:

1. Thirty-six quarter hours of course work similar to the requirements for the regular Master of Science program (see above) except;

2. Twenty-four quarter hours of Nuclear Engineering 5960, Nuclear Engineering Practice. A student usually registers for 6 hours of Nuclear Engineering 5980 each quarter and investigates problems assigned by his advisor. At the end of each quarter the student submits a written report and makes an oral presentation of the work.

3. Final examination covering graduate thesis, course work and practice school problems.

MASTER OF ENGINEERING PROGRAM

A graduate program in nuclear engineering leading to the degree of Master of Engineering is available to those graduates with an accredited engineering degree or one which satisfies ECPD basic level criteria.

In addition to Graduate School requirements the following degree requirements must be met:

1. 36 quarter hours of course work, 18 of which must be in nuclear engineering.

2. A minimum of 9 hours of design project, thesis, or 24 hours of Nuclear Engineering Practice (5980). Documentary proof of significant engineering experience may be submitted in lieu of the design project, thesis or Nuclear Engineering Practice, but in this case 45 hours of course work are required.

3. Nine hours of course work submitted must be from outside of department.

4. A minimum of one-third of the program must be in engineering design, and one-third in one of, or a combination of, advanced mathematics, computer sciences, basic sciences, or engineering sciences.

5. A candidate must pass a final oral examination on all work presented for the degree.

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 3.5 average in graduate course work. Candidates will be required to demonstrate general competence in the preliminary examination in the areas of engineering science, mathematics, and physics. At the same time, all candidates will be required to demonstrate special competence in nuclear design.

Specific course requirements for the Ph.D. degree in Nuclear Engineering include:

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.

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

3. A minimum of 45 quarter hours in nuclear engineering courses numbered 5000 and above (or the equivalent), with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.

4. A minimum of 18 quarter hours in mathematics or computer science in courses beyond nuclear engineering undergraduate requirements. Must be numbered 4000 or above.

5. A minimum of nine quarter hours in courses numbered 5000 and above from a department other than nuclear engineering. The choice depends on the student's overall program and should be based on his/her knowledge in a given field.

6. A reading knowledge of one foreign language will be determined by the student's doctoral committee.

1110-20-30 Introduction to Nuclear Reactor Theory (3, 3, 3) Nuclear structure; radioactive decay laws; neutron interaction; fission process; chain-reacting systems; diffusion equation including multigroup diffusion theory, neutron moderation, reactivity coefficients; perturbation theory. Prereq: Physics 3730 or consent of instructor.


1210-20-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation, counting equipment, half-life and decay schemes, gamma spectrum, cross-section measurements, analog computation, diffusion properties of neutrons, critical loading experiments, control rod calibration, statistical weight, shielding, xenon poisoning, prompt critical reactor behavior, fissility and adjoint flux. Prereq or Coreq: 4110 or equivalent.

4530 Reactor Simulation Laboratory (3) Simulation of reactor design and operation with analog computer; reactor kinetics: single and multigroup theory, reactivity coefficients, poisoning, control rod calibration; power reactor subcritical assembly. Prereq: 4110.

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

480 Energy Transport (3) Development of differential and integral energy conservation equations; conduction, convection, and radiation heat transfer; applications to nuclear reactor fuel elements and heat exchangers. Prereq: Momentum mass and energy transport.
5720 Reactor Thermal Design (3) Hydrodynamics and heat transfer in boiling systems; boiling crises; fuel element thermal design, steam generator design. Prereq: 4710.

5730 Nuclear Reactor Design (3) First order reactor design, integration with non-nuclear heat transfer and power conversion systems, economic evaluation; optimization procedures, description of typical systems. Coreq: 4130.

5810 Radiation Shielding (3) Types of radiation sources, gamma ray and neutron attenuation, biological effects of radiation, shield design. Prereq: Physics 4270, Math 4160.

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

5480 Nuclear Reactor Safety (3) Presentation of reactor safety concepts and criteria; credible accidents; fission product release and transport; containment systems; accident analysis; engineering safeguards. Prereq: 4120. Coreq: 4730 or consent of instructor.

4920 Nuclear Fuel Management (3) Discussion of problems associated with processing of nuclear materials, fuel cycle analysis; burn-up calculation. Prereq: 4120.

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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 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, Math 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.


5240 Reactor Instrumentation (3) Principles and applications of instrument components and systems for the operation, control, and safety of nuclear reactors; role of instrumentation in public health and safety; engineered safeguards for nuclear power plants. Prereq: 4820, or consent of instructor.

5310-20-30 Nuclear Systems Reliability (3, 3, 3) Principles of system reliability analysis as applied to nuclear systems. Both qualitative and quantitative methods are included. Coreq: Stat 3450.

5710-20-30 Nuclear Design (3, 3, 3) Development and application of analytical techniques for the neutronic aspect of nuclear reactor core design. Techniques considered are multigroup discrete ordinate theory, multigroup P_n theory, integral transport theory, perturbation theory, and others. The generation of the required multigroup constants is formulated starting with the available point data and using the Nordheim treatment in the slowing down region and gas kernel in the thermal region. Prereq: 4130 or equivalent.

5740 Reactor Shielding (3) Application of analytic solutions of Boltzmann transport equation to shield design problems. Spherical harmonics, moments methods, numerical solutions, adjoint calculations, and invariant imbedding cases studied. Prereq: 4810.


5840-50 Fast Breeder Reactors (3, 3) Special characteristics of fast breeder reactors, with emphasis on the LMFBFR. The need for breeders; neutron physics and thermal characteristics of the reactor core; development status of engineering components; fuel cycle cost analysis; safety; coolants other than sodium; world status of development.

5910-20 Advanced Nuclear Reactor Design (3, 3) Factors affecting nuclear reactor design, and optimization with respect to performance criteria. Integration of neutronic, mechanical and thermal flow systems. Cycle, reactor plant cost estimating.

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 the Nuclear Engineering department. May be repeated. Only the 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) Special topics related to reactor theory such as transport theory, control rod theory, and perturbation theory. Selected topics from the literature. Prereq: Consent of instructor.

6140 Radiation Shielding (3) Advanced topics in radiation shielding. Monte Carlo techniques and space radiation problems. Natural space radiators, energy-source radiators, dose conversion, probability, etc. Selected neutron, gamma, and space-radiation shielding problems. Prereq: Consent of instructor.

6150 Reactor Dynamics (3) Special topics in reactor dynamics and control. Prereq: Math 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 STUDENTS

Requirements for graduate study are prescribed by the Graduate School and by the student’s major department. Students lacking adequate preparation may be required to take additional courses at the undergraduate level as prerequisites to graduate study. A student deficient in English may be required to take courses as necessary to remove the deficiency.

APPLICATIONS FOR ADMISSION

Two copies of the student’s transcript and an application for admission are submitted directly to the Graduate School.

In addition, a College of Home Economics application and three letters of reference are sent to the Associate Dean of the College of Home Economics. Forms may be obtained from the college. 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.

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

Major (includes minimum of nine hours of 5000 courses) 18 hours
Thesis 9 hours
Collateral area(s) of study (includes minimum of six hours of 5000 courses) 18 hours

(45 hours total)

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 ** shall 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 pro-

* Requirements include Crafts, Interior Design, and Housing 5519 or Child and Family Studies 5170, 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 nine hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5000.

In some instances two related collateral areas may be selected with nine hours in each area and a minimum of three hours of a 5000 course. (Reach...

Collateral area(s) of study may be chosen in an area other than in home economics with the approval of the appropriate professors.

An oral examination is required.

Note: Nine hours is the maximum credit allowed for special problems work and seminar work in any one area of home economics.

** Requirements include Crafts, Interior Design, and Housing 5519 or Child and Family Studies 5170, Consumer Studies and Housing 5100 or Planning 5100 or Economics 5340 or Agricultural Economics 4320.

Twelve hours in an area of home economics other than the area (consumer studies or housing) chosen above.

Minimum 27 hours in and nine hours outside College of Home Economics. Minimum of 27 hours 5000-6000 level courses and total minimum of 45 hours. Courses may be used to meet more than one requirement but all minimum requirements will need to be met.
gram. Some majors may require nine hours in one collateral area.

Request for the non-thesis option must be made in writing by the student to the department head not later than the end of the first term in residence.

DOCTORAL PROGRAMS

The doctoral program in home economics provides three options for study: interdisciplinary, food science, and nutrition. The interdisciplinary option involves 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 interdisciplinary option.

(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

Emphasis may be on:

(1) Normal developmental processes, in individuals and families;

(2) Socialization through childhood, adolescence, and adulthood;

(3) Interaction processes within families; community services and planning to meet developmental needs of individuals and families.

(4) Physiological Development and Well-Being in man throughout the life cycle. Emphasis for particular age groups may be on:

(a) Physiological response to nutrient intake;

(b) Improvement of nutritional status through informed community action;

(c) Cultural, economic and technological influences on food selection.

Environmental Factors-design, housing, food service systems.

clothing, textiles, and crafts as they relate to human needs. Emphasis may be on the impact of:

(cultural, sociological, psychological, and economic change; technological developments; aesthetics in improving the quality of the environment.

(2) A minimum of 96 quarter hours in courses beyond the Bachelor's degree exclusive of credit hours for the interdisciplinary option.

(3) Fifteen to 24 hours in cognitive or supporting courses (mainly from departments in other colleges in the University) including courses to give sufficient competence in statistics or research methods needed for dissertation research. Additional courses will complement the option emphasis and dissertation research area.

(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; six 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 four 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 nine hours may be substituted for 5000 and 6000 courses in nutrition).

(3) Minimum of four 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 craftsmen. Cooperation with national and local craft organizations has so stimulated the work of craftsmen throughout the area that their work has gained national recognition. See also page 92.

GRADUATE PROGRAMS FOR HOME ECONOMICS EXTENSION

Graduate programs at both the doctoral and Master's levels are available for students interested in home economics extension. At the doctoral degree level, programs of study may be planned in the interdisciplinary or in the food science or the nutrition options. A Master's degree major in Consumer Studies and Housing; Public Policy is particularly suitable for students interested in home economics extension, although Master's programs may be planned in any subject matter area of home economics with agricultural extension education as a collateral area. Additionally, four-week courses are offered in February each year for students particularly interested in home economics extension. Students interested in a graduate program and/or the four-week 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 — M.S.

Consumer Studies and Housing — M.S.

Home Economics — Ph.D.

Professors:

R. L. Highberger, Ph.D. Iowa; J. L. Kulpers (Head), Ph.D. Michigan State.

Associate Professors:

J. L. Cunningham, Ph.D. Michigan State; D. B. Eastwood, Ph.D. Tufts;

V. M. Nordquist, Ph.D. Tennessee;

R. M. Swagler, Ph.D. Ohio State.

Assistant Professors:

M. F. Kalinowski, Ph.D. Massachusetts; B. C. Miller, Ph.D. Minnesota;

4110 Student Teaching in Preschool Settings (3) Increasing responsibility for planning and guiding groups of young children under supervision of head teacher. Prereq: 2 hr weekly seminar, consent of instructor. S/NC only.

4120 Family Finance (3) Analysis of alternate ways of meeting financial problems encountered during the family life cycle. Prereq: Human Socialization or Family Development, or equivalent. S/NC only.

4121 Family Life in the Community (3) Needs of children; community agencies meeting these needs; visits to agencies contributing to the welfare of children. Prereq: Human Socialization, Human Development or equivalent. S/NC only.

4122 Administration of Programs for Young Children (3) Planning for the staff, housing, supervision, and management of nursery schools and child care centers. Prereq: 4 hrs history, 4 hrs social sciences. Recommended as prerequisite to be taken concurrently with Human Socialization or Family Development. S/NC only.

4210 Family Finance (3) Analysis of alternate ways of meeting financial problems encountered during the family life cycle. Prereq: Human Socialization or Family Development, or equivalent. S/NC only.

4230 Conserving Time and Energy in the Home (3) Application of management principles to homemaking activities; evaluation of equipment, work centers and work procedures in terms of time and energy demands. Adaptations for the handicapped. S/NC only.

4230 Infant Development (3) Development during prenatal period and during first 2 years of life. Prereq: Human Socialization or Human Development, physiology 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: Human Socialization or Family Development, or equivalent. Consent only or consent of instructor.

4350 Advanced Child Development (3) Survey of selected theories relevant to child development. Prereq: 4 hrs psychology, 6 hrs child development or equivalent or consent of instructor. S/NC only.

4400 Learning Experiences with Parents (3) Dynamics of parent-child interaction. Emphasis on a variety of techniques for developing interaction and working relationships between parents and teachers through experiences in a variety of settings. Prereq: Observation and Experience in Preschool Programs or 4640 or equivalent.

4430 Family Relationships (3) Interpersonal relationships among family members and sociocultural roles. Prereq: Intimate Relationships or Family Development.

4610 Child in the Community (3) Needs of children; community agencies meeting these needs; visits to agencies contributing to the welfare of children. Prereq: Human Socialization, Human Development or equivalent. S/NC only.

4620 Administration of Programs for Young Children (3) Planning for the staff, housing, supervision, and management of nursery schools and child care centers. Prereq: 4 hrs history, 4 hrs social sciences. Recommended as prerequisite to be taken concurrently with Human Socialization or Family Development. S/NC only.

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 consumer concerns. hrs arranged. May be repeated. Maximum 15 hrs.

4710 Contemporary Developments (1-3) A student or staff initiated course for study of a selected topic or topic pertinent to the field; topics selected for study to be determined by students and instructor with departmental approval. Prereq: Consent of instructor. May be repeated with consent of department head. Maximum 9 hrs.

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

4830 Consumers and the Market (3) Factors important to homemakers as family purchasing agents: standardization of goods; grading, branding, labeling; advertising; consumer practices in reflecting costs; specific household commodity information. Prereq: Principles of Economics. S/NC only.

5000 Thesis

5020 Non-Thesis Graduation Completion (3) Required for students who do not otherwise graduate 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.

5050 Practicum (1-12) Field experience in selected agencies and organizations that focus on solutions to social problems in the community. Prereq: Consent of instructor. 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. Prereq: Consent of instructor. S/NC only.

5170 Consumer Economics (3) Consumer functions in the economy; structure of consumer markets; government action relating to consumers; factors affecting prices of consumer goods.

5180 Family Financial Consultation (3) Analysis of family expenditure patterns, considerations of common financial difficulties, and avenues by which families are assisted. Field experience with consumer consulting services. Prereq: 510 or 4350 or 5170.

5190 Standards in Consumer Protection (3) Product and performance standards in consumer protection. Theoretical and operational questions relating to standards, including analysis of costs and benefits to consumers. Prereq: 4350, 5170 or consent of instructor.

5210 Theories of Child Development (3) Major theories of child development. Prereq: 4350 or equivalent.

5220 Family Life Programs (3) School and community programs in family life; survey and evaluation; students concentrate on type best suited to their experience and future professional orientation. Prereq: 3 hrs child development, 3 hrs family relationships, 3 hrs sociology, 2 hrs and 1 lab.

5310 Theory and Research on Human Sexuality (3) Cultural, social, and psychological dimensions of human sexuality. Review of major contributions from anthropological, sociological, and personality theory and research.

5410 Advanced Family Relationships (3) Problems in modern family life; individual adjustments; family relationships. Prereq: Family Development, 4430, or consent of instructor.

5420 Parents and Children (3) Discussion of common problems of young children faced by parents and teachers with particular emphasis on methods available to modify problem behavior.

5430 Families in Crisis (3) Interpersonal transactions in disordered family behavior. Prereq: 5410 or equivalent.

5510 Survey of Research in Child and Family Studies (3) Review, evaluation, discussion of research literature; locating, abstracting, reporting research studies. Prereq: 5550 or equivalent.

5530 Research Methods in Child and Family Studies (3) Survey of research procedures used in study of child and family behavior; basic methodology of the behavioral sciences. Prereq: Research Methods as prerequisite to beginning thesis work in this area. Prereq: 9 hrs child and family studies.

5540 Supervision in Child Care Programs (3) Emphasis on guidance of students working in nursery schools and child care centers; helping students through seminar discussion, individual conferences and various evaluation techniques. Prereq: 5540; 3 hrs and 1 lab (2 hrs).

5610 Theories of Management in the Family Environment (3) Examination of fundamental management concepts, their development and application to current family situations.

5620 Nursery School Administration (3) Organization of child care centers, nursery schools, and play centers for preschool children. Housing, staff, schedules, programs, financing, etc. Prereq: 4110 or equivalent.

5630 Seminar in Infant Development (3) Theory and research relating to developing during infancy. Prereq: 4230.

5640 Teaching Child and Family Studies (5) Seminar and practicum in techniques for teaching an understanding of child development and family relationships. Prereq: Consent of instructor. S/NC only.


5800 Problems in Child, Family and Consumer Studies (1-3) Advanced study selected from the field of child development and family variables in family planning programs. Internship in planned parenthood programs and clinic. May be repeated. Maximum 9 hrs.

5840 Family Planning Programs (3) Community and family planning programs. Internship in planned parenthood programs and clinic. May be repeated. Maximum 9 hrs.

5900 Seminar in Child and Family Studies (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6250 Advanced Topics (3) Comprehensive individual study and group discussion of topics related to current problems in the area. Prereq: Consent of the instructor. May be repeated. Maximum 9 hrs.

6310 Individual and Family Development. Physiological Development (3) Variability in the development of family members' physiological potential, development, and status. The family's contribution to members' total potential for growth and development and to the realization of human potential. Prereq: 6 hrs in advanced child and family studies, 2 hrs nutrition, 4 hrs physiology, or equivalents.

6320 Individual and Family Development: Cognition (3) Processes through which the human individual learns to recognize his world. Emphasis on processes involved in development across the life span with focus on research findings and methodology. Prereq: 5210, 5630, 5650, or equivalents.
6330 Individual and Family Development: Socialization (3) Processes of socialization throughout the life cycle. Focus on the family as a primary socializing agent. Prereq: 5210, 5410, or equiv.

6410 Theories of Family Interaction (3) Review of theories and concepts of family interaction. Emphasis on critical evaluation of theoretical formulations of contemporary research on family behavior. Prereq: 5410 or equiv.

6450 Conceptual Frameworks for the Family (3) Theoretical perspectives for understanding families. Exploration and applications of frameworks on both theoretical and research levels. Historical to contemporary development of family theories. Prereq: 5410 or consent of instructor.

6540 Seminar in Programs for Infants and Preschool Children (3) Exploration of research related to programs for infants and young children. Evaluation of various program models for education of infants and young children, methods of working with parents, and student training programs. Prereq: 5210, 5540 or equivalent.

6610-20 Applied Behavior Analysis in Natural Settings (6, 6) Individual supervision in the application of behavior analysis in natural settings. Prereq: 5420 or consent of instructor.

6710 Elements of Consumer Choice (3) Analysis of the consumer's decision making, beginning with the theory of consumer choice, impact of influence on consumers and consideration of dynamic aspects of consumer behavior. In- cluding the roles of aspirations, expectations, uncertainty and information. Prereq: 5170 or consent of instructor.

6720 Consumer Protection (3) Consumer protection includes: regulations, standards, information disclosure and other consumer protection legislation. Assumptions involved in these efforts and relative success of different strategies. Prereq: 5170, 5190 or consent of instructor.

Crafts, Interior Design, and Housing

MAJORS

Crafts, Interior Design, and Housing

Public Policy

M.S. Ph.D.

DEGREES

Public Policy studies and Housing: M.S.

Economics

Professors: R. G. Blakemore (Head), Ph.D. Florida State; J. Kingscott, M.A. Florida State; M. G. Heard (Director, Arrowmont School of Crafts), A.M. Columbia.

Associate Professors: L. M. Mamer, M.S. Iowa State; W. Moran, M.S. Wisconsin.


To be admitted to the Graduate School in the craft program a student must have a professional knowledge of media and technique. Work with creative design concepts is emphasized at the graduate level; media and technique are important only in so far as the experimentation with these contributes to the philosophical and creative orientation of the designer-craftsmen. 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 various aspects of design and learning the interpretation of the media. Because the philosophical orientation of the student varies widely, progression from one level to another is based on the understanding and communication of visual concepts.

A student's course of study includes intensive training in his chosen areas of specialization such as metalwork, ceramics, weaving, textile design, or interior design as well as courses dealing with the broader aspects of design. All student programs include: Seminar in Design (5040), Advanced Design Studio (5050), 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 a unique opportunity to participate in the summer program at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Instructors at the school are nationally and internationally recognized designer-craftsmen who offer additional areas of expertise. Therefore, graduate students attend the Arrowmont School of Crafts during the summer term(s) 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 and technological and the sociological influences on the development of design; changing living conditions; interrela- tion of architecture and furnishings. Significant designers and their work.

4140 Exhibition Design (4) Display of craft and interior design problems in relation to media, props and special exhibition areas. Emphasis on knowledge and understanding of the design principles as they relate to promotion, design construction, display and evaluation for text and three dimensions. Annual student Craft and Interior Design exhibit culmi- nates quarter. Prereq: Introduction to Related Arts or equivalent.

4155 Interior Space Planning I (6) Analysis, planning and design of the office environment; includes contract specifications.

4156 Interior Space Planning II (6) Studio problems involving large scale non-residential interior spaces such as offices, transportation facilities, stores, institutions, etc. Prereq: 4155 or consent of instructor.

4310 Crafts in America (3) Craft movement; factors that contributed to growth and development. Edutational, social, economic, recreational and therapeutic values of crafts. Place of craftsman in society as producer, teacher, designer for industry.

4320 Family Housing Problems (3) Housing requirements of families. Reading and judging house plans; effective use of space; maintenance problems; housing regulations and restrictions; site selection and neighborhood development; financing procedures. Prereq: Principles of Economics.

4330 Care and Repair of Household Equipment (3) Care of equipment to give maximum service in relation to operation and service cost; understanding of common repair problems. Prereq: Equipment in the Home, 1 hr and 2 labs.

4410 Craft Media (4) Possibilities and limitations of craft media; understanding educational and social values of craft work. Designing and executing craft projects using inexpensive materials and tools. 3 labs.

4420 Leather Design (4) Relationship of design to function, techniques and materials. Creating leather objects of original design. 1 hr and 2 labs.

4430 Plastics (4) Possibilities and limitations of various plastics; methods of fabrication; relation of design to function, processes, types of material and use of tools. 1 hr and 2 labs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise registered during any quarter when 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 Seminar in Design (3) Intensive reading, discussion and critical evaluation of 20th century design concepts. The men, the mili- tions and the creative components leading to visual innovation.

5050 Advanced Design Studio (4) Studio experience planned to explore strengths, structural variability, and form potentials of design media, searching for aesthetic potential in depth.

5060 Practicum (1-12) Field experience in selected agencies and organizations that focus on solutions to problems in housing.
forms in enameling. 5365-Experimentation in the development of two and three dimensional forms in plastics. Each course may be repeated one time.

5367-57-67 Ceramics I, II, III (4, 4, 4) 5347—
Initial development of theory for investigation of aesthetic concepts in ceramics. 5357—Advanced experimentation using aesthetic concepts in the development of two and three dimensional forms in ceramics. 5367—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in ceramics and consent of department head. Each course may be repeated one time.

5341-51-61 Metal Design I, II, III (4, 4, 4)
5341—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 the development of two and three dimensional forms in metal. 5361—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in metal design and consent of department head. Each course may be repeated one time.

5342-52-62 Weaving I, II, III (4, 4, 4) 5342—
Initial development of theory for investigation of aesthetic concepts in in two and three dimensional forms in fiber constructions. 5352—Advanced experimentation using aesthetic concepts in the development of two and three dimensional forms in weaving. 5362—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in weaving and consent of department head. Each course may be repeated one time.

5343-53-63 Textile Design I, II, III (4, 4, 4) 5343—
Initial development of theory for investigation of aesthetic concepts in the surface decoration of textiles. 5353—Advanced experimentation in unifying aesthetic concepts in the surface decoration of textiles. 5363—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in textile design and consent of department head. Each course may be repeated one time.

5344-54-64 Wood Design I, II, III (4, 4, 4) 5344—
Initial development of theory for investigation of aesthetic concepts in two and three dimensional forms in wood design. 5354—Advanced experimentation using aesthetic concepts in the development of two and three dimensional forms in wood. 5364—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in wood design and consent of department head. Each course may be repeated one time.

5345-55-65 Enameling I, II, III (4, 4, 4) 5345—
Initial development of theory for investigation of aesthetic concepts in enameling. 5355—Advanced experimentation using aesthetic concepts in the development of two and three dimensional forms in enameling. 5365—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in enameling and consent of department head. Each course may be repeated one time.

5346-56-66 Plastics I, II, III (4, 4, 4) 5346—
Initial development of theory for investigation of aesthetic concepts in plastics. 5356—Advanced experimentation using aesthetic concepts in the development of two and three dimensional forms in plastic. 5366—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in plastics and consent of department head. Each course may be repeated one time.

5368 Ceramics—Glaze Calculation (4) Experimentation with various types of clay bodies and glazes for reduction and oxidation firing atmospheres. Prereq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5369 Ceramics—Kiln Construction (4) Investigation and development of various types and sizes 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 related art or equivalent.

5510 Environmental Factors in Interior Design (3) Study of human factors and associated research techniques as they relate to the design of Indoor environments—emphasis on the derivation and design implications from anatomy, physiology, anthropometry, and the behavioral sciences. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5520 Environmental Factors in Interior Design (3) Study of systematic design methodology as applied to the design of micro-environments 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 the analysis, synthesis and evaluation of research oriented interior design projects. Comprehensive design research project to be carried out by 2 or 3 members. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5610 Furniture Design (3) Analysis of human factors data in the design of body support, task support, and storage furniture pieces and systems; emphasis on the production of construction drawings and scale models. Prereq: Consent of instructor.

5613 Housing Management (3) Role and functions of the housing management specialist in dealing with problems of private and assisted housing. Prereq: 4320 or consent of instructor.

5614 Housing Regulations and Controls (3) Function of regulations and other control practices and mechanisms as determinants of the nature, availability of housing in local communities by various user groups. Prereq: 4350 or consent of instructor.

5615 Housing Programs and Policies (3) Analysis of various federal and public programs and policies designed to promote realization of suitable homes and living environments for families. Economic and social problems related to national housing objectives. Prereq: 4320 or consent of instructor.

5620 Experimental Methods in Household Equipment (3) Research methods and techniques used in determining performance of household equipment. Prereq: Equipment in the Home or consent of instructor. 1 hr and 2 labs.

5630 Environmental Requirements for Family Work Centers (3) Analysis of work centers in planning work center areas such as for kitchens and laboratories: evaluation in terms of adequacy, convenience, daylighting, ventilation, facilities and costs; problems of installation and remodeling.

5810 Crafts (1-4) Advanced study in crafts. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5820 Interior Design (1-3) Advanced study in interior design. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5830 Problems in Housing (1-3) Advanced study in housing. Hours and credit arranged. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

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) Examination of various research methods and methodologies of the social sciences as employed in housing research. Prereq: Consent of instructor.

6210 Environmental Design Analysis (3) Advanced methodology in the psycho-biology of environmental design with particular attention to multidisciplinary research data and methods. Prereq.: 5510-20-30.

6320 Role of Crafts in Society (3) Comprehensive individual study and group discussion of advanced concepts and current problems in crafts. Prereq: 4310, 5040, 6 hrs of graduate level sociology, or consent of instructor.

6410 Conceptual Development in Craft Design (3) Advanced concepts in the use of visually perceived design elements as demonstrated in hand crafted objects. Prereq: 4310, 5040, 6 hrs of graduate level psychology, or consent of instructor.

6420 Perspectives in Crafts and Interior Design (3) Historical influences as related to contemporary concepts in crafts and interior design. Prereq: 5640, 6 hrs of graduate level art history, or consent of instructor.

Courses offered periodically only at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated.
Food Science

4000 Origin of Food and Foodways (3) Tracing of food and the development of individual and groups foodways. Prereq: 6 hrs social science or humanities.

4010 Introductory Experimental Food Science (3) Use of physical and sensory evaluation in experimentation with fats, high protein foods, and batter and dough systems. Prereq: Nature of Foods II.


4040 Food in Contemporary Society (3) Consumer's options, responsibility and potential influence with respect to food supply.

5000 Thesis

5902 Non-Thesis Graduation Completion (3) 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) Introduction to thermodynamics; physicochemical properties of proteins, carbohydrates and lipids; chemistry of the colloid state; chemical kinetics; specialized kinetists of enzymatic processes. Prereq: Nutrition 3320 and College Algebra or equivalent.

5510 Food Texture (3) Classification of foods according to textural parameters; use of instruments in the evaluation of textures. Prereq: 4010 or Food Technology 4920; statistics; or consent of instructor.

5520 Food Sensory Testing Methods (3) Principles and methodology of sensory evaluation of food; application of the methods; analysis of sensory data. Prereq: 4010; statistics; or consent of instructor.

5590 Advanced Experimental Food Science (3) Application of research methods to individual problems. Prereq: 5510-20 or consent of instructor.

5550 Food Behavior of the Individual (3) Development of and changes in the choices of food and habits of the individual. Prereq: 4000, 3 hrs of nutrition, or consent of instructor.


5510-20 Advanced Food Science (3, 3) Biochemical and biophysical interactions in food. Must be taken in sequence. Prereq: 4010; Nutrition 3320 or equivalent, or consent of instructor.

5630 Carbohydrates and Fats in Relation to Food Science (3) Physical and chemical characteristics of sugars, starches and fats with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5640 Proteins in Relation to Food Science (3) Physical and chemical characteristics of the proteins of milk, eggs, flour and meat with emphasis on their behavior in food. Prereq: 4010; Nutrition 3320-30 or equivalent.

5700 Current Programs and Trends in Food Science (1-3) Recent advances in food science, their impact on curricular considerations, and their implications for teachers, extension workers, and dietitians. Prereq: Consent of Instructor. May be repeated. S/NC only.

5800 Problems in Food Science (1-3) Advanced study from the field of food science. Prereq: Consent of department head and professor in charge of investigation. May be repeated.

5850 Field Experience (3-9) Experience in a foodways industry or agency under the supervision of a faculty member. Prereq: Consent of instructor.

5900 Seminar in Food Science (1-3) Prereq: Consent of instructor. May be repeated.

6000 Doctoral Research and Dissertation

6110 Advanced Topics in Food Science (3) Comprehensive individual study and group discussion of topics related to current problems in food science. Prereq: Consent of instructor. May be repeated.

6210 Food Dispersions (3) Physical characteristics of solutions, colloidal dispersions, and suspensions in relation to treatments applied. Prereq: 5530.

5310-23 Structure of Food Plants and Animal Tissues (3, 3) Histological structure of food plants and animal tissues as related to physical characteristics and chemical properties of their components. Prereq: 5630-40.

5510-23 Food and Socio-Cultural Change (3, 3) Critical evaluation of factors and interrelationships affecting food intake and consumption patterns. Must be repeated. Prereq: 5550 or 5560; or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

Nutrition

3310 Organic Chemistry (4) Emphasis on subjects leading to 3320-30 and Text. and Clo. Prereq: 3520. Prereq: General Chemistry, 3 hrs and 1 lab. Not for graduate credit for food science, nutrition and food systems administration majors.

3320 Food Analysis (4) Elementary quantitative analysis; typical food analyses. Prereq: 3310 or equivalent. 3 hrs and 1 lab. Not for graduate credit for food science, nutrition and food systems administration majors.

3330 Physiological Chemistry (3) Metabolism of carbohydrates, lipids, and proteins. Role of vitamins and minerals in metabolism. Prereq: 3320 or equivalent. Not for graduate credit for food science, nutrition and food systems administration majors.

3339 Physiological Chemistry Laboratory (1) Prereq: 3320. 3 hrs. Not for graduate credit for food science, nutrition, and food systems administration majors.

4010 Reproductive and Developmental Nutrition (3) Nutritive requirements for expectant mothers, infants, and preschool children. Prereq: 6 hrs of nutrition. 2 hrs and 1 lab.

4020 Nutrition for Children, Adolescents and Adults (3) Application of basic principles and research findings to good nutrition for children, adolescents and adults. Prereq: 6 hrs of nutrition. 2 hrs and 1 lab.

4030 Community Nutrition (3) Introduction to nutrition problems and services in the community; supervised field experiences are an integral part of the course. Prereq: 6 hrs of nutrition. 6 hrs.

4110 Introduction to Nutrition Research (3) Discussion of principles and laboratory experiences. Prereq: 6 hours of nutrition, 2 hrs and 1 lab.

4230 Nutrition in Disease (4) Nutrition problems in diseases influenced by diet. Prereq: 4 hrs of nutrition. 4 hrs and 1 lab.

4331 Clinical Experience in Dietetics (1) Planned clinical experiences applying principles of nutrition in disease. Coreq: 4230.
4240 Nutrition in Disease II (3) Interdisciplinary lectures and discussions on the metabolic processes of normal and diseased organs and/or tissues and the dietary or behavior modifications required. Prereq: 4230. Designed for senior students in the coordinated undergraduate program in dietetics.

4430 Diet and Drug Therapy (3) Effect of drug therapy on absorption and utilization of nutrients, and effect of diet on absorption, utilization and toxicity of drugs. Prereq: Science of Nutrition or consent of instructor.

5000 Thesis

5002 Non-Thesis Graduation Completion (2) Required for the non-thesis student not otherwise registered during any quarter when such a student, using university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110 Advanced Physiological Chemistry (4) Bioenergetics and related metabolism of nutrients; Prereq: 3330 or equivalent. 3 hrs and 1 lab.

5120 Advanced Physiological Chemistry (3) Nutritional factors in relation to body fluids, gas transport and endocrine function. Prereq: 3330.

5140 Foods and Nutrition: Physicochemical Principles (3) Introduction to thermodynamics; physicochemical properties of proteins, carbohydrates and lipids; chemistry of the colloid state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: 3330 and College Algebra or equivalent.


5230 Experimental Methods in Nutrition (3) Use of small animals in experimental nutrition. Prereq: 5 hrs Science of Nutrition. 2 hrs and 1 lab.


5310 Community Nutrition (3) Nutrition problems and practices in the community; supervised field work. Prereq: 5 hrs Science of Nutrition; consent of instructor. 3 labs.

5320 Community Nutrition (3) Observations and participation in nutrition programs of local and state agencies. Prereq: 5310 and consent of instructor. 3 labs.

5330 Community Nutrition (3) Nutrition programs of state and federal agencies; preparation of material for nutrition education; supervised field work. Prereq: Consent of instructor. 3 labs.

5340 Field Study in Community Nutrition (1-12) Personal participation in and analysis of a state or regional nutrition community program. Location of the in-depth study to be selected in consultation with the instructor. Prereq: 5320 and consent of instructor. S/NC only.

5350 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students in the Child Development Center, UT Center for the Health Sciences, Memphis. Prereq: Consent of the department head.

5410-20 Human Nutrition (3, 3) Functions of carbohydrates, proteins, fats, minerals and vitamins. Nutritional requirements of man throughout the life span and practical problems in meeting requirements. Prereq: 5 hrs Science of Nutrition; 5110.

5430 Physiological Bases for Diets in Disease (3) Developments in the dietary treatment of disease in which nutrition plays a major role. Prereq: 5210 or equivalent.


5450 Survey Methods in Human Nutrition (3) Design and evaluation of food services and nutrition programs. Prereq: 5210 or 5410-20, 2 hrs and 1 lab.

5460 World Food Supply and Human Nutrition (3) Food supplies and food practices as related to human nutrition throughout the world. Regional, national and international agencies concerned with food and nutrition problems. Prereq: 5210 or 5410-20.

5470 Nutrition and Aging (3) Nutritional problems of the aging individual. Emphasis on nutritional requirements, dietary intakes and the effect of nutrition on the rate of biological aging. Prereq: 5210 or consent of instructor.

5810 Nutrition in Mental Retardation and Developmental Disorders (1-12) Orientation to, observation of and participation in the interdisciplinary diagnosis and treatment of the developmentally disabled child. Emphasis is given to the role of the nutritionist; includes clinical experience and lectures at the Development Center, Center for the Health Sciences, Memphis. Prereq: Consent of department head.

5700 Current Programs and Trends in Nutrition (1-3) Discussion of selected recent developments in the field of nutrition and their implications for teachers, extension workers, dietitians, public health nutritionists, and others in related fields. May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

5800 Problems in Nutrition (1-3) Advanced study selected from the field of nutrition. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.

5950-60 Seminar (1, 1) May be repeated.

6000 Doctoral Research and Dissertation

6110 Proteins and Amino Acids (3) Lectures, reports and discussions. Prereq: 5410-20.

6120 Mineral Metabolism (3) Lectures, reports and discussions of functions of minerals in physiological processes. Prereq: 5410-20.

6130 Lipid Metabolism (3) Lectures, reports and discussions. Prereq: 5410-20.

6140 Vitamin Metabolism (3) Lectures, reports and discussions. Prereq: 5410-20.

6210 Advanced Topics in Nutrition (1-3) Discussion of current advances, concepts, research techniques and current problems. Prereq: 5410-20 or consent of instructor.

6900 Seminar (1-3) May be repeated. Maximum 9 hrs. S/NC only.

5420 Food and Lodging Managerial Cost Control (3) Cost control for food and lodging systems. Prereq: 4100; Fundamentals of Accounting.

5460 Food and Lodging Physical Plant, Planning and Maintenance (3) Planning, development and construction of food and lodging physical plant and maintenance. Electrical, mechanical, plumbing, air conditioning and ventilation. Prereq: 4100 or consent of instructor. 3 hrs and 1 lab.

5470 Food and Lodging Information Systems (3) Qualitative and quantitative analysis of information systems for decision making in food and lodging operations. Prereq: 4130, 4560, and Electronic Data Processing.

5000 Thesis

5002 Non-Thesis Graduation Completion (2) Required for the non-thesis student not otherwise registered during any quarter when such a student wishes to use university facilities for faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110-20 Experimental Quantitative Food Study (3, 3) Analysis of food production, holding environment, and service problems related to quality of food prepared in volume. Use of management resources. Prereq: 4130, Quantity Food Procurement, Production and Service, or consent of instructor.

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) Experimental approach to environment in which food is prepared, held, and served in volume. Prereq: 4150.

5230 Food Systems Evaluation (3) Evaluation of management resources in food systems. Standards for control. Prereq: 4130, or consent of instructor.


5310 Administration of Food Service Delivery Systems (3) The role and responsibilities of the administrator in maintaining desired quality and standards in the food service delivery system. Prereq: Quantity Food Procurement, Production and Service, or consent of instructor.

5350 Clinical Training in Health Care Agencies (3) An instructional and supervisory technique utilized in clinical settings by nurses and dietitians for the training of entry-level health care providers. Prereq: Management of Health Care or 4140 or consent of instructor.

5700 Current Programs and Trends in Food Systems Administration (1-3) Recent advances in food systems administration and their implications for dietitians, school food service directors and others in related fields. Prereq: Consent of instructor. May be repeated.

5800 Problems in Food Systems Administration (1-3) May be repeated.

5850 Field Experience (3-9) Planned administrative experience in the 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 group discussion of topics related to current problems in food systems administration. Prereq: Consent of instructor.

6110 Manpower Planning and Training for the Food Service Industry (3) Identification of manpower needs by skill levels; planning and evaluation of programs for personnel in food service industry. Prereq: 4140, 5210 or consent of instructor.

6130-20 Quantitative Methods to Control Resources in Food Service Systems (3, 3) Interrelationships of resources and evaluation of their efficiency and effectiveness in food service systems. Prereq: 5230 or consent of instructor. Taken in sequence. Credit for 6130 contingent upon completion of 6350.

6900 Seminar (1-3) May be repeated. S/NC only.

Home Economics

MAJOR DEGREE

Ph.D. Home Economics

Professors:
L. M. Oeland (Dean), Ph.D. Wisconsin, D.Sc. Rhode Island; G. E. Goertz (Associate Dean), Ph.D. Kansas State.

Associate Professor:
J. L. Cunningham, Ph.D. Michigan State.

Assistant Professor:
V. J. Aragon (Assistant Dean), M.S. Tennessee.

5060 Practicum (1-12) Field experience in selected organizations that focus on interdisciplinary solutions to multilevel problems of society. Consent of instructor. May be repeated. Maximum 12 hrs.

5100 International Studies (1-15) Student or staff initiated course for study in a 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 research programs; emphasis on projection of future developments.

5220 Development of Community Services Programs (3) (Same as Agricultural Extension 5210).

5230 Evaluation of Community Services Programs (3) Purposes of evaluation, clarification of objectives and procedures for determining evaluation of program performance, and evaluation of recent literature; implications for further research.

5600 Home Economics in the Community (3) The role of home economists in the community and how interactions among professionals of all community resources can facilitate finding solutions for and/or solving problems of individuals, families and communities as related to the quality of life. Prereq: Agricultural Economics 4320 or Economics 5540 or Planning 5100 or Child and Family Studies 5700 or consent of instructor.


5800 Problems in Community Services (1-3) Prereq: Consent of the professor in charge of the area. 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 the development and use of human resources in the solution of family and consumer problems. Prereq: 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 procedures 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: 6110. May be repeated.

6500 Methodological Issues in Home Economics (3) Advanced methodology in home economics, with particular attention to interdisciplinary research methods. Prereq: 1 graduate-level course in research methodology or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

Textiles and Clothing

MAJOR DEGREE

Textiles and Clothing M.S. Home Economics Ph.D.

Professor:
A. J. Treece (Head), Ph.D. Ohio State.

Associate Professor:
I. M. Ford, Ph.D. Pennsylvania State; B. C. Goswami, Ph.D. Manchester (England); C. J. Noel, Ph.D. Notre Dame.

Assistant Professors:
R. P. Dowlen, M.S. Tennessee; M. F. Miller, Ph.D. Pennsylvania State.

Lecturers:
A. L. Bullock, B.S. Mississippi College.

4210 Elementary Textile Microscopy (3) Introduction to microscopic techniques as applied to the study of textile fibers and fabrics. Prereq: Textiles II; Textile Chemistry, 1 hr and 2 labs.

4240 Design Analysis II (3) Creative interpretation of design dressing in relation to the flow of styles in relation to the various areas of textiles and clothing, 1 hr and 2 labs.

5400 Thesis

5902 Non-Thesis Graduation Completion (3) 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) Physical and chemical testing. Research methods. 3 labs.

5120 Advanced Problems in Textiles and Clothing (3) Refresher course; emphasis on new developments in textiles. Aids in selecting fabrics, agencies related thereto, and individual problems which students have met in the textile field. 2 hrs and 1 lab.

5130 Advanced Tailoring (3) Comparison of hand-tailoring and machine methods used in making suits, coats, or costumes. 3 labs.

5150 Principles of Design Analysis (3) Application of flat pattern theory to garment design incorporating relationships of fabric geometry, texture, hand, and surface ornamentation to design. Prereq: Consent of instructor. 1 hr and 2 labs.

5160 Review of Literature (3) Intensive survey and evaluation of recent literature; implications for further research.

5170 Social, Psychological and Economic Aspects of Clothing (3) Clothing as it relates to human behavior. Prereq: 6 hrs or equivalent from each of the following areas: sociology, psychology, economics.

5180 Advanced Textile Economics (3) Economic problems or problem areas of current importance in the textile and apparel industries—production, consumption and governmental policy. Prereq: 3420, 6 hours of economics or consent of instructor.

5210 Evaluation of Instructional Materials in the Field of Textiles and Clothing (3) Evaluating instructional materials to use in communicating information in the various areas of textiles and clothing. 1 hr and 2 labs.

5220 Historic Textiles (3) Development of the textile industry in the world with emphasis on fibers used, design and color.

5240 Practicum (1-3) 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—Weaving and dyeing; 5270—Emphasis on dyes and dyeing, 2 hrs and 2 labs. Prereq: 3420 or equivalent, one quarter of organic chemistry.

5310 Fashion Analysis (3) Fashion as a social and economic force; evolutionary theory of fashion operation. Prereq: 6 hrs each of sociology and economics.

5320 Problems in Historic Costume (3) A variable content course with emphasis on the flow of styles in relation to cultural determinants. Prereq: 3480 or consent of instructor. May be repeated. Maximum 9 hrs.

5710-20-30Current Programs and Trends in Textiles and Clothing (1-3, 1-3, 1-3) Pertinent developments and trends in textiles and clothing and their implications for new types of programs, techniques, TV, and/or curricula approaches. Content and emphasis will vary according to changes in the field and needs of groups serviced. Prereq: Consent of instructor.

5800 Problems in Textiles and Clothing (1-2) Advanced study selected from the 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.


6110 Selected Issues in Textiles and Clothing (3) In-depth investigation of advanced topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6140 Selected Behavioral Theories in Clothing (3) Role of clothing in the functioning of people, utilizing behavioral theories. Prereq: 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6150 Social-Psychological Theories of Clothing Consumption (3) Analysis and evaluation of social science theories of consumer behavior in relation to the areas of textiles and apparel. Prereq: CFS 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6160 Textile Flammability (3) Factors affecting textile flammability as a consumer issue. Standards, regulations, test methods, economic impact. Prereq: 5120, 5180, 5250, or consent of instructor.

6170 Physical Performance Behavior of Textile Structures I (3) Fundamentals of yarns and fabric structures; relationship of structure to physical characteristics of textile materials. Prereq: 5120, or consent of instructor.

6910 Seminar in Textiles and Clothing (1-3) May be repeated. Maximum 6 hrs.
# Intercollegiate Programs

## Aviation Systems

**MAJOR**
Aviation Systems

**DEGREE**
M.S.

**Professors:**

**Associate Professor:**

The University of Tennessee Space Institute offers this program leading to the Master of Science with a major in Aviation Systems. The Aviation Systems program is designed for those who possess bachelor’s degrees in engineering or science and who wish to study under a “systems philosophy” toward careers in research and development or administration in various phases pertinent to aviation. The program features 18 quarter hours major field credit in various aspects of aviation systems, six or more quarter hours credit in each of the areas of research, development and administration, and electives which permit further specialization in either area.

To qualify for admission to this program, the applicant must possess a Bachelor’s degree in engineering or science from a recognized institution, show evidence of ability to pursue and benefit from the program, and fulfill 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 A.E. 4110 and A.E. 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 is the usual program 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, six quarter hours in I.E. 5700 and I.E. 5710 and for the administration area, six quarter hours in Economics 5070 and Accounting 5810, for a total of 12 quarter hours.
3. Six quarter hours of electives selected from the major field, engineering and/or the areas in Item 2.
4. Nine quarter hours in A.S. 5000, Thesis, hence demonstrating the ability to conduct and report on an independent investigation.

The non-thesis program will be permitted in special circumstances and involves satisfactory completion of the following minimum requirements:

1. Eighteen quarter-hour credits in the major field of aviation systems.
2. For the research and development area, nine quarter hours in I.E. 5700 and I.E. 5710 and for the administration area, nine quarter hours in Economics 5070, Accounting 5810 and Finance 5510, for a total of 18 quarter hours.
3. Six quarter hours of electives in one of the areas in Item 2.
4. Six quarter hours of electives in the major field, engineering and/or the areas of Item 2.
5. Satisfactory completion of three quarter hours in A.S. 5100, Project in Aviation Systems.
6. Satisfactory completion of a comprehensive final written examination on all course work taken 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:**

Electives typical of those suitable for credit in the area of Aviation Systems, Research and Development include: A.E. 5150-60-70; Computer Science 4410-20-30 and 5110-20; Industrial Engineering 4060, 4150, 4230, 5710, 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**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>5070</td>
<td>Airports and the Community (3) Structure of airports and their communities, Technology and economics of cargo, baggage, ticket and passenger handling, Airport management, economics and logistics. Interfaces with the community, collection and distribution, demand requirement analyses, types of developments and their projections. Prereq: A.E. 5810.</td>
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</table>
5100 Project in Aviation Systems (3) In-depth study and formal report on an aviation systems topic, normally performed during the last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.

5210-20 Experimental Flight Mechanics (3, 3) Consideration of flight mechanics with emphasis on experimental techniques. Special equipment airborne laboratory allows active student participation in a series of experiments demonstrating the acquisition of flight test data. Tests will be conducted covering a broad range of flight performance and control characteristics. In addition to the development of the theory necessary to support the tests, experimental techniques, instrumentation and data reduction methods will also be the subject of the series of lectures included in the course. 5210 emphasizes performance and 5220 emphasizes stability and control. Prereq: A.E. 4120.

5970 Special Topics in Aviation Systems (3) Current problems in aviation systems. Prereq: Consent of instructor. May be repeated with consent. See also course descriptions for AE 5510, AE 5520, and IE 5540.

Cybernetics and Bionics

Professors:
T. C. Helvey (Emeritus), D.Sc. H.C., University of the Atlantic*; R. S. Sleeper, M.A. Harvard*.

5110 General Systems and Cybernetics Fundamentals (3) Fundamentals of the theories of cybernetics, bionics, informatics, and general systems theory, associated with a review of the theories of information, automatic and manual controls, and computers, which are necessary for the understanding of the main topics.

5120 Cybernetic Biophysics (3) Interdisciplinary and systems aspects of the mechanism of the human body are presented which include the topology, chemistry, physics, and mental functions. Course presents primarily the engineering aspects of man; useful elective of all engineering programs.

5130 Applied Cybernetics and Bionics (3) Utilization of cybernetics and bionics for communication and control in large human systems and in the approach to man-machine synthesis. Prereq: for those having participated in 5110 and 5120; persons primarily interested in an overview of systems dynamics may take with the instructor's consent.

5140 Cybernetics of Human Behavior (3) Aspects of human behavior with emphasis upon open and closed feedback loop interactions with the environment. Systems aspect of cognition and mental functions, second order interaction in interpersonal communication. Recommended for engineers and persons interested in machine interactions.

5990 Cybernetics Seminar (3)

* Space Institute, Tullahoma.

Ecology

MAJOR

ECOLOGY

DEGREES

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

J. Frank McCormick, Director, Ph.D. Emory

The Graduate Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary ecology for students from undergraduate programs in basic and applied biology, social sciences, mathematics and engineering. Research opportunities in both fundamental and applied ecology are intended to prepare students for academic careers as well as professional positions in industry or government. The Environmental Sciences Division of the Oak Ridge National Laboratory and the Tennessee Valley Authority provide advisors and research facilities. The Great Smoky Mountains, Cumberland Plateau, valley and ridge topography, TVA lakes and wild rivers provide locally a spectrum of natural habitats and consequent biological diversity which is truly unique. In addition, research opportunities abound for student research elsewhere on this continent and abroad.

ADMISSION

Requirements for admission to this program are: (1) admission to the Graduate School; (2) at least 12 quarter hours of college chemistry, nine quarter hours of college mathematics, and four quarter hours of geography 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, 408 10th Street, University of Tennessee, Knoxville, Tennessee 37916.

ADVISORS

Advisors are selected from ecologists in several departments of the University who have competence in the area in which the student expects to work. Entering students should consult early with the Director of the program on the choice of a faculty advisor who will become the chairman of the student's faculty committee.

MASTER OF SCIENCE

The minimum 45 quarter hours of graduate credit shall include 18 hours of ecology courses (exclusive of thesis), of which six hours shall be in Ecology 5210-20-30 and at least eight additional hours in ecology courses numbered above 5100; nine hours of thesis in Ecology 5000, and 18 additional hours in ecology or supporting courses. To insure an interdepartmental program, the required minimum of 45 hours shall include no more than 18 hours of non-thesis courses from any one department of instruction.

The general requirements for this

Master's degree are listed on page 17. A minor in ecology shall include Ecology 5210-20-30 (six hours) and at least three additional hours in approved ecology courses.

DOCTOR OF PHILOSOPHY

The requirements for this degree are in general the same as those of the Graduate School with the following two exceptions: (1) each student's faculty committee shall consist of at least two members from the department in which the dissertation is being supervised and at least two from outside this department; (2) this doctoral program must include Ecology 5210-20-30 and a minimum of nine quarter hours of courses numbered above 6000. A student cannot enroll for dissertation until the research proposal has been discussed and approved by the doctoral committee.

Shared Faculty


COURSES

The following courses are those offered directly by the Ecology Program and those which, although listed in other departments, have been approved to satisfy Master's degree requirements. Additional ecology courses are described elsewhere in the catalog under the departments identified in the following list.

Agricultural Biology

4010 Biology of Soil Microorganisms (4)
4510 Freshwater Fishery Biology (4)
4520 Management of Lakes and Ponds (4)

Botany

4310 Plant Ecology (4)
5340 Plant Geography (4)
5350 Analysis of Plant Communities (4)
5510-25-30 Systems Ecology (3, 3, 3)
5830 Field Methods in Plant Ecology (4)
The goals and problems of environmental policy are considered. Test scores of 500 or above on the Graduate Management Admission Test, or on each section of the aptitude portion of the GRE, are required. The advanced section for psychology is required.

PH.D. PROGRAM

I. Course Requirements

A. Minimum course requirements

1. I.M. or Psych. 5170, 5180, 5190 (Proseminar in Industrial and Organizational Psychology)

2. Statistics 5050-60-70 (Behavioral Statistics). Exemption by petition

3. Psych. 5070 (Academic Practice)

4. Minimum of three 6000-level seminars to be selected from Psych. or I.M. 6250, 6260, 6270, and I.M. or Psych. 6380*

5. 36 hours of Psych. or I.M. 6000 (Doctoral Dissertation)

B. Recommended electives

1. For students who require preparation in statistics:

   Behavioral Statistics sequence (Statistics department)

2. For preparation for advanced section (81) G.R.E.: Psych. Proseminar

3. For students who require preparation in psychometrics:

   Applied Psychometrics

4. For students who require preparation in management:

   I.M. 5110, 5120, 5230 (the latter is the same as Psych. 5450)

5. For students who wish to pursue special research interests aside from their dissertation:

   I.M. 5250, 5260, 5570 (Readings in Organizational Psychology)
   I.M. or Psych. 6900 (Supervised Field Research)

6. Courses available in areas related to industrial and organizational psychology:

   a. Through College of Business Administration:

      Wage and Salary Administration (I.M. 5220)
   b. Through College of Liberal Arts: Psych. 6450, 6460, 6470

II. Program Requirements

A. Attainment of a B average in the Proseminar in Industrial and Organizational Psychology.

B. Completion of a comprehensive examination in general psychology

* May be repeated for additional credit.
** Any student in this doctoral program may be required to prepare a Master's thesis by the Industrial and Organizational Psychology Committee. This policy will be implemented by the committee at such time as a review of the student's record indicates that additional data on the qualifications for pursuing a Ph.D. are required.

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**Ecology

5000 Thesis

5100 Special Problems in Ecology (1-3) Individual investigations in ecology. Prerequisite: May be repeated with consent of instructor. Maximum 3 hrs.

5210-20-30 Principles of Ecology (2, 2, 2) An interdisciplinary study of theories and problems in ecology. Comparisons between land, freshwater, and marine environments, including man's roles in the world's ecosystems. Must be taken in sequence. Prerequisite: Four quarter hours of ecology at the upper division level.

5310 Ecology for Planners and Engineers (3) Ecological principles and the effects that man's activities and natural processes have on living organisms, including man. Lectures and field trips. Designed for students in the Graduate School of Planning and Environmental Engineering.

5320 Implementation of Environmental Policy (3) The goals and problems of environmental legislation, especially the National Environmental Policy Act; the purpose, preparation, and evaluation of environmental impact statements and similar interdisciplinary studies. Prerequisite: 5210 or 5310, or Environmental Law.

6000 Degree Research and Dissertation

6100 Special Topics in Ecology (3) Seminars on advanced topics and recent developments in ecology. Prerequisite: Consent of instructor. May be repeated.

6110 Seminar in Animal Behavior (2)

6120 Seminar in Aquatic Ecology (2)

6130 Seminar in Physiological Ecology (2)

6140 Seminar in Community Ecology (2)

6150 Seminar in Radiation Ecology (2)

6160 Seminar in Systems Ecology (2)

Economics

4260 Economics of Resources (3)

Environmental Engineering

4700 Air Pollution-Air Resources Management (3)

Forestry

4005 Forest Ecosystems (3)

4480 Game Mammals (4)

4480 Game Birds (4)

5210 Seminar in Wildlife Conservation (3)

5220 Seminar in Forest Tree Biology (3)

5240 Seminar in Forest Genetics (3)

Geography

5610 Selected Topics in Climatology (4)

Geology

5290 Quaternary Problems (4)

5290 Plant and Soil Science

4320 Soil Formation, Morphology and Classification (4)

5240 Soil Productivity and Management (3)

5250 Pedology (4)

5810 Crop Climatology (4)

5920 Advanced Crop Physiology and Ecology (4)

Psychology

5750 Ethological Psychology (3)

5870 Animal Ecology (4)

4560-70 Limnology (4, 4)

5570 Animal Populations (3)

5850 Insect Autecology (4)

5860 Geographic Distribution of Animals (4)

5870 Insect Synecology (4)

**Industrial and Organizational Psychology

MAJOR DEGREES

Organizational Psychology M.S., Ph.D.

Committee:

J. M. Larsen, Jr. (Chairman); R. D. Arvey; F. R. D. Digibe: M. E. Gordon; J. M. Louisbey; E. D. Sundstrum; G. H. Whitemock.

(For complete Faculty Listing, see Department of Industrial Management and Psychology)

The master's and doctoral programs are offered jointly by the Department of Psychology and the Department of Industrial and Personnel Management. They are designed to prepare students for personnel, managerial, and organizational research, for university teaching, and for consulting relationships with industry. The emphasis is upon applied research utilizing a thorough theoretical background, including classical and modern organization theory, organizational behavior, psychology, and industrial management. The programs are administered by a joint committee of the two departments, appointed by the Vice Chancellor for Graduate Studies and Research on recommendations from the two department heads.

It is intended that students entering the program will represent widely different undergraduate and graduate backgrounds including psychology, business administration, engineering, science, and liberal arts. The first year program provides the opportunity to take courses which will assist the student to attain a reasonable level of sophistication in areas of deficiency (Psychology 5350-60-70).

ADMISSION PROCEDURE

 Applicants for admission should request forms and materials from both the Graduate Office and the Chairman, Industrial and Organizational Psychology Program, 413 Skolicky 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 nine 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 of 500 or above also are necessary on the Graduate Management Admission Test, or on each section of the aptitude portion of the GRE. The advanced section for psychology is required.

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within no more than two years of entry by attaining a score of 650 on
the GRE Advanced Test in Psychology.

C. Completion of a general preliminary examination in scientific meth-
ology within no more than two years of entry. This examination
covers the following specific areas: statistics
psychometrics
experimental design

D. Completion of a special preliminary examination in the area of the stu-
dent's major research and profes-
sional interests. This examination
must be attempted no later than
nine months following completion
of the general preliminary exami-
nation. This examination may be
repeated once, normally no later
than six months after the first at-
tempt, at the discretion of the stu-
dent's doctoral committee.

E. Completion of an oral examination following the preparation of a do-
c toral dissertation. This examination
covers the field of the doctoral re-
search and related topics, and must
be passed at least two weeks prior
to the awarding of the degree.

F. Maintenance of at least a 3.0 grade
point average.

M.S. PROGRAM

I. Course Requirements
A. I.M. or Psych. 5170, 5180, 5190
Proseminar in Industrial and
Organizational Psychology
B. Statistics 5050, 60, 70 (Behavioral
Statistics) and applied psy-
chometrics, 3 hrs.
C. 18 hours of additional course work
to be selected primarily from among
the 5000-level course offerings in
industrial management and psychol-
ogy [e.g., I.M. 5110, 5120, 5230;
Psych. 5080 (Current Topics In Ap-
plied Psychology)]
D. 9 hours of Psych. or I.M. 5000
(Master's Thesis)
E. Recommended: Psychology
Proseminar.

II. Program Requirements
The Ph.D. program requirements de-
scribed above in sections II A, II B,
and II F comprise the major require-
ments for a Master's degree. An oral
examination covering the thesis and
related topics must also be completed.

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)
Not allowed for graduate credit for ecology
majors.

Water Resources Development
Floyd C. Larson, Director,
Water Resources Research Center

MAJOR DEGREE
Water Resources Development M.S.

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 work 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 studies, in-
cluding nine hours of thesis work. The
exact curriculum of each student is de-
cided in consultation with a faculty
committee, depending on the background
and field of interest. If during the under-
graduate 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 specialty or in a related field.

3410 Principles of Ground Water Geology (3)
(Same as Geology 3410.)

3565 Introduction to Public Administrative Or-
ganization & Management (4) (Same as Poli-
tical Science 3565.)

4110 Managerial Economics (3) (Same as
Economics 4110.)

4810 Water Law (3) (Same as Environmental
Engr. 4810.)

5000 Thesis

5130 Planning Research Methods I (3) (Same
as Planning 5130.)

5160 Planning and Utilities (3) (Same as En-
vironmental Engr. 5160 and Planning 5160.)

5200 Water Resources Systems (3) (Same as
Environmental Engr. 5200.)

5330 Descriptive Hydrology (3) (Same as En-
vironmental Engr. 5330.)

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 re-
source development including flood manage-
ment, hydroelectric power, navigation, recrea-
tion, alternatives in water resource planning,
tomorrow in today's planning, project formul-
ation and justification, direct and indirect eco-
nomic consequences, state and local participa-
tion, and municipal and industrial uses of
water developments.
The College of Liberal Arts offers programs leading to eight advanced degrees*. See page 9 for degrees and majors.

Departments of Instruction

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

Anthropology

MAJOR DEGREE
Anthropology M.A., Ph.D.

Professors:
W. M. Bass (Head), Ph.D. Pennsylvania;
A. K. Gath, Ph.D. Michigan; P. W. Parmalee,
Ph.D. Texas A. & M.

Associate Professors:
C. H. Faubli, Ph.D. Indiana; J. E. Harrison,
Ph.D. Syracuse; R. L. Jaetz, Ph.D. Kansas;
M. C. R. McCullough, Ph.D. Pennsylvania.

Assistant Professors:
J. M. Bishop, Ph.D. California (Berkeley);
A. M. Henderson, Ph.D. Colorado;
M. H. Logan, Ph.D. Pennsylvania State;
F. H. Smith, Ph.D. Michigan.

MASTER'S PROGRAM

The formal requirements for the Master's degree include:

1. A minimum of three quarters of residence at the University of Minnesota.
2. A minimum of 45 quarter hours for graduate credit, including preparation of thesis. Thirty-six of these 45 hours must be in anthropology, nine 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.

PH.D. 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.

3070 Genetics and Society (3) (Same as Botany 3070)
3410 Principles of Cultural Anthropology (3)
3411 Principles of Cultural Anthropology (3) Review of cross-cultural comparative urban and village communities and methodologies used in community studies. Prereq: Human Culture recommended.
3440 Religion of Primitive Peoples (3) The religions of non-literate peoples. The place of religion in their social and cultural systems. Prereq: Human Culture recommended. (Same as Religious Studies 3440)
3450 Community Studies in Complex Culture (3) Review of cross-cultural comparative urban and village communities and methodologies used in community studies. Prereq: Human Culture recommended.
3510 Peoples and Cultures of Mainland Asia (3) Ethnographic survey of the indigenous cultures of mainland Asia. Cultural diversity and human ecology in areal perspective. Prereq: Human Culture recommended.
3530 Peoples and Cultures of Africa (3) Ethnographic survey of the aboriginal cultures of sub-Saharan Africa. Cultural diversity and human ecology in areal perspective. Prereq: Human Culture recommended.
3540 North American Indian (3) An ethnographic survey of the cultures of the Arctic, Southwest, Plains and Eastern Areas. Emphasis on the cultural differences of peoples occupying these areas during the pre-colonial period. Prereq: Human Culture recommended.
3555 Cherokee Ethno History (3) Survey of socio-political aspects of internal affairs and external relationships from first European contact to present. Emphasis on 18th and 19th centuries.
3610 Archaeology of United States and Canada (3) Survey of prehistoric peoples north of Mexico from initial occupation to European contact. Prereq: Prehistoric Archaeology recommended.
3620 European Prehistory I (3) Cultural developments during the Paleolithic, Mesolithic, and Neolithic. Prereq: Prehistoric Archaeology recommended.
3630 European Prehistory II (3) Cultural developments during the Metal Ages. From the close of the Neolithic through the Iron Age. Prereq: Prehistoric Archaeology recommended.
3632 and 3633 should be taken in sequence.
3649 Ancient Civilization of Mesoamerica (3) Introduction to the archaeology of areas of ad- vanced cultural development in Meso- and Central America beginning with the earliest cultures and proceeding to contact with Europeans. Prereq: Human Culture recommended.

3650 Prehistory of Tennessee (3) History of archaeologival research in Tennessee with survey of prehistoric American Indian cultures identified through this research.

3710 European Folk Cultures (3) Traditional aspects of European life, as expressed in folk- lore, beliefs, art, and folklore, under changing historical and socio-economic conditions.

3800 Language and Culture (3) Relationship between linguistic categories and patterns of culture. Knowledge of linguistics not required. Prereq: Human Culture recommended.

3811 Introduction to Museology (3) (Same as Art 3811).

3900 Human Osteology (4) Intensive examination of the human skeleton. Prereq: Human Origins and consent of instructor. 3 hrs and 1 lab.


3930 The Biology of Races of Man (3) Principles of physical anthropology with emphasis on significant differences among existing stocks; influence of biology and culture in race formation; analysis of studies concerning blood groups, race mixture, constitution, growth and nutrition. Prereq: Human Origins recommended.

3950 Human Identification (3) Introduction to techniques used in identification of human skeletal material in forensic medicine.

4200 Contemporary North American Indian (3) Survey of Indian cultures from initial Euro- American contact to present; emphasis on cul- ture change, U.S. Government Indian policy, reservation life; contemporary Southeastern Indian social and cultural problems. Prereq: Human Culture 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) Applicability of anthropological theory, methods, and findings in programs of community and national development, public health, interna- tional affairs, and social services. Exploration of the roles of anthropologists, questions of values and ethics in intervention schemes, and of the organization of planned changes in applied programs. Intensive analysis of selected case studies. Prereq: Human Culture or consent of instructor.

4250 Medical Anthropology: Lecture (3) A survey of medical anthropology. Emphasis is on Western and non-Western cultural aspects of health, disease, treatment, death, and related concepts. Focus is on analyses and descriptions of anthropological fieldwork.

4259 Medical Anthropology: Laboratory (3) Fieldwork in medical anthropology. Emphasis is on cultural aspects of health, disease, and death in industrial societies and the folk medicine systems which co-exist with Western technical medicine. Prereq or coreq: 4250.

4300 Readings in Anthropology (1-9) Intensive reading, problem oriented. Prereq: Consent of instructor.

4340 Field Work in Archaeology (3-9) Practitioner work surveying, excavating, processing, and analyzing of data; intensive reading. Prereq: 3 quarters of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

4350 Field Work in Cultural Anthropology (3-9) A practitioner devoted to fieldwork methods, ethnographic fieldwork reporting, survey and interview techniques, and the devising and carrying out of fieldwork projects. Prereq: 3 quarters of introductory anthropology and consent of instructor. Recommended: 4219. May be repeated. Maximum 9 hrs.

4350 Field Work in Physical Anthropology (3-9) Practicum in the collection and analysis of human biological data. May include either skeletal or non-skeletal data. 3 quarter of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

4400 Non-Western Education: Anthropological Approaches (3) Analysis of problems resulting from application of Western methods of education in developing societies and in aboriginal communities with industrialized societies (e.g. American Indians).

4420 Dynamics of Culture (3) Culture change: innovation, diffusion and acculturation; cultural continuity and stability. Prereq: Human Culture or consent of instructor.

4430 Personality and Culture (3) Analysis of relations between personality and culture. Application of psychological techniques in cross-cultural studies. Cultural differences and their implications for behavior. Prereq: Human Culture or consent of instructor.

4440 Urban Anthropology (3) Survey of the- oretical and methodological issues anthropolo- gists encounter researching cross-cultural urban settlements. Focus is on anthropological perspective and urban problems and planning. Prereq: 3450 or consent of instructor.

4450 Current Trends in Anthropology (3) An analytical integrative review in symposium of the current advanced trends, theories, fieldwork methods, and general assumptions 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 studies together and attempts to arrive at con- clusions on questions as how sex roles are learned, the parameters and directions of acceptable sexual behavior and degrees of tolerance for sexual deviation in various cultures.

4500 Peoples of China I: Chinese Society Before 1839 (3) An anthropological survey of Chinese society and culture during the pre- and early Western contact periods, Prereq: Human Culture or consent of instructor. Recommended: 3510 or an East Asian course.

4510 Peoples of China II: Chinese Society After 1839 (3) An anthropological survey of Chinese society and culture in the period of intense Western contact, rejection of the West, and development of modern, communist Chi- nese society and culture. Prereq: Human Cul- ture, or consent of instructor. Recommended: 4560, or an East Asian course.

4550 Indians of the Southeastern United States (3) Survey of Southeastern Indian cultures; emphasis on aboriginal adjustment to environment; lifeways of Southeastern American groups prior to Euro-American contact. Prereq: Human Culture or consent of instructor. Recommended: 4560.

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: Prehistoric Archaeology or consent of instructor.

4640 Zoaarchaeology (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.

4750 Archaeology of Southeastern United States (3) Survey of aboriginal societies of the southeastern United American Indian. Special emphasis on Tennes- see prehistory. Prereq: 3510 or consent of instructor.

4740 Southern Appalachian Folk Culture (4) Research-oriented course dealing with wide range of traditional culture in Southern Ap- palachian societies. emphasis on history, economy, clothing, belief, speech, art, song, dance, and oral traditions and customs. Prereq: Consent of instructor. May be repeated.

4870 Cherokee Language (3) Linguistic sur- vey of structure of the Cherokee language.

4930 Physical Growth and Constitution (3) Comparative growth patterns throughout the life cycle of man, skeletal and dental matura- tion; sex differences in growth; human con- stitutional types. Prereq: First quarter general anthropology. Strongly recommended: General Genetics or consent of instructor.

4950 Primate Studies (3) Survey of field and laboratory investigations of comparative anatomy and non-human primate behavior. Prereq: Human Origins or consent of instructor.

4960 Primate Paleontology (3) Survey of fossil primate forms; the origin and evolution of the primates; origin and classification of the earliest Hominid and related forms. Prereq: Human Origins recommended. Zool 4380.

4970 Human Paleontology (3) Survey of the major human fossil forms and interpretations of human phylogeny. Emphasis on Pleistocene and more recent Hominid forms and the fac- tors which shaped them into modern man. Prereq: 3 quarters of introductory anthropology. Recommended: 4960 and Zool 4380.

5000 Thesis

5010 Graduate Research (1-9) Independent investigation of special problems in anthro- pology.

5100 Seminar in Cultural Anthropology (3-9)

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

5140 Seminar in Zooarchaeology (3) Approach to the analysis and interpretation of archaeological faunas. Intensive reading; evaluation and discussion of major faunal studies,
French, German, or Italian, unless waived by the art history faculty.

**Classification of Art Courses**

A. Studio Art: 3516, 3517, 4015, 4115, 4215, 4315, 4415, 4515, 4525, 4534, 4545, 4615, 4616, 4617.

B. Art History: 3705, 3715, 3716, 3725, 3726, 3735, 3736, 3737, 3745, 3746, 3755-56-57, 3765, 3775-76-77, 3911, 4555-55-57, 4875-76-77.

**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.


**3705 Northern European Painting:** 1350-1600 (4) Painting and printmaking of the low countries, France, Germany, and England. Includes international Gothic, icons of Eyck, Bosch, Dürer, Holbein, and Bruegel.

**3715 Early Italian Renaissance Art:** 1300-1500 (4) Painting, sculpture, and architecture. Includes Giotto, Masaccio, Donatello, Brunelleschi, Alberti, Botticelli, and Leonardo.

**3716 Art in Southern Europe and New World** in Sixteenth Century (4) Italy, Spain, and Latin America, 1475-1600. Emphasis on Leonardo, Michelangelo, Raphael, Pontormo, Bellini, Giorgione, Titian, Tintoretto, Veronese, and artistic relations between Iberia and Latin America.


**3735 History of Nineteenth Century Painting in Europe and America** (4) Emphasis on: Neo-Classicism, Romanticism, Friedrich, Constable, Turner, Courbet and Barbizon landscapists, Hudson River Group, Pre-Raphaelite Brotherhood, Manet, Courbet, Impressionism, Eskins, Homer, Seurat through Cézanne.

**3737 History of Twentieth Century Painting in Europe and America** (4) Fauvism, Die Brücke, Cubism, Der Blaue Reiter, Futurism, Dada and Surrealism, geometric abstraction, social commentary painting, Abstract Expressionism in the U.S.A. and parallels in Europe, Pop, Op, Minimal, and Concept Art.

**3745 History of Modern Architecture** in Europe and America (4) Survey of seventeenth-century styles, Sullivan and skyscraper. Twentieth century: Viennese leaders, the Bauhaus, Gropius, van der Rohe, Le Corbusier, and Wright. Aalto to Kahn, Tange and Metabolism, Archigram, Sori, and Venturi.

**3746 History of Modern Sculpture in Europe and America** (4) From 1880 to 1900: Neo-Classicism to Rodin. From 1900 to present: emphasis on Cubism, Constructivism, Expressionism, Assemblage, Pop, Primary Forms, Environments, and Earthworks.

**3755-56-57 Studies in Art History** (4, 4, 4) Concentration in selected areas. Prereq: 9 hours of art history or consent of instructor.

**3757 History of North American Art** (4) Survey of landmarks in painting, architecture, sculpture, and design from prehistory to 1900.

**3766 History of Twentieth Century American Art** (4) Analysis of developments in painting, sculpture, and design from 1900.

**3775 Art of Indian Asia** (4) History of Indian art with consideration of art of Central Asia and Southeast Asia.

**3776 Chinese Art** (4)

**3777 Japanese Art** (4)

**3811 Introduction to Museology** (3) Concepts, practices and historical development of museums of art, archaeology, anthropology and science. (Same as Anthropology 3811.)

**4015 Individual Problems** (4) May be repeated. Maximum 12 hrs. Prereq: Consent of instructor.

**4115 Drawing IV** (4) Advanced compositions, stressing figure. May be repeated. Maximum 12 hrs. Prereq: 12 hrs of 3115.

**4215 Painting IV** (4) May be repeated. Maximum 12 hrs. Prereq: Consent of instructor.

**4315 Watercolor IV** (4) Advanced composition in transparent and opaque watercolor. May be repeated. Maximum 12 hrs. Prereq: Consent of instructor.

**4415 Sculpture IV** (4) May be repeated. Maximum 12 hrs.

**4515 Visual Communication IV** (4) Corporate design introduction.


**4545 Visual Communications Seminar II** (2) Political, social, economic and moral problems of contemporary designer. Prereq: 4515.

**4615 Intaglio IV** (4) Color problems with intaglio lithography. May be repeated. Maximum 12 hrs.

**4616 Lithography IV** (4) Color problems in lithography. May be repeated. Maximum 12 hrs.

**4617 Advanced Screen Printing** (4) May be repeated. Maximum 12 hrs.

**4855-56-57 Reading and Research in Art History** (2, 2, 2) Prereq: 16 hrs of art history and consent of instructor.

**4875-76-77 Studies in Oriental Art History** (4, 4, 4) Concentration in selected areas.

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

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

**5101 Foreign Study (1-12)** See page 146.

**5102 Off-Campus Study (1-12)** See page 146.

**5103 Independent Study (1-12)** See page 146.

**5110-20-30-40-50-60 Drawing and Composition (3, 3, 3, 3, 3, 3)

**5120-20-30-40-50-60 Oil Painting (3, 3, 3, 3, 3, 3)

**5140-20-30-40-50-60 Watercolor Painting (3, 3, 3, 3, 3, 3)

**5160-20-30-40-50-60 Sculpture (3, 3, 3, 3, 3, 3)

**5162-22-23, Serigraphy (3, 3, 3)

**5770-80-90, Seminar in Art History (3, 3, 3)

**5900 Seminar in Art Criticism (3)

**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
The intent of each major program is to provide the student with the scholarly and professional skills necessary for functioning as an independent professional clinician in any clinical environment. Within this broad coverage of speech pathology or audiology, it is possible for a student to specialize to some extent. For example, in the M.A. in the Audiology program, a student may emphasize audiological assessment, aural habilitation—rehabilitation, medical or pediatric, or industrial audiology. Within the M.A. in the Speech Pathology program, a student may emphasize language disorders, cultural language differences, or speech disorders such as aphasia or stuttering. Students interested in specializing beyond the typical broad M.A. program should consult the department office or the lists of suggested courses, practica and independent studies.

Students majoring in the two areas are expected to complete the academic requirements for clinical certification from the American Speech and Hearing Association, including the required number of clock hours of clinical practicum. An exception to this rule needs approval of the Department Curriculum Committee. Enrolment in clinical practicum courses is required for all clinical practice experiences. If the undergraduate preparation does not include sufficient

course work in speech pathology, audiology, psychology, and related fields, the student may be required to make up such deficiencies.

Students must elect either the thesis program or the non-thesis option. Students in both programs are required to take 5110 or 5119. The Master's program with the thesis will include a minimum of 45 quarter hours of approved graduate credit, including nine quarter hours of 5000 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least one-half of these total courses must be at the 5000 or 6000 level, no more than nine hours of which may be thesis courses. Students in the non-thesis option program must present a total of 48 quarter hours of approved graduate credit and pass a final written examination. A minimum of 24 quarter hours must be at the 5000 or 6000 level. The decision as to choice of the thesis or non-thesis program is normally made following completion of 5110 and a conference with the student's advisor.

THE DOCTORAL PROGRAM

The Ph.D. program in speech and hearing sciences seeks to develop individuals for research or college teaching careers in the field of speech pathology, audiology, or speech and hearing science. This degree program is research oriented, with primary emphasis upon developing the scientific and cognitive skills which allow individuals to identify and independently study important questions concerning the human act of oral and aural communication. Students will be expected to master the accumulated knowledge in the area of:

1. basic speech, hearing and language processes,
2. speech, hearing and language disorders,
3. related disciplines providing insight into human communication processes,
4. technical skills in instrumentation and experimental design which enable the student to investigate problems pertaining to speech and hearing processes.

The program will normally consist of two or more calendar years of graduate study beyond the Master's degree with the first year being devoted primarily to formal course work and the last year to full-time research culminating in the doctoral dissertation.

Specific programs of study will be determined by the student in consultation with his faculty committee. In addition to the general Graduate School requirements, specific requirements for the degree of Doctor of Philosophy in speech and hearing sciences will include:

1. Successful completion of course work in the study of one or more research tools, or other specific scientific methodological methodologies pertinent to the research interests of the student or area of specialization. The choice of research tool(s) is subject to departmental approval.
2. A minimum of nine 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.
4. 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.
5. Research and dissertation to give at least 16 hours of graduate credit (6000 level).
6. A final oral examination.
5119 Instrumentation in Speech and Hearing Science (3) An instrumentation course involving the spectrum of laboratory equipment available in speech pathology. Upon completion, the student should be able to select proper instrumentation for measuring the parameters of speech and hearing.

5200 Seminar on Slurring (3) Current significance of research related to slurring. Prereq: 4310 or consent of instructor.

5201 Aphasia (3) A historical review of aphasia literature including theories of brain function, classification and terminology, tests and rationale for testing, etiology, therapy considerations and prognosis for recovery. Prereq: 4300 or equivalent or consent of instructor.

5230-50-70 Advanced Clinical Practice in Speech Disorders (1-6) Prereq: Consent of instructor. S/NC only. 5340 may be repeated. Maximum 9 hrs. S/NC only.

5320-40-50 Advanced Clinical Practice in Speech Diagnosis (1-6, 1-6, 1-6) Prereq: Consent of instructor. Maximum 9 hrs. S/NC only.

5360-60-70 Advanced Clinical Practice in Speech Diagnosis (1-6, 1-6, 1-6) Prereq: Consent of instructor. S/NC only. 5370 may be repeated.

5380 Cerebral Palsy (3) Study of cerebral palsy with emphasis on functional, diagnostic and rehabilitative considerations. Prereq: Articulation Disorders. (Same as Special Education 5390.)

5390 Cleft Palate (3) Etiology, diagnosis, and clinical management of cleft palate speakers with emphasis on speech. Prereq: Articulation Disorders. (Same as Special Education 5390.)

5440 Hearing Aid Evaluation (3) Study of the procedures involved in assessing the benefits of amplification for the acoustically handicapped. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

5450 Sound Measurement and Analysis in Hearing Conservation (3) Study of noise measuring systems and techniques; a survey of factors in military and industrial audiology, and study of the role of the audiologist in industry. Prereq: 4710 or consent of instructor.

5460 Differential Diagnosis of Auditory Disorders (3) Theory and practice of advanced pure tone and speech audiometry; instrumentation and interpretation of audiometric findings with special reference to differential diagnosis. Prereq: 4720.

5470 Impedance Measurement in Audiology (3) Theoretical considerations behind the measurement of the middle ear system by acoustic techniques. Prereq: 4710, 4720, 4730 or consent of instructor.

5500 Seminar in Audiology (3) Study of significant research relevant to language and communication development in certain disorders of language. Prereq: Speech and Language Development, Psychology 3210 or equivalent. (Same as Psychology 5790.)

5501 Seminar in Language Differences (3) Study of significant research relevant to language differences of culturally different children.

5502 Non-Thesis Graduation Completion (3) 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.

5503 Seminar in Audiology Study and Practice (1-6) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. (Same as Special Education 5040.)

5505 Practicum in Aural Habilitation (1-6) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

5505 Practicum in Aural Habilitation (1-6) Enrolment by consent of instructor may be repeated. Maximum 9 hrs. S/NC only.


5550 Special Problems in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5560 Independent Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5560 Independent Study in Audiology (1-6) Supervised independent study, with emphasis on research activities in the field of audiology. May be repeated. Maximum 6 hrs.

5570 Seminar in Practicum: Language Pathology in Children (1-6) A controlled study and/or practicum involving the discussion and utilization of testing tools and analyses of habilitative philosophies and techniques. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5580 Advanced Clinical Practice in Speech Pathology (3) Theoretical and practical considerations related to the normal acquisition of language and certain disorders of language. Prereq: Speech and Language Development, Psychology 3210 or equivalent. (Same as Psychology 5790.)

5600 Applied Anatomy and Physiology of Speech Mechanism (3) Dissection and related readings. Prereq: 5060 or equivalent.

5610 Experimental Phonetics (3) Principles involved in the study of the production and perception of speech.

5620 Psychocoustic (3) Principles involved in auditory perception and reception of non-speech stimuli.

5630 Applied Anatomy and Physiology of Speech Mechanism (3) Dissection and related readings. Prereq: 5060 or equivalent.

5670 Experimental Techniques in Cochlear Physiology and Neurophysiology (3) Prereq: 5790 or equivalent.

5680 Seminar in Speech Science (3) Advanced study of experimental design and methods. Prereq: Speech physiology, acoustical analysis, recognition, perception and intelligibility of speech, communication theory, and psycholinguistic measurement of speech and language. Topics vary from quarter to quarter. Prereq: 5610 or consent of instructor. May be repeated. Maximum 9 hrs.

5690 Seminar in Hearing Science (3) Advanced study of various topics of the perception of the non-speech acoustic signal: detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 5620 or consent of instructor. May be repeated. Maximum 9 hrs.


5711 Physiological Acoustics (3) Techniques for electro-physiological measurement of auditory sensitivity, sound transmission by the ear, distortion in the ear, and the ear as an analytic mechanism. Prereq: 4710, 4720, Speech Science II, or approval of the instructor.

5720 Comparison of the Peripheral Auditory Structures (3) Tutorial laboratory course in comparative anatomy of the temporal bone employing microscopic dissection techniques. Prereq: 5070 or consent of instructor.

5730 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, application of statistics, and completion of a pilot research project.


Biochemistry

MAJOR

DEGREES

Biochemistry

M.S., Ph.D.

Professors:
J. W. Greenawalt (Head), Ph.D. Purdue;
J. E. Churchich, Ph.D. Sheffield (England);
K. S. Molett, Ph.D. (Physiological Chemistry);
T. P. Stelo, Ph.D. Michigan; J. R. Totter,
Ph.D. Iowa State.

Associate Professor:
J. G. Joshi, Ph.D. Poona (India).

Assistant Professors:
R. Bryant, Ph.D. Illinois;
R. H. Feinberg, Ph.D. California (Berkeley);
S. W. Hulson, Ph.D. Chicago; 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 courses:

1. Introductory Organic Chemistry with laboratory (at least 1 year)*, Inorganic Quantitative Analysis* (e.g., at least 1 quarter of analytical chemistry), Organic Qualitative Analysis* (e.g., Chemistry 4510), Introductory Physics*, Differential and Integral Calculus*; at least 3 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 6210-20-30), Infrared and Raman Spectroscopy (Physics 5440), Radiation Chemistry (Physics/Chemistry 5460), Advanced Thermodynamics and Statistical Mechanics (Chemistry 5110-20-30); plus minimum of 3 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.


3. Participation in Biochemistry 6410-20-30 and in the advanced biochemistry seminars during the entire period of residence.

4. Preliminary examinations are administered prior to 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 1 and 2.

5. A dissertation reporting the results of original and significant research carried out during the term of candidacy.

6. A final dissertation 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, 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 three 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: the chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; synthetic metabolism; nucleic acid chemistry and genetics; the regulation of biological processes. May be repeated.

5000 Thesis

5101 Biochemical Techniques (2) Theory and laboratory practice in sedimentation, chromatographic and electrophoretic techniques in the isolation and characterization of macromolecules. May be repeated.

5120 Membranes, Compartments, and the Regulation of Energy Metabolism (3) Examination of the metabolic pathways for electron transport, oxidative phosphorylation, and lipid synthesis, storage and degradation, and of the intracellular and inter-organ compartmentalization and the phenomenon of permeation which make possible the biological control of these pathways. May be repeated.

5130 Protein Structure and Enzyme Function (3) Physico-chemical properties of proteins, primary, secondary, tertiary and quaternary structure; denaturation, renaturation and other conformational changes. Fundamental relations; 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 the nucleic acids; hydrogel bonding and double-stranded structures, topology, supercoiling, and other higher order structural considerations; the biosynthesis of DNA's and RNA's; repair mechanisms; degradation, mechanisms of genetic information storage and retrieval. Prereq: 4110-20 or equivalent.

5230 Proteins' Synthesis and Its Role in Metabolic Regulation (3) Mechanism of assembly of peptide chains; ribosome structure and function; deciphering and genetic code; regulation of transcription and translation (e.g., induction, repression, etc.). Prereq: 4110-20.

5300 Graduate Research Participation (3-9) May be repeated. Maximum 12 hrs.

5310-20 Experimental Techniques (2, 2, 2) A tutorial laboratory course in modern experi-
mental methodology and instrumentation. Intended primarily for departmental majors.

5450 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated.

6000 Doctoral Research and Dissertation
ADVANCED BIOCHEMISTRY SEMINARS
Special subjects not covered in detail in the formal lecture courses of the department will be presented by students and staff. These will be supplemented with lectures by invited guest speakers who are recognized as leading authorities in the particular topic being discussed. One series (e.g., 6110-20-30) will generally be presented each year in a three-year repeating cycle. May be repeated with the consent of the department. Satisfactory/No Credit.

6110 Enzyme Kinetics and Mechanisms of Enzyme Action (1) S/NC only.
6120 Functions of the Vitamins (1) S/NC only.
6130 Functions of the Trace Elements (1) S/NC only.
6210 Structure and Function of Macromolecules (1) S/NC only.
6220 Biochemical Genetics (1) S/NC only.
6230 Metabolic Regulation (1) S/NC only.
6310 Biological Energy Transformations (1) S/NC only.
6320 Antigen-Antibody Interactions (1) S/NC only.
6330 Biochemistry of Specialized Physiological Processes (1) S/NC only.
6410-20-30 Current Topics in Biochemistry (2, 2, 2) Seminars and lectures dealing with current advances in the field of chemical biology. May be repeated with the consent of the department. S/NC only.

Biology

MAJOR

Biology

DEGREE

M.A.C.T.

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 Chairman of the Committee.

The admission requirements are:
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 M.A.C.T. degree in Biology will meet a minimum distribution of graduate and undergraduate courses as follows:

A. Eight quarter hours in each of the following:
1. Taxonomy and/or Ecology.
2. Morphology, Developmental Biology and/or Anatomy.
3. Physiology and/or Biochemistry.
4. Genetics, Cytology and/or Cyto genetics.
B. 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 among the four fields as specified by the interdepartmental committee administering the M.A.C.T. program in Biology.
C. At least 21 quarter hours of course work in requirement B (not including special projects and thesis) numbered at the 5000 or 6000 level.
D. At least nine quarter hours of Master's research and an acceptable thesis.
E. Total graduate credit in the biological sciences (or appropriate supporting fields) of 57 quarter hours (including that in A, B, C and D).
F. A three quarter one-hour seminar (or seminar series) on the problems and techniques of college teaching.
G. Six quarters of part-time, supervised college teacher-internship training.
H. A final comprehensive examination, oral, covering the thesis endeavor and the subject matter of the course requirements.

Botany

MAJOR

Botany

DEGREES

M.S., Ph.D.

Professors:
R. W. Holton (Head), Ph.D. Michigan;
E. E. G. Clebsch, Ph.D. Duke; R. H. DeSelim,
Ph.D. Ohio State; W. R. Herndon, Ph.D.
Vandervilet; L. R. Heater (Emeritus), Ph.D.
Cornell; G. E. Hunt, Ph.D.; Cornell; 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. Waine, Ph.D. Texas.

Associate Professors:
C. C. Amundsen, Ph.D. Colorado; S. L. Bell,
Ph.D. Chicago; M. W. Bierner, 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:
K. W. Hughes, Ph.D. Utah; O. J. Schwarz,
Ph.D. North Carolina State; D. K. Smith, Ph.D.
Tennessee.

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, nine quarter hours.

General degree requirements are given on page 17, and special departmental requirements include successful completion of:

MASTER OF SCIENCE DEGREE
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 or an A or B in French 3030 or German 3030 (can also be applied to the doctoral program).
3. Satisfactory completion of two credit hours at the 8000 level.
5. Presentation of a 30-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.

DOCTOR OF PHILOSOPHY DEGREE
1. Satisfactory presentation of a written formulation 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 written comprehensive preliminary examination.
3. Presentation of one or more cognate areas outside of the department totaling nine 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 nine credit hours at the 8000 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
**3010-20 Plants in Evolution (4, 4) Monera and its relatives (4).** Emphasis on evolutionary relationships, morphology, and development. Prereq: 3007 or 5017, and 5081 recommended. 1 hr and 3 labs.

**3031 Vascular Plant Taxonomy (4) Family characteristics of vascular plants, including principles of phyllody and classification, based primarily on plants of the local flora.** Prereq: 3030 or equivalent. 2 hrs and 2 labs.

**5061 Phylogeny (4) An intensive, comparative study of the major divisions of algae, both freshwater and marine, including the ecological, developmental, and phylogenetic aspects. Field and laboratory studies emphasizing identification and classification introduction to experimental phyology.** Prereq: 3010 or consent of instructor. 2 hrs and 2 labs.

**5070 Principles of Biological Illustation (3) Principles and application of photography, including photomicrography and photomacrophraphy, drawing graphics, and other methods to the recording and presentation for research and publication of data in pictorial or graphic form.** 1 hr and 2 labs.

**5150 Advanced Morphology of Flowering Plants (3) Development of human cultures, evolution of cultures and the role of plants in present civilizations. Occasional field trips.**

**5220 Advanced Plant Physiology II (3) Growth and differentiation of plants at the molecular, cellular, and organismic levels. Chemical regulation of development; macro-molecular interpretations of differentiation; photosynthesis; endogenous rhythms; dormancy; germination; flowering and senescence.** Prereq: 5210 or Botany 4120 and a plant or cell physiology course. 2 hrs and 2 labs.

**5290 Quaternary Problems (4) (Same as Geology 5290.)**

**5310-20-30 Special Problems in Botany (1-6, 1-6) Special topics. Prereq: Consent of instructor. May be repeated.**

**5340 Plant Geography (4) Distribution of ecosy-**

**5350 Analysis of Plant Communities (4) Plants as species and ecosystems components considered from the standpoint of geneology, ordination, and ecosystem function.** Prereq: 4310. 2 hrs and 2 periods (field trips).

**5410-20-30 Seminar in the Teaching of College Botany (1, 1, 1) Objectives in the teaching of college botany. Emphasis on principles and techniques in the general course; seminars in techniques, testing, concepts, and materials. Required of teaching assistants. Prereq: Consent of instructor. S/NC only.**


**5810 Cytogenetics (4) Changes in chromosomes and genes with relation to mutation, hybridization, speciation, and phylogeny. Prereq: General Genetics; 5780, or Zoology 4310. 2 hrs and 2 labs.**

**5820-21-22-23-24 Methods and Instrumentation in Laboratory Investigations (1, 1, 1, 1) A laboratory course providing project experience and theoretical background in various currently used research techniques. May include ion-exchange resins, adsorption spectrometry, disc electrophoresis, polarography, zonal and ultracentrifugation, gas chromatography, automatic analyzers, microscopy, culture methods, use and detection of radioisotopes, and others. Prereq: 4310 and Microbiology 3410. 2 hrs and 2 periods (field trips).**

**5910-20 Developmental Plant Morphology (3, 1) Developmental morphology of plants from the aspect of the morpho-**

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**Not for graduate credit for botany majors.**
growth, environmental and genetics factors. Prereq: 3010-20 or 4120, and 3210 or 5210 for 5910; 5910 for 5920. 2 hrs and 1 lab for 5910; 1 lab for 5920.

6009 Doctoral Research and Dissertation

6019 Advanced Topics in Morphology of Vascular Plants (2-4) Needs of the student determine the content. Topics will be selected from the broad categories of experimental anatomy, morphology and morphogenesis. Prereq: 3025-30, 4120, 5910-20 or consent of instructor. May be repeated with consent.

6069 Advanced Topics in Cryptogamic Botany (2-4) Advanced studies and current research in (a) experimental physiology, (b) mycology, (c) botany, (d) palynology, or (e) developmental morphology of cryptogams. May be repeated with consent of the department.

6210 Photobiology (3) The interaction of non-ionizing radiation with living systems. Prereq: Elements of Physics or equivalent; Biochemistry 4110.

6310 Advanced Topics in Cytology and Cell Biology (2-4) Requirements and interests of the students would determine topics, such as (1) actions of chemicals on actively dividing cells, (2) current ultrastructural research in selected cryptogams organelles and cellular systems, (3) experimental cytology, (4) cellular control of nucleic acid biosynthesis. Prereq: 5780 or Zoology 4310; General Genetics; Biochemistry 4110-20. May be repeated with consent.


6420 Advanced Topics in Genetics (2-4) Literature survey of selected topics from all areas of genetics. Prereq: General Genetics; Biochemistry 4110-20. May be repeated with consent.

6620 Seminar in the History of Botany (2)

6530-40 Radiation Ecology (2, 2) Use of radioisotopes for delineation of food chains, including quantitative analysis. For emphasis in environment, these additional courses must include Chemistry 5250-59-60-69-70-79, Ecology 5310, and Environmental Engineering 3000. For emphasis in energy, these additional courses must include Chemistry 5410, a chemistry sequence (Chemistry 5110-20-30-35 or 5250-60-70 or 5250-60-70 or 5710-20-30, 5810), Geology 5810, and Mechanical Engineering 4140. All course selections must be approved by the appropriate departmental committees.

1. Research and a thesis on an environment or energy-related problem to give nine to 18 hours of graduate credit. 2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.

3. Sufficient additional graduate course work in chemistry and/or related fields to give a total of 45 hours. For emphasis in environment, these additional courses must include Chemistry 5250-59-60-69-70-79, Ecology 5310, and Environmental Engineering 3000. For emphasis in energy, these additional courses must include Chemistry 5410, a chemistry sequence (Chemistry 5110-20-30-35 or 5250-60-70 or 5250-60-70 or 5710-20-30, 5810), Geology 5810, and Mechanical Engineering 4140. All course selections must be approved by the appropriate departmental committees.

4. Participation in seminar (5911-21-31) during the entire period of graduate study. (No more than three credit hours of seminar may be applied to the above requirements.) 5. A final oral examination.

5. A final oral examination.

MASTER OF ARTS IN COLLEGE TEACHING

The requirements for the M.A.C.T. degree in chemistry consist of the satisfactory completion of:

1. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.

2. Research and a thesis to give nine to 18 hours of graduate credit (5000).

3. Sufficient additional graduate course work in chemistry and/or related fields to make an overall total of 45 hours. These additional hours must include one of the following sequences: 5110-20-29-30, 5250-50-60-69-79, 5340-50, 5410-20-30, 5710-20-30. 4. Participation in seminar (5911-21-31) during the entire period of graduate study. No more than three credit hours of seminar may be applied to the above requirements.

5. A final oral examination.

DOCTOR OF PHILOSOPHY 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 biochemistry. For the Ph.D. degree in chemistry with specialization in analytical, inorganic,
organic, physical, or theoretical chemistry, 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 including at least six hours at the 6000 level and one of the following courses: (a) for analytical, 5250-59-60-69-70-79; (b) for organic, 5420-5710-20-30; (c) for physical, 5340-50, 5410-20-30-50, 5710-20-30; (d) for physical, 5340-50, 5410-20-30-50, Physics 5210.

Graduate course work in related fields may be used for undesignated course work in this requirement upon approval of the student's faculty committee.

5. A comprehensive advanced examination in the field of specialization.

6. Demonstration of a reading knowledge of one of the following languages:
   - French, German, Russian, or an approved alternate.

7. A final oral examination.

The requirements for the Ph.D. degree in chemistry with specialization in environment or energy consist of the satisfactory completion of:

1. Research and a dissertation on an environmental- or energy-related problem to give at least 36 hours of graduate credit.

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 and a six-month Internship in a government or industrial laboratory.

4. Thirty-nine hours of additional graduate course work including six hours at the 6000 level. For emphasis in environment, these additional courses must include Chemistry 5250-59-60-69-70-79, Ecology 5310, Environmental Engineering 3000, plus selected courses from other areas of chemistry, environmental engineering, meteorology, microbiology, health physics, ecology, computer science, statistics, and industrial health. For emphasis in energy, these additional courses must include Chemistry 5410, a chemistry sequence (Chemistry 5110-20-30 or 5250-60-50 or 5420-30 or 5710-20-30-50, 5810), Geology 5810, Mechanical Engineering 4140, plus other course selections from areas such as catalysis, heterogeneous equilibria, kinetics, the chemical sciences, combustion and propulsion engines, resource economics, nuclear engineering, and electrical engineering. All course selections must be approved by the appropriate departmental committee.

5. A comprehensive advanced examination.

6. Demonstration of a reading knowledge of one of the following languages:
   - French, German, Russian, or an approved alternate.

7. A final oral examination.

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 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, and 7 above.

The program in chemical physics is conducted jointly with the Physics department which offers a similar degree. A program leading to the Ph.D. degree with specialization in polymer science is conducted jointly with the Department of Chemical and Metallurgical Engineering, which offers a degree with similar specialization. This specialization requires satisfactory completion of:

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).

2. Chemistry 4160-70, 5531, 5140-50, 5160 or 5170, Chemical Engineering 4910.

3. Participation in Chemistry Seminar (5911-21-31) and the Polymer Seminar Program during the entire period of graduate study.

4. Thirty hours of additional graduate course work, including at least six hours at the 6000 level and at least 12 hours 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.

*3211-21-31 Organic Chemistry (3, 3, 3) The compounds of carbon and their reactions, reaction mechanisms, structure and properties of selected carboxylic and other physical properties. Must be taken in sequence.

*3219-29-39 Organic Chemistry Laboratory (1, 1) Experiments on topics discussed in 3211-21-31. The corresponding lecture (3211-21-31) 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. The corresponding lecture (3211-21-31) is a coreq for students not having credit for the lecture.


Coreq: Analytical chemistry.

*3429-39 Physical Chemistry Laboratory (1, 1) Gases, liquids, chemical equilibria, solutions, phase equilibria, reaction kinetics and electrochemistry. The corresponding courses (3420 and 3430) are corequisites. 1 lab.

*3511-21-31 Principles of Organic Chemistry (3, 3, 3) Structure and reactivity of aliphatic and aromatic compounds emphasizing reactions of synthetic interest and of spectroscopic and physical techniques to elucidate reaction mechanisms. Recommended for chemistry majors and students planning careers in physical or biological sciences. Must be taken in sequence. Prereq: General Chemistry. Corresponding laboratory: 3211-29-39 or 3319, with 3529-39 as a corequisite. The latter is recommended.

*3529-39 Organic Chemistry Laboratory (1, 1) Experiments on topics discussed in 3321-31. Similar to 3329-39 except designed for students who have need for operating knowledge of various spectroscopic and chromatographic techniques. Corresponding lecture (3211-31) is a corequisite 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 techniques, tracer procedures and safety precautions in agriculture, biology, medicine, nutrition. Not for credit by chemistry or physics majors or minors. Prereq: 1 year of general mathematics or equivalent, 1 year 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 corequisite.

4160-70 Intermediate Physical Chemistry (3, 3) (Designed for entering graduate students who have had one year of chemistry.) 4160—the three laws of thermodynamics, phase equilibria and solutions, and chemical equilibria. 4170—Gases and kinetic theory, chemical kinetics, molecular spectroscopy, and introduction to chemical statistics.

4210 Advanced Analytical Chemistry (3) Chemical separations including chromatography, ion exchange and solvent extraction; spectrophotometric techniques. Prereq: Analytical chemistry.

4219 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4210. Coreq: 4210.

4220 Advanced Analytical Chemistry (3) Electroanalytical methods of analyses (including potentiometry, coulometry, voltammetry); magnetic resonance methods; mass spectrometry; x-ray absorption and fluorescence techniques. Recommended: 3420 or 4920.

4229 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4220. Coreq: 4220.

4420 Physical Inorganic Chemistry (3) The fundamental theoretical concepts leading to an understanding of inorganic chemistry; the quantum theory of the atom, principles of molecular structure and metallochemical nuclear chemistry. Prereq: 4340-20-39, 4110.

4430 Intermediate Inorganic Chemistry (3) Detailed application of theoretical concepts of the inorganic elements, their chemical states, and their reaction mechanisms.

4510 Organic Qualitative Analysis (3) Identification of pure organic compounds and mixtures. Prereq: 3211-21-31, 3219-29-39 or 3219, 3529-39 3 labs. Not open to students who have completed 4610.

4550 Organic Reaction Mechanisms (3) Theory

* Not for graduate credit for chemistry majors.
of bonding and reaction mechanisms. Prereq: 1 year of organic chemistry.

4610-20 Advanced Chemical Experimentation (2) Applications of modern physical methods and synthetic organic compounds with emphasis on independent study using advanced techniques. Prereq: 3231-39 or 3531-39, 3420-20-30 or 4610 not open to students who have completed 4510.

4640 Electronics for Chemists (4) Electronics in design and construction of chemical instrumentation. Prereq: 1 year of physics.

4910-20-30 Biophysical Chemistry (3, 3, 3) Physicochemical principles with application to biological systems. Must be taken in sequence. Not open to students having 3410-20-30.


5129 Advanced Organic Chemistry Laboratory (3) Techniques in synthetic organic compounds illustrating modern techniques. Prereq: 1 year of organic chemistry.

5140 Introductory Polymer Chemistry (3) Fundamental principles, stressing the role of chemistry in the interdisciplinary field of polymer science; relation of molecular structure to bulk properties of polymers. Prereq: 1 year each of undergraduate organic and physical chemistry.

5150Kinetics of Polymerization (3) Kinetics of formation and molecular weight distributions of polymers, heterogeneous and homogeneous step growth and chain growth polymerizations. Prereq: 5140 and 4160-70 or equivalent.

5160 Organic Chemistry of Polymers (3) Synthesis of monomers; mechanism, stereochemistry, and sequence distortion of polymerization; polymer formation, block, graft, and network polymers. Reactions of synthetic methods including degradation. Prereq: 5140 and 5531.

5170 Physical Chemistry of Polymers (3) Rubber elasticity; solution properties of macromolecular compounds; conformational and conformational statistics of polymers. Prereq: 5150.

5240 Electronics for Chemists (4) Includes the material of Chemistry 4640 plus a special project. Prereq: Consent of instructor.

5250-60-70 Advanced Analytical Chemistry (3, 3, 3) 5250-Absorption and emission spectroscopy: fluorescence, phosphorescence; R, NMR, UV, and mass spectra; 5260-Chemical separation methods: solvent extraction, chromatography, electrophoresis; radiochemical methods; fluorescence; x-ray methods; 5270-Elementary quantum and thermal analytical methods; on-stream and automatic analysis. Prereq: 1 year of physical chemistry.

5250-69-79 Advanced Analytical Chemistry Laboratory (1, 1, 1) Experiments in the use of chemical separation methods and instrumental methods covered in the concurrent lecture course. Prereq: 1 year of physical chemistry. Coreq: 5250 for 5259; 5260 for 5269; 5270 for 5279.

5280-90 Clinical Chemistry (3, 2) Introduction to clinical chemistry, significance of physiological parameters, electrolytic balance, metabolic dysfunctions, analytical methodology, data processing, and special problem areas. Prereq: Biochemistry 4110; 1 year of instrumental and separation methods of analysis. Coreq: Biochemistry 4120 or equivalent.

5299 Clinical Chemistry Laboratory (1) Techniques of handling physiologic samples, analytical methods and special problem areas. Prereq or consent of instructor.

5310-20-30 Research in Chemistry (3, 3, 3) Special reading, consultation and laboratory (not applicable to formal course requirements.)

5340 Quantum Chemistry (3) Postulate approach to the fundamental principles of quantum mechanics and application of the Schrödinger equation; approximate (ab initio and semi-empirical) molecular orbital methods; calculation of molecular properties.

5350 Quantum Chemistry (3) Electronic excited states, introduction to group theory, perturbation theory; reactivity of organic molecules. Prereq: 5340.

5410-20-30 Advanced Physical Chemistry (3, 3, 3) Classical physics: 5420-Molecular structure and spectroscopy; 5430-Chemical kinetics. Prereq: 4110 or 4160-70.

5440 Experimental Methods of Infrared and Raman Spectroscopy (3) (Same as Physics 5440.)


5460 Radiation Chemistry (3) Interaction of high-energy radiation with matter with emphasis on the medium. Sources: (a) natural phenomena; (b) secondary processes and transient intermediates in diffusion models in the radiation chemistry of water and aqueous solutions; (c) gas-phase radiolysis; liquid organic compounds; solid state studies. Prereq: 5420 or Physics 4610, 4720-30. (Same as Physics 5460.)

5511 Survey of Inorganic Chemistry (3) Atomistic structure, the wave mechanical atom, ionic and covalent bonding, periodic relationships of the elements, inorganic stereochemistry, coordination chemistry, and the descriptive chemistry of the elements.

5521 Survey of Analytical Chemistry (3) Voluitmetric 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 oxygenated derivatives, carbonyl compounds, stereochemistry, aromatics, and spectral analysis of organic molecules by infrared, ultraviolet, nuclear magnetic resonance and mass spectral techniques.

5710-20-30 Theoretical Inorganic Chemistry (3, 3, 3) 5710-The nature of chemical bonding: ionic, covalent, metallic, molecular; 5720-Coordination compounds; 5730-Theoretical methods of structural inorganic chemistry. Prereq: 1 year of physical chemistry.

5810 Nuclear Chemistry (3) Nuclear properties, radioactivity, nuclear decay processes, nuclear structure and models, nuclear reactions, radiations and matter, radiation detection. Prereq: 1 year of physical chemistry.

5911-21-31 Chemistry Seminar (1, 1, 1) Discussion of current research, general chemistry, and current research literature and general chemistry. May be repeated. Registration required each quarter except summer for resident graduate students. S/NC only.

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as studied by opto-acoustic spectroscopy; chemical reactivity of excited states; ionization and free radical reactions; electron capture and electron-transfer processes. Pre-req: 5430.

6450 Electrochemistry (3) Electrical double layer; electrode kinetics; transport properties of electrolytes; electroanalytical methods. Pre-req: 5430 or 5270.

6475 Electronic Structure of Radicals (3) Applications of electron spin resonance to the study of molecular conformation, structure, and bonding in organic and inorganic radicals; comparison of experimental results with theoretical predictions based on the Walsh rules and on INDO molecular orbital calculations. Pre-req: 5340-50 and 6520.

6480 Statistical Thermodynamics (3) Application of statistical mechanical methods to systems of low concentration, phase equilibria, condensation phenomena, etc. Pre-req: 5410, 5450.

6495 Advanced Chemical Kinetics (3) Mechanistic study of chemical reactions at the 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 and transport phenomena, and chemical lasers. Pre-req: 5430.

6510 Thermodynamics of Solutions (3) The theory of regular solutions and of electrolyte solutions; measurement of activity coefficients and other thermodynamic properties; selected topics from the literature. Pre-req: 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. Pre-req: 5340.

6711 Selected Topics in Inorganic Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: photoelectron spectroscopy, transuranium chemistry, organometallic compounds, inorganic solution kinetics and mechanisms, crystal chemistry, non-aqueous chemistry, chemistry of halogens and compounds. Pre-req: Consent of instructor. May be repeated. Maximum 9 hrs.


6750 Molten Salt Chemistry (3) Structure, spectroscopic properties, solution thermodynamics, electrochemistry and phase equilibria of molten melts of metal salts. Pre-req: 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. Recent topics: nuclear decay schemes, nuclear models, nuclear reaction theory, nuclear detection techniques, activation analyses; Pre-req: Consent of instructor. May be repeated. Maximum 9 hrs.

6820 Molecular Vibration-Rotation Theory (3) (Same as Physics 6820.)

Classics

Professors: H. C. Rutledge (Head), Ph.D. Ohio State; A. Rapp (Emeritus), Ph.D. Illinois.

Associate Professors: M. L. Henbest, 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.

Greece

3010 Plato (3)
3020 Herodotus (3)
3030 Euripides (2)
4020 Aeschylus; Sophocles (3)
4030 Lysias (3)
4040 Aristophanes (3)
4050-60-70 Directed Readings in Greek (3, 3, 3)
5110-20-30 The Greek Epic, Homer (3, 3, 3)
5210-20-30 Greek Drama (3, 3, 3) Aeschylus, Sophocles, Euripides, Aristophanes.

Latin

3440 Livy (3)
3450 Pelly and Martial (3)
3460 Elegiac Poets (3)
4120 Horace, Satires and Epistles (3)
4310 Readings from Medieval Latin (3)
4320-30 Selected Readings from Latin Literature (3, 3) Latin 4110-20-30 will alternate with Latin 4110-20-30. May be repeated.
4340 Horace, Odes (3)
4350 Tacitus (3)
4360 Lucretius (3)
4370 Readings in Medieval Latin (3)
5310 Seminar in Caesar (3) Reading in the writings of Caesar, including the Gallic Wars. Recommended for teachers. Summer.
5410-20-30 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. Slides and tapes illustrate influence of Greek myths on art, music, and literature of ancient Greece 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.)
3310 Art and Archaeology of the Aegean Bronze and Iron Age (3) The Cyclades islands, Greek mainland, and Crete. Emphasis on palaces of Crete and Mycenae, Tiryns, and Pylos, their fall, the following Dark Age, and rebirth of Greek civilization. Illustrated lectures.
3320 Art and Archaeology of Archaic and Classical Greece (3) Survey of development of Greek architecture, sculpture, and painting from 650 B.C. to death of Alexander. Illustrated lectures.
3330 Art and Archaeology of Hellenistic Greece and Rome (3) Hellenistic Greek, Etruscan, and Roman sculpture, painting, and architecture with attention to city planning. Illustrated lectures.
3340 Cities of the Greek and Roman World (4) Archaeological survey of Greek and Roman cities from 3000 B.C. to 500 A.D. with emphasis on development of city planning and quality of life. Such cities as Mycenae, Athens, Priene, Alexandria, Rome, and Lepcis Magna will be studied.
3350 Shrines and Sanctuaries of the Greek and Roman World (4) Survey course with emphasis on archaeological remains such as Olympia, Epidaurus, Paestum, Cumae, Praeneste, and Baalbek.
4010 Greek Drama in English Translation (3) Survey of dramatic masterpieces of Greek.
4210 The Teaching of Latin (3) Carries no language credit. Purposes, techniques, materials, and evaluation; directed observation in public schools; preparation of teaching plans and materials.
4220 Seminar in Classical Studies (3) Special problems in the literature of the ancients. May be repeated with consent of department.
4230 Classical Mythology and Its Uses (3) An intensive review and survey of Greek and Roman mythology. Emphasis on the uses of classical mythology in literature, music, and the plastic arts, especially of modern times.
4510 Selected Readings in Latin Literature in Translation (3) Content varies; may be repeated with consent of department.
5520 Problems in Old World Archaeology (3) (Same as Anthropology 5620.)

Comparative Literature

H. C. Rutledge, Chairman

4012-22-32 Special Topics in Comparative Literature (3, 3) Content varies; may be repeated.
4050-60-70 Dante and Medieval Culture (3, 3) Readings and lectures in English for students majoring or minoring in other departments. (Same as Italian 4050-60-70.)
5012 Comparative Theories of Literature (3) Croce, Richards, Frye, Wellek, and others. Pre-req: Completion of three literature courses in a foreign language above 3000, or the equivalent.
5022 Approaches in Comparative Literature (3) The French and American schools; "comparative literature" vs. "general literature"; Van Tilburg, Clough, Baldensperger, Wellek. Pre-req: 5012; completion of three literature courses in a foreign language above 3000, or the equivalent.
5632 Studies in Comparative Literature (3) Independent research problems. Pre-req: 5012 and 5022.
Computer Science

MAJOR  DEGREE  M.S.

Professors:
R. T. Gregory (Head), Ph.D. Illinois;
R. E. Clines, Ph.D. Purdue (Mathematics);
F. Donaldson, Ph.D. Texas; R. J. Plammon,
Ph.D. Alabama (Computer Science); G. R. Sherman,
Ph.D. Purdue (Director of Computing Center).

Associate Professors:
R. M. Aiken, Ph.D. Northwestern;
R. C. Gonzales, Ph.D. Florida (Electrical Engineering);
C. E. Hughes, Ph.D. Pennsylvania State;
S. M. Selkov, Ph.D. Pennsylvania.

Assistant Professors:
A. M. Davies, Ph.D. Illinois; T. Feggin, Ph.D.
Texas; C. P. Huang, Ph.D. SUNY (Buffalo); S. R. Jordan,
Ph.D. Wisconsin; J. M. Moshell, Ph.D. SUNY;
J. P. Ploeger, Ph.D. Pennsylvania State;
J. R. Pinkert, Ph.D. Wisconsin;
D. W. Straight, Ph.D. Texas; M. G. Thomasin, Ph.D. Duke.

ENTRANCE 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. A basic statistics and probability

course such as Statistics 3450 (statistics
for engineering) or Math 3050 or 4650.
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.

REQUIREMENTS FOR
THE M.S. DEGREE

All students must receive departmental
credit for or exhibit proficiency in the
following courses:
1. CS 4550 and 4510
2. EE 5615-25-35
3. One of the three courses CS 4710,
EE 4035, or CS 4925
4. 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
EE 5615-25-35.

2. Pass written and oral comprehensive examinations.

Organizations of files; programming languages for
information structures. Prereq: Computer Organization and Programming II or consent of
instructor.

3. Introduction to Structured Programming
(4) Intermediate computer programming. Use of
general purpose language as PL/I. Concept of structured programming. Prereq: 3 hrs in programming or consent of
instructor.

4. Introduction to Numerical Algorithms
and Programming (3) Roots of equations,
systems of linear equations, least-squares fitting, numerical integration, numerical methods for ordinary differential equations.
Introduction to programming in FORTRAN. Prereq or coreq: Multivariable Calculus and Matrix Algebra. (Same as Mathematics 3150.)

5. Introduction to Numerical Algorithms (3) Roots of equations, systems of linear equations, least-squares fitting, numerical integration, numerical methods for ordinary differential equations. 3150 and 3155 may not both be taken for credit. Prereq: Introduction to Computer Science or consent of instructor. Prereq or coreq: Multivariable Calculus and Matrix Algebra.

4. Discrete Structures and Logical Foundations of Computer Science (5) Sets, relations, orderings, Boolean algebra, propositional logic, functions and computable functions; graph theory and applications to computer systems; set theoretical characterizations of computing machines and computing languages. Prereq: 3150 or consent of instructor.

5. Introduction to Algorithms, Languages, and Automation (3) Introduction to finite automatata; "effective procedures" and algorithms; Turing machines; formal languages and grammars. Prereq: 4035-45.

6. Introduction to Numerical Linear Algebra (3) Floating-point numbers and arithmetic on modern digital computers; numerical algorithms for solving systems of linear equations; linear least-squares methods and eigenvalue computations. Prereq: 3150 or 3155. (Same as Math 4035-49.)

7. Introduction to Numerical Analysis (3) (Same as Mathematics 4310.)

8. Computation in Statistical Analysis (3) Use of digital computer in standard statistical analysis, such as frequency tabulations, percentages and data reduction, correlation and regression. Emphasis on studying success and failure of major projects as well as investigating future role in health care. Prereq: 4820. Consent of instructor.

9. Computer Modeling and Simulation of Physical Systems (3) Techniques for computer modeling and simulation of physical systems, including laboratories, digital computers, and general purpose language computer programs. Prereq: 3150 or consent of instructor. Prereq: Computer Organization and Programming II or consent of instructor.

10. Medical Computing (3) A study of the application of computer technology to the field of medical computing. Prereq: Computer Organization and Programming II or consent of instructor.

11. Artificial Intelligence (3) Study of the application of intelligent processes by computers. Techniques of representation, search, and manipulation for various areas: problem solving, game playing, pattern perception, theorem proving, etc. Prereq: Computer Organization and Programming II or consent of instructor.

12. Medical Computing (3) A study of the application of computer technology to the field of medical computing. Prereq: Computer Organization and Programming II or consent of instructor.

13. Compiler Design (3) Trace development of major components of a compiler using the

College of Liberal Arts
constructs provided by formal language theory. Recognizers, symbol tables, semantic routines, allocation of storage, code optimization. Prereq: 4510, Computer Organization and Programming III, and 5750.

5455 Finite Difference Methods for Partial Differential Equations (3) (Same as Math 5455.)

5465 Mathematical Aspects of the Finite Elements Method (3) (Same as Math 5465.)

5565-5570 Numerical Mathematics (3, 3, 3) (Same as Math 5565-55-75.)

5570-80 Advanced Operating Systems (3, 3) Theory and analysis of operating systems. Synchronization and deadlocks. Analysis of operating systems using mathematical models, simulation, 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: 4510 or equivalent or consent of instructor.


5730 Computability and Computational Complexity (3) Computability and decidability; Turing machines and the halting problem. Register machines. Recursive and recursively enumerable sets; partial and total recursive functions. Time and space bounded computations: the P vs. NP problem. Prereq: Formal Languages and Automata.

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: Formal Languages and Automata.


5910-20-30 Special Topics in Computer Science (1-3, 1-3, 1-3) May be repeated. Maximum 9 hrs.

5940-50 Advanced Small Computer Systems (3, 3) (Same as Elec. Engr. 5940-50.)

5970-90 Seminar (1-3, 1-3, 1-3) May be repeated. Maximum 9 hrs.

Cultural Studies

Asian Studies

4010-20-30 Readings in Asian Literature (4, 4, 4) Prereq: Mastery of intermediate level of Japanese, Chinese, or Sanskrit and consent of instructor.

4120 Selected Topics in Asian Studies (4) Content varies. May be repeated. Maximum 12 hrs.

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: Introduction to Black Studies.

3500 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: Introduction to Black Studies or consent of instructor.

4200 Senior Seminar on Pan-Africanism (4) Explores concepts and philosophers of Pan-Africanism and implication of this ideology for various societal institutions.

4310 Research in Black Studies (4) Deals with Black experience and research process.

4500 Current Issues and Topics in Black Studies (3-4) Problems, topics and issues in the area of Black Studies. The course content and credit will be determined by the instructor. May be repeated. Maximum 8 hrs.


4880 Afro-American Psychology (4) (Same as Psychology 4880.)

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

Linguistics

4020 Historical Linguistics, Neogrammarian School, and Growth of Structuralism (3) Traces development of scientific approach to linguistics from Jacob Grimm and Franz Bopp through nineteenth century and change in linguistic interest under influence of Ferdinand de Saussure, Leonard Bloomfield and others.

4471-81 English as a Second or Foreign Language (3, 3) (Same as English 4471-81.)

Economics

See College of Business Administration.

English

MAJOR DEGREE

English M.A., M.A.C.T., Ph.D.

Professors:

J. H. Fisher (Head), Ph.D. Pennsylvania; E. W. Bratton (Asst. Head), Ph.D. Illinois; P. G. Adams1 (Director of Graduate Studies) Ph.D. Texas; N. Wright1 (Acting Director of Graduate Studies) Ph.D. Yale; J. L. Allen1, Ph.D. Florida; K. Curry, Ph.D. Yale; R. B. Davis1, Ph.D. Virginia; R. V. Drake, Jr., Ph.D. Yale; J. A. Hansen, Ph.D. Yale; R. M. Kelly, Ph.D. Duke; F. D. Miller1, Ph.D. Virginia; J. E. Reese (Chancellor), Ph.D. Kentucky; N. J. Sanders, Ph.D. Shakespeare Institute, Stratford-upon-Avon; H. E. Spivey1, Ph.D. North Carolina; B. T. Stewart, Ph.D. Pennsylvania; T. V. Wheeler, Ph.D. North Carolina.

Associate Professors:

L. S. Burghardt, Ph.D. Chicago; D. A. Carroll, Ph.D. North Carolina; B. K. Dumas, Ph.D. Arkansas; A. R. Ensrn, Ph.D. Indiana; B. J.

Gaines, Ph.D. Wisconsin; J. E. Gill, Ph.D. North Carolina; B. J. Foote, Ph.D. Florida; R. B. Miller1, Ph.D. Brown; D. A. Myers, Ph.D. Florida; A. R. Fenner, Ph.D. Colorado; F. K. Robinson, Ph.D. Texas; R. H. Walker, M.A. Texas.

Assistant Professors:

J. A. Armstead, Ph.D. Duke; D. R. Cox, Ph.D. Missouri; R. T. Goode, Ph.D. Texas; D. F. Goslee, Ph.D. Yale; N. M. Goslee, Ph.D. Yale; T. J. A. Heffernan, D.Phil. Cambridge; M. A. Lofaro, Ph.D. Maryland; M. P. Richards, Ph.D. Wisconsin.

Detailed information about the Master's and Doctor's programs may be obtained by writing the Director of the Graduate Program in 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 36 hour courses in English or 45 hour courses 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.

Students seeking the Master of Arts without a thesis may substitute nine hours of 5000-6000 courses for the thesis, making a total of 45 hours.

For the degree of Master of Arts in College Teaching (M.A.C.T.) the requirements include (1) 45 quarter hours of courses in English, (2) 6 hours in special courses designed for M.A.C.T. students, (3) a thesis or 9 additional quarter hours of 5000-6000 level courses in English, (4) evidence of proficiency in one foreign language, (5) a final examination, and (6) a program of supervised teaching approved by the department.

The language requirement may be fulfilled in one of the following ways:

a. The completion, before beginning graduate study, of a second year of a foreign language in college with a grade of C or better.

b. The completion of French 3020 or German 3020, at The University of Tennessee, with a grade of B or better.

c. The passing of the regular Ph.D. language examination as currently administered.

Registration in any course in the 5000 or 6000 series may be repeated for credit with the permission of the department. That is, courses having the same number, but with differing subject matter, may be taken with each separate subject description.

THE DOCTORAL PROGRAM

The departmental requirement for the Ph.D. degree in English is completion of a

---

1 John C. Hodges Professor.
2 Alumni Distinguished Service Professor.
3 Visiting Professor.
4 On leave, 1976-77.
5 Visiting and fall and winter quarters, 1976-77.
6 Visiting winter and spring quarters 1977.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Notes</th>
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<tr>
<td>4880</td>
<td>Seventeenth-Century Prose and Poetry: Bacon and Donne to Marvell</td>
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<td>4910</td>
<td>Chaucer—Early Poems and Troilus and Criseyde</td>
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<td>4920</td>
<td>Chaucer—The Canterbury Tales</td>
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<tr>
<td>4950</td>
<td>Approaches to Literature (3)</td>
<td>Basic knowledge and techniques necessary to understand and evaluate various kinds of imaginative literature</td>
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<td>5000</td>
<td>Thesis</td>
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<td>5002</td>
<td>Non-Thesis Graduation Completion (3)</td>
<td>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.</td>
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<tr>
<td>5101</td>
<td>Foreign Study (1-12)</td>
<td>See page 146</td>
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<tr>
<td>5102</td>
<td>Off-Campus Study (1-12)</td>
<td>See page 146</td>
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<tr>
<td>5103</td>
<td>Independent Study (1-12)</td>
<td>See page 146</td>
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<tr>
<td>5110-20-30</td>
<td>Tutorial in English (1, 1, 1)</td>
<td>Observation of courses in freshman and sophomore English, grading of papers, supervised teaching, weekly conferences or seminars on the teaching of college English. Prereq: Consent of instructor. Required of M.A.C.T. candidates. S/NC only.</td>
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<td>5150</td>
<td>Old English Prose (3)</td>
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<tr>
<td>5170-80</td>
<td>History of the English Language (3, 3)</td>
<td>5170-Phonetic transcription, Old English, development of inflection and syntax. 5180-Middle and Early Modern English, developments in pronunciation and vocabulary.</td>
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<td>5210-30-30</td>
<td>Readings in American Literature from the Colonial Period to the Present (3, 3, 3)</td>
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<td>5310</td>
<td>Rhetoric and Composition: Theory and Practice (3)</td>
<td>Concentration on stylistics and types of expository writing.</td>
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<tr>
<td>5410-20-30</td>
<td>Readings in Middle English Literature (3, 3, 3)</td>
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<td>5510-20</td>
<td>Readings in Literary Criticism from Plato and Aristotle to the Present Day (3, 3)</td>
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<td>5510-20-30</td>
<td>Readings in English Literature of the Nineteenth Century (3, 3, 3)</td>
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<td>5570-20-30</td>
<td>Readings in English Literature of the Eighteenth Century (3, 3, 3)</td>
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<td>5580-20-30</td>
<td>Readings in English Literature of the Renaissance (3, 3, 3)</td>
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<td>5860</td>
<td>Introduction to Literary Research (3)</td>
<td>Critical examination of the aims of English studies, the professions of the English teacher, theory of literature, and methods of research, including collecting of information, evaluation of material, and transmitting of the results of scholarship.</td>
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<td>5910-20-30</td>
<td>Readings in English and American Literature of the Twentieth Century (3, 3, 3)</td>
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<td>6000</td>
<td>Doctoral Research and Dissertation</td>
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<td>6110-20-30</td>
<td>Studies in Elizabethan Literature (3, 3, 3)</td>
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<tr>
<td>6150</td>
<td>Old English Poetry (3)</td>
<td>Prereq: 5150.</td>
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<tr>
<td>6160</td>
<td>Beowulf (3)</td>
<td>Prereq: 5150, 6150.</td>
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<tr>
<td>6170</td>
<td>Studies in Middle English (3)</td>
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<tr>
<td>6181-82-83</td>
<td>Studies in the English Language (3, 3, 3)</td>
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<tr>
<td>6210-20-30</td>
<td>Studies in American Literature (3, 3, 3)</td>
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<tr>
<td>6241-42</td>
<td>Studies in Colonial American Literature (3, 3, 3)</td>
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than Edwards to the adoption of the 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 Spencer and Milton (3, 3, 3)
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)
6910-20-30 Studies in Twentieth-Century Literature (3, 3, 3)

French
See Romance Languages

Geography
MAJOR
Geography

DEGREES
M.S., Ph.D.

Professors:
E. H. Hammond (Head), Ph.D. California

Associate Professors:
C. S. Allen, Ph.D. Georgia; T. L. Bell, Ph.D. Iowa; L. W. Brinkman, Jr., Ph.D. Wisconsin; J. B. Rehder, Ph.D. Louisiana State.

Assistant Professors:
J. R. Carter, Ph.D. Georgia; W. N. Cherry, M.S. Tennessee; B. Rainey, Ph.D. Northwestern.

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. Thesis and comprehensive examination required.

DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those persons who demonstrate proficiency 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. Specific course requirements will be determined by the student's committee in accordance with 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.


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 potentials of rural America.

3490 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 metallic resources.

3520 The Atmospheric System and Man (4) Overview of general circulation system leading to world pattern of climates. Role of climate in agriculture, architecture, 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; geography of administrative units.

3650 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, cultural, and economic characteristics 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 geographic character to regions of United States and Canada.

3920 Geography of the American South (4)

3940 Geography of Appalachia (4) Interrelations 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.

4100 Quantitative Methods in Geography (4) Geographic applications of statistical techniques, point pattern analysis and analysis of areal units. Prereq: Elementary Quantitative Methods 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 the management of environmental systems.

4510 Industrial Geography (4) Factors affecting location of manufacturing activities, with emphasis on the United States. Prereq: 3410 or consent of instructor.

4530 Geography of Agriculture (4)

4710 Cartography (4) Map construction, reproduction, and practice in map drawing.

4720 Data Mapping (4) Methods for representing spatial distributions by maps and graphs. Mappable 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.

5000 Thesis

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5150 Introduction to Geographical Research (3) The aims of geographical research; survey of printed source materials; practice in effective presentation of research findings.

5160 Research Design and Field Problems (4) Development of research plan, preparation of appropriate study designs, and practical field application. Normally offered as a 4-week summer course for 6 hours credit. Students may not take other courses or have due assignments during this 4-week period.

5170 Geographic Concept and Method (3) Traditional and modern thought regarding the nature, scope, problems, and methods of geography.

5200 Special Problems in Geography (2-4) Reading and research on problems or topics of interest to individual students. Must define topic and receive instructor's approval of study plan before registering for course. May be repeated with consent of instructor.

5250 Advanced Historical Geography (4) Application of principles and techniques of research in historical geography. Critical review of work of major historical geographers, with emphasis on current literature and ideas. Prereq: 4240 or permission of instructor. May be repeated with consent of instructor.

5260 Advanced Cultural Geography (3) Geographic analysis of rural settlement in the 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 Advanced Regional Geography of the United States (3) Intensive work in the delineation and analysis of one or more selected regions of the United States. The regions involved will change from offering to offering. May be repeated with consent of instructor.

5320 Advanced Regional Geography of the South (3)

5410-20 Advanced Economic Geography (3, 5)

5520 Advanced Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 3430 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. May be repeated for credit with permission of instructor. Prereq: 3530 or consent of instructor.

5610 Topics in Climatology (3) Examination of trends, problems, and methods in modern climatology. May be repeated for credit with permission of instructor. Prereq: 3620 or 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) Applied research using remote sensing and aerial photographic imagery for the 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

5110-20 Seminar in Economic Geography (3, 3)

6220-50 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:

G. Briggs (Head), Ph.D. Wisconsin; H. J. Kiepfer, Ph.D. Ohio; O. Kopp, Ph.D. Columbia; R. E. McLaughlin, Ph.D. Tennessee; D. H. Roeder, Ph.D. Geology (Germany); K. R. Walker, Ph.D. Yale; J. G. Walls, Ph.D. North Carolina.

Associate Professors:

G. M. Clark, Ph.D. Pennsylvania State; L. A. Taylor, Ph.D. Lehigh.

Assistant Professors:

D. W. Byerly, Ph.D. Tennessee; F. B. Keller, M.Phi. Yale; K. C. Misra, Ph.D. Western Ontario; W. P. Straub, Ph.D. Iowa State.

THE MASTER'S PROGRAM

The department requires a minimum of 45 quarter hours including at least 16 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 without having had an acceptable field sampling of geology, or to take Geology 4440, or an equivalent course elsewhere, as part of the above department requirements. One year of general physics is required, if not taken as an undergraduate. Orientation examinations will be given to determine course program, which must be approved by the student's committee.

DOCTORAL PROGRAM

Specific course program and thesis topic determined by candidate's faculty committee.

1. Program to be determined by faculty committee. Requirements include a minimum of 34 quarter hours in courses for graduate credit, in addition to dissertation. These courses must include a minimum of 45 hours in the 5000- or 6000-series, of which at least 15 hours must be in the 6000-series. 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) An introduction to the study of minerals, rocks and soils. Laboratory includes hand specimen and analysis of methods of identification of important rock-forming and economic minerals and major rock and soil types. Prereq: Geoscience I or Introductory Geology and 2 labs.

3160 Mineralogy (4) Classification and identification of silicate and non-silicate minerals. Minerals as phases in natural systems. Laboratory includes hand specimen, chemical and x-ray methods of identification. Prereq: 3160; General Chemistry or equivalent. 2 hrs and 2 labs.

*3210-20 Invertebrate Paleontology (4, 4) Systematic review of important invertebrate fossil groups. 3210—Protrista to Brachiopoda, including sponges, coelenterates and bryozoa. 3220—Phoronida to Hemichordata, including annelids, molluscs, arthropods and echinoderms. May be taken separately or in any order. Prereq: Paleobiology, General Biology, or consent of instructor. 3 hrs and 1 lab or field period.

3250 Micro-paleontology (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 or field period.

*3260 Paleobiology (4) An introduction to the principles and materials of paleontology as applied to the interpretation of earth history. Prereq: Geoscience II or Introductory Geology. 3 hrs and 1 lab or field period.

3270 Geological History of Land Organisms (4) The geological history of the terrestrial biota and ecosystem with special emphasis on the fossil record of land plants and animals. Prereq: Paleobiology or consent of instructor. 3 lectures and 1 lab or field period.

3290 Physical and Biological Quaternary Environment of Humans (4) Interdisciplinary interactions of the physical and biological Quaternary environment with humanity, stressing important affects on landscapes and biota that influence humans today. 2 lectures and 2 labs or field periods.

3310 Lithology (4) Classification and properties of igneous, metamorphic and sedimentary rocks. Laboratory includes both hand specimen and microscopic study of important rock types. Prereq: 3160. Strongly recommended: 3160. 2 lectures and 2 labs.

3330 Geology of East Tennessee (4) Lectures and field excursion. Prereq: 12 hrs of geology and consent of instructor.

*3360 Stratigraphy-Sedimentation (4) An introductory study of stratigraphic principles and practices and of sedimentary processes and the interpretation of depositional environments. Prereq: Geoscience II or Introductory Geology and 3160. 3 hrs and 1 lab or field period.

*3370 Structural Geology (4) Introductory discussion of structures such as folds, faults, joints, cleavage and primary structures. Laboratory work includes depth and thickness problems, structure contour and cross-section maps, etc. Prereq: Geoscience II or Introductory Geology and Single Variable Calculus or equivalent. 3 hrs and 1 lab.

*3410 Principles of Ground Water Geology (3) Geologic materials and processes affecting the occurrence and behavior of water. 2 lectures and 1 lab. (Same as Water Resources Development 3410.)

3510 Introductory Environmental Geology (4) Geologic problems involving earth environment and resources, and geologic parameters associated with their control and misuse. Prereq: Geoscience II or Introductory Geology or consent of instructor. 2 hrs and 2 labs or field periods.

*3520 Our Changing Landscapes (4) A basic introduction to the study of landscape-forming processes and their interactions with earth materials to produce landscapes. Laboratory experience includes slope and streamtable experiments and field experience. 2 hrs and 2 labs or field periods.

3610 Quaternary Geology for Engineers (3) Erosional and depositional processes, landforms, ground-water. 2 lectures and 1 lab or field period. Prereq: Introductory Geology for Engineers or equivalent.

3710 Origin and Evolution of the Continents and Ocean Basins (4) An introductory study of the origins of the continents and that have occurred in the earth's crust with emphasis on modern concepts of continental drift and plate tectonics. Prereq: Geoscience II or Introductory Geology.

4110 Principles of Economic Geology (4) Formation of mineral deposits. Prereq: 3160, 3370, or equivalent. 3 lectures and 1 lab.

4115 Elementary Applied Geophysics (4) Basic principles of electrical, seismic, gravity and magnetic surveys. Prereq: Geoscience II and elementary physics. Differential and integral calculus desirable. 3 lectures and 1 lab.

* Not available for graduate credit for geology majors.
4130 Sedimentology (3) Prereq: 3160. 2 hrs and 2 labs.
4210 Biostratigraphy (4) Fossil faunas and floras and their use in geochronology, strati-
graphic correlation, and paleoecology. Prereq: 3260. 3 hrs and 1 lab.
4230 Paleocology (4) Principles of environ-
mental 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 making
inferences about biologic and environmental sus-
ception and geographic distribution of past floras
on earth. Prereq: Geoscience II or Introductory
Geology or History of Life on Earth; Plants in
Evolution or consent of instructor. 3 hrs and 1 lab. (Same as Botany 4240.)
4310 Geologic Mapping (4) Interpretation and
methods. Prereq: 12 hrs of 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, and geological photographs and fabric dia-
grams. 3 lectures and 1 seminar or lab. Prereq: 3370 or consent of instructor.
4440 Field Geology (5) Five weeks' field
course, first term summer quarter. Employs every
imaginable method of students. A report is required,
to be submitted no later than end of fall
quarter. Prereq: 12 quarter-courses in geology
and consent of instructor.
4460 Geologic Photography and Photogram-
metry (4) An introduction to the principles of
terrestrial and aerial geologic photography, in-
cluding photography in the field, principles and practice,
geometry of terrestrial and aerial photographs, and
image interpretation. Prerep: 3370 or con-
sent of instructor. 3 lectures and 1 lab.
4510 Principles of Geomorphology (4) A study of
the gradational processes acting in the
earth's surface and the landforms produced.
Prereq: Geoscience I or Introductory Geology
or consent of instructor. 3 hrs and 1 lab. (Same as Geography 4510.)
4610 Principles of Geochemistry (4) Application of
chemical principles to geologic prob-
lems; emphasis on crystal chemistry and relation
between basic atomic structure and distribution and behavior of elements in the
earth's crust. Prereq: General Chemistry or
equivalent required. Recommended: Introduc-
tion to earth materials.
4650 Mineral Phase Equilibria (3) Principles of
fundamental chemistry and application of phase
equilibria studies in rock-forming mineral sys-
tems as aid to understanding conditions of
formation and modification of rocks. Prereq: 3310 or consent of instructor.
4660 Electron Microprobe Analysis: Theory and
Application (3) Techniques and appli-
cability of electron probe in chemical analysis;
emphasis on applications in the earth sciences.
Prereq: 3310 or consent of instructor. 2 lec-
tures and 1 lab.
4760 Global Tectonics (3) The earth's gravity
field; structural units and internal structure
of the earth; the geomagnetic field, paleomag-
netism, radioactivity and the age of the earth;
the earth's internal heat, creep and seismology
of the mantle. 3 lectures per week. Prereq: 4115 or consent of instructor.
4810 Special Problems in Geology (1-4) May be
repeated. Consent of instructor.
5000 Thesis
5050 Geochemistry of Ore Mineral Deposits (3) Study of ore deposits based on experi-
mental, empirical, and theoretical geochemical considerations. Prereq: 4850 and 4110 or con-
sent of instructor.
5060 Experimental Geochemistry (3) Study of
various experimental techniques for investigat-
ing mineral, chemical, and geothermal systems. 3 lectures and 1 lab.
5069 Experimental Geochemistry Laboratory (1-3).
Independent laboratory problems in geochemistry using lab techniques in 5060. Prereq: 5060 or consent of instructor.
5120 Geophysics—Gravity and Magnetic Meth-
ods (4) Potential methods discussed in depth,
introduction to geodesy and palaeomagnetism.
Prereq: 4115, Differential and Integral Calculus or consent of instructor. Advanced engi-
neering mathematics desirable. 3 lectures and 1 lab.
5130 Geophysics—Seismic Exploration Meth-
ods (4) Seismic refraction and reflection meth-
ods discussed in depth. Introduction to earthquake seismology and the earth's interior.
Prereq: 4115 or consent of instructor. 3 lectures and 1 lab.
5210 Special Problems in Geology (1-4) May
be repeated with consent of instructor. 3 hrs and 1 lab or field period.
5280 Quantumary Problems (4) An interdis-
ciplinary approach to the interpretation of physical and biological phenomena directly or
indirectly influenced by Pleistocene glaciation.
Prereq: Elements of Geology (3 quarters) or consent of instructor. (Same as Botany 5200 and
Geology 5210.)
5310 Principles of Stratigraphy (4) Prereq: 4130.
5320-53 30 Advanced Historical Geology (3, 3)
5340 Seminar in Local Stratigraphy (1) Stra-
tigraphy of the Knoxville area.
5350 Selected Topics in Geology (1) Presenta-
tion of graduate research topics, from current
literature, and subjects of general interest. Registration required each quarter except sum-
mer for resident full-time graduate students. S/NC only.
5360 Selected Topics in Geology (1) May be
repeated for credit with consent of depart-
ment.
5370 Mesofabric Analysis (4) Introduction to
techniques of gathering, processing, and Inter-
preting fossil fabrics. 3 lectures and 1 lab or field meeting. Prereq: 3370.
5460 Photogeologic Interpretation (4) Ad-
vanced photogrammetric techniques used to
obtain geological measurements from aerial
photographs. Practice in photo interpretation
of imagery covering selected geologic features. Prereq: 5450 or equivalent or consent of
instructor.
5470 Plate Tectonics and Orogeny (4) Geo-
metry and kinematics of plate motion are
used to devise models of geosynclines, fold
belts, metamorphic and plutonic belts, with
recent and ancient examples. 3 lectures and 1 seminar or lab. Prereq: 3370.
5510 Optical Mineralogy (4) Identification of
mineral studies. Prereq: Mineralogy and 5630
minerals; their structures and properties; ap-
lication of mineralogical techniques in clas-
minal studies. Prereq: Mineralogy and 5630 or equivalent. 2 lectures and 2 labs. To be
offered on alternate-year basis.
5650 Thermodynamics for Geologists (3) Prin-
ciples of chemical thermodynamics as related
to geologic processes. Prereq: General Chem-
istry and Analytic Geometry and Calculus of
a Single Variable or equivalents.
5660 Chemical Geochemistry (3) Chemical ap-
proach to selected geologic problems. Topical
study include oxidation-reduction, phase equilib-
rium, chemical mineralogy. Prereq: 5650.
5670 Geochronologic Prospecting (3) Theory and
practice of geochronological prospecting for
metallic ore deposits, i.e., the use of chemical
analyses of rock, soil, plants, water, and
stream sediments for locating ores. Prereq: 4110
and General Chemistry or equivalents.
5710 Advanced Paleontology (4) Fossil in-
vertebrates.
5750 Petrophysics (3) Fluid and heat flow
through rock. Mohr circle theory and stress-
strain behavior of rock. 3 lectures. Prereq: Analytic Geometry and Calculus of a Single
Variable. Elements in Physics.
5810 Geology of Fuels (4) Origin, occur-
cences, and uses of fuels. Prereq: 5820.
5820 Metallic Mineral Deposits (4) Origin,
ocurrence, and uses of metallic minerals.
5830 Nonmetallic Mineral Deposits (4) Origin,
ocurrence, and uses of nonmetallic minerals. 3 hrs and 1 lab or field period.
5840 Ore Microscopy (4) The study of ores and
mineral deposits by reflected light microscopy,
x-ray, and other techniques. Prereq: 4110, 5510, and consent of instructor. 2 hrs and 2 labs.
5850 Regional Studies in Economic Geology (3)
Lecture study and lectures during winter
cluster, followed by field trip between winter and
spring quarters to mining operations and
other places of geological interest. Prereq: 4110 and consent of instructor. 2 hours plus
field trip. May be repeated with consent of
department.
5915 Regional Geomorphology (4) Study of
patterns of geomorphologically-related areas,
which have common elements such as history
or development, related processes which have
resulted in genetically 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)
addition to 36 hours of doctoral research and dissertation. At least 45 quarter hours of the minimum must be taken in 5000 or 6000 courses. Of these 45 hours, a minimum of 18 hours must be chosen from the pro-seminar (5200) and the literary or philological seminars (6210-20-30-40-50-60 and 6310-20-30). At least nine hours must be taken in a cognate field. Students are encouraged to take additional work in allied fields. A minor in an allied field must consist of at least 18 hours of 5000 or 6000 courses. Students must show a fluent command of German, both oral and written, and a knowledge of two other foreign languages, French and another language, such as Italian, Latin or Russian, appropriate to his field of research. A preliminary comprehensive examination, both written and oral, on German Language and Literature and the minor field or fields, must be passed before the student may be admitted to candidacy. The student will be examined on an extensive reading list which covers the whole range of German literature, and will be expected to show familiarity with major works of world literature. The candidate will be required to defend the dissertation in an oral examination, which will cover also the general area of the dissertation. Central emphasis is put on the doctoral dissertation as a final test of the candidate's scholarly qualifications. The field of study is divided into (1) German literature and (2) German (or Germanic) philology or linguistics. A student may concentrate on one or the other. Dissertation and seminar research topics will be chosen in accordance with the varying preferences and specific interests of the faculty. Detailed programs will be established in each case by the student's faculty committee.

German

3010-20-30 Elements of German for Upper Division and Graduate Students (3, 3, 3) For graduate students preparing for language examinations. No graduate credit allowed.

3210-20-30 German Literature in English Translation (3, 3, 3) No foreign language credit.

3240 Old Norse Literature in English Translation (3, 3) No foreign language credit.

3250 Modern Scandinavian Literature in English Translation (3) Introduction to modern literature of Sweden, Norway, Denmark, and Iceland. Representative readings by such writers as Ibsen, Strindberg, Lagerhöf, Hamsun, Vesaas, Lagerkvist, Bang, Nexø, Laxness. No foreign language credit.

4050 The Faust Legend (3) Survey of development of legend from Faust chappo to present, excluding Goethe's Faust. No foreign language credit.

4110-20-30 Studies in Classical and Modern Writers I, II, III (3, 3, 3) May be repeated for credit. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30) or equivalent.

4140-50 Selected Topics in German Literature from 1750 to the Present (3, 3) Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30) or equivalent.

4160 Studies in German Authors (3) Study of the life and works of a single outstanding German literary figure. Content varies. May be repeated for credit. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30).

4170 Theatrical German (1-3) Performance in one or more German plays. May be repeated for credit with consent of department. Prereq: Intermediate German or equivalent or consent of instructor.


4250 Introduction to Descriptive Linguistics (3) (Same as French 4250).

4260 Introduction to Historical and Comparative Linguistics (3) Linguistic change, phonological and morphological change. Cultural, historical, sociological influences upon the development of language. Semantics, lexicography. All these topics copiously illustrated by selected examples from Indo-European languages. Prereq: 9 hours of upper division English, or 9 hours of upper division courses in a modern or ancient language (exclusive of German and French 3010-20-30, courses in literature in translation, and general courses in Latin and Greek requiring knowledge of these languages), or consent of department. (Same as French, Russian, and Spanish 4260).

4270 Introduction to Germanic Linguistics (3) The phonetics and phonemics of German. German grammar and the German vocabulary from a descriptive point of view. The dialects of German. An introduction to the study of the other Germanic languages.

4310-20 History of the German Language (3, 3)

4610-20-30 German Civilization (3, 3, 3) Prereq: Intermediate German or equivalent.

4810-20-30 Advanced Conversation and Composition (3, 3, 3) Prereq: 3810-20-30 or equivalent or consent of department.

5000 Thesis

5101 Foreign Study (1-12) See page 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

5140 Old Saxon (3) The phonology, morphology, and syntax.

5200 Proseminar (3) Bibliography; methods; illustrative problems; preparation of papers.

5210-20-30 College Teaching of German I, II, III (3, 3, 3) Prereq: 9 hours of upper division courses in a modern or ancient language (exclusive of German and French 3010-20-30, courses in literature in translation, and general courses in Latin and Greek requiring knowledge of these languages), or consent of department. (Same as French, Russian, and Spanish 5210-20-30).

5410-20-30 Medieval German Language and Literature (3, 3, 3) 5410—Introduction to Middle High German. 5430—Readings in Mediæval German Literature.

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)
I. Ancient and Medieval

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>(1) Ancient Near East</td>
<td>Greece</td>
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<tr>
<td>(2) Greece</td>
<td>Rome</td>
</tr>
<tr>
<td>(3) Rome</td>
<td>Early Middle Ages, 375-1122</td>
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<tr>
<td>(4) Early Middle Ages, 1095-1450</td>
<td>Late Middle Ages, 1095-1450</td>
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II. Early Modern

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>(1) Renaissance and Reformation</td>
<td>Europe, 1559-1615</td>
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<tr>
<td>(2) European World Since 1615</td>
<td>American History to 1815</td>
</tr>
<tr>
<td>(3) United States, 1815-Present</td>
<td>Latin America, 1492-1825</td>
</tr>
<tr>
<td>(4) Latin America, 1789-Present</td>
<td>Asia, 1614-Present</td>
</tr>
<tr>
<td>(5) East Asia, 1614-Present</td>
<td>Middle East, 1798-Present</td>
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III. Modern

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<tbody>
<tr>
<td>(1) Europe, 1815-1914</td>
<td>Europe, 1798-1914</td>
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<tr>
<td>(2) European World Since 1914</td>
<td>Latin America, 1789-1914</td>
</tr>
<tr>
<td>(3) United States, 1815-Present</td>
<td>Latin America, 1815-Present</td>
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<tr>
<td>(4) Latin America, 1815-1914</td>
<td>Asia, 1614-Present</td>
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<tr>
<td>(5) Asia, 1614-Present</td>
<td>Middle East, 1798-Present</td>
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IV. National, Sectional and Topical

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<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>(1) England, 1485-1763</td>
<td>Great Britain, 1700-Present</td>
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<tr>
<td>(2) Great Britain, 1700-Present</td>
<td>France, 1559-1615</td>
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<tr>
<td>(3) France, 1789-Present</td>
<td>Germany, 1555-1806</td>
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<tr>
<td>(4) Germany, 1806-Present</td>
<td>Russia, 1600-1800</td>
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<td>(5) Russia, 1800-Present</td>
<td>Russia, 1800-Present</td>
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<td>(6) Russia, 1800-Present</td>
<td>Colonialism and Imperialism</td>
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<td>(7) Colonialism and Imperialism</td>
<td>Diplomatic History of the United States</td>
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<td>(8) Diplomatic History of the United States</td>
<td>Social and Cultural History of the United States</td>
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<tr>
<td>(9) Social and Cultural History of the United States</td>
<td>The South</td>
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<tr>
<td>(10) The South</td>
<td>Frontier and Westward Movement</td>
</tr>
<tr>
<td>(11) Frontier and Westward Movement</td>
<td>African-American History</td>
</tr>
<tr>
<td>(12) African-American History</td>
<td>Preliminary examinations will be both written and oral.</td>
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</tbody>
</table>

5. 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.

3001-71 History of Western Religious Thought and Institutions (3, 3, 4) (Same as Religious Studies 3061-71.)

3140-50-60 History of England (3, 3, 3) 3140—Henry VII through the Revolution of 1688, 3150—1689 through the Reform Bill of 1832, 3160—1860 to the present

3211-21 History of Tennessee (3, 3) 3211—18th century to Civil War Era, 3321—18th century to present

3411-12-13 Renaissance and Reformation (3, 3, 3) 3411—The Renaissance, 3412—The Reformation 1517-1550, 3413—The Catholic Reformation and the Wars of Religion. (Same as Religious Studies 3411-12-13.)


3445-46 History of France (4, 4) 3445—France to 1785, 3446—France since 1785.

3470-80-90 History of Russia (3, 3, 3) 3470—To 1801, 3480—19th Century, 3490—20th Century.
Before admission to this program, the applicant must have either (a) certification for teaching secondary mathematics in at least 1 of the states of the United States, or (b) a strong background in 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) Completion of 45 hours of course work. A minimum of 30 hours must be taken in residence.
(2) A minimum of 36 hours must be selected from the mathematics courses 3050, 3060, 3090, 3100, 3110, 3120, 3130, 3150, 3155, 3230, 3240, 3310, 3510, 3520, 3530, 3710, 3720, 3810, 3910, or other mathematics courses numbered above 4000.
(3) Passing a comprehensive examination on completion of all course work.
(4) A minimum of 9 hours of courses numbered above 5000 subject to the approval of the mathematics department and the department in which the courses are taken.

MASTER'S PROGRAM
The Master of Arts degree and the Master of Science degree are designed primarily for prospective high school or college teachers and also for people interested in applied mathematics.

The departmental requirement for either of these degrees is a thesis, for which 9 credit hours must be earned, and 36 additional hours of acceptable course work numbered above 4000. Of the above 36 hours, 9 hours may be in a minor outside the department and 18 hours (exclusive of thesis) must be completed from courses in mathematics numbered above 5000.

It is strongly recommended that a candidate for the Master's degree with a major in mathematics develop a reading knowledge of French, German, or Russian.

A student offering mathematics as a minor for the Master of Science 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.

DOCTORAL PROGRAM
The preliminary examination for the Ph.D. degree in mathematics will include 4 of the following subjects (including at least 2 from Group A) to the extent indicated by the accompanying course numbers, and such other subjects as the graduate faculty may prescribe.

(A) Algebra 5510-20-30 Functions of a Complex Variable 5110-20-30 Functions of a Real Variable 5210-20-30 Topology 5910-20-30
(B) Linear Algebra 5240-50-60 Mathematical Statistics 5750-60-70

Numerical Analysis 5650-60 Partial Differential Equations 5450-60-70

Note: A student selecting 2 subjects from Group B above is required to take a 1 year graduate level (numbered 5000 or above) course in mathematics that is extensively used, outside of the Mathematics department. This course must be approved by the Mathematics department head.

It is expected that the candidate will participate in courses and seminars in mathematics and related fields beyond those required to qualify for the preliminary examination. The amount and nature of this work will be determined by the student and his committee.

Two foreign languages are required. German or French 3030 with a grade of A or B may be substituted for the corresponding language 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: Introductory Calculus, General Mathematics 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.

3050 Polynomials and Rings (3) Elementary introduction to modern abstract algebra. Axiomatic approach is used to study divisibility and factorization in rings of integers and of polynomials with coefficients from various fields. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

*3100 Logic and Sets (3) Elements of mathematical logic; truth sets and open sentences; diagrams for truth sets; the theory of elementary algebra of sets with operations of union and intersection. Prereq: 1 yr of college math. Primarily for students in the College of Education.

*3110 The Real Number System (3) Laws of arithmetic; rational and irrational numbers; fields. Prereq: 1 yr of college math. Primarily for students in the College of Education.

3150 Introduction to Numerical Algorithms and Programming (3) (Same as Computer Science 5150)

3155 Introduction to Numerical Algorithms (3) (Same as Computer Science 5155)

3220 History of Mathematics (3) Survey of development of various branches of mathematics, from ancient to modern times. Prereq: Single Variable Calculus or Calculus or equivalent.

3310 Advanced Euclidean Geometry (3) Triangles and circles, constructions, modern concepts. Prereq: 1 yr of college math.

* These courses are sometimes offered in special summer institutes for 6-8 week period with 4 hours credit. Such special courses are designated 3911, 3910, et cetera.

3320 Non-Euclidean Geometry (3) Foundations of geometry, Elliptic and hyperbolic plane geometry. Prereq: 1 year of college math.

3330 Transformational Geometry (3) Fundamental transformations of Euclidean geometry. Classification of isometries and similarities; symmetries of a polygon; inversions. Prereq: 1 year of college math.

3510 Intermediate Analysis (3) Primarily for students in secondary mathematics education. Course covers elementary calculus from advanced viewpoint with emphasis on proofs of basic theorems. Topics covered include limits of sequences and functions, continuous functions, derivatives, definite integral, and fundamental theorem of integral calculus. Prereq: Calculus of Algebraic Functions, Linear Algebra and Calculus or Single Variable Calculus.


3780-90 Introduction to Combinatorial Theory (3, 3) Introduction to problems of arrangement and selection within discrete systems. Enumeration by recurrence relations and generating functions, graph theoretical properties, inclusion and exclusion principles, finite fields, partitions, block designs. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

3810 How to Prove It (3) Course is designed to improve student's understanding of mathematical proof by means of practice and participation in seminar setting. Variables: contexts and certain standard topics such as elementary set theory, relations and functions, and mathematical induction. Coreqs: Multivariable Calculus and Matrix Algebra or Calculus.

3920-30 Topology of Euclidean Spaces (4, 4) Topics will include topology of line and plane, separation properties, compactness, connectedness, completeness, continuous functions, homeomorphisms, continua, and topological invariants. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra or Calculus, or Honors: Multivariable Calculus and Linear Algebra.

3990 Studies in Mathematics (1-4) Credit determined at registration. Prereq: Consent of instructor. May be repeated for credit with consent of department. Maximum 9 hrs.

4035-45 Introduction to Numerical Linear Algebra (3, 3) (Same as Computer Science 4035-45)

4050 Matrix Algebra and Applications (3) Matrices, elementary operations, systems of linear equations, vector spaces, determinants, eigenvalues and eigenvectors. Prereq: Multivariable Calculus and Matrix Algebra or Calculus or consent of instructor.

4060-70 Matrix Algebra and Applications (3, 3) Eigenvalues and eigenvectors, singular values and singular vectors, unitary and similar transformations, quadratic forms, vector and matrix norms, Jordan canonical form, and related topics. Prereq: Multivariable Calculus and Matrix Algebra or Calculus.

4120 Linear Algebra (3) Abstraction of vector spaces, linear transformations, and their matrices, systems of linear equations and determinants, inner products, and diagonalization of symmetric matrices. Prereq: Multivariable Calculus and Matrix Algebra or 4050.

4150-60 Abstract Algebra (3, 3) Equivalence relations and partitions, properties of integers, elementary theory of groups of rings, polynomial rings, integral domains, divisibility.
unique factorization domains, fields. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra or 4500.

4225-35 Introduction to Numerical Analysis (3, 3) Interpolation and approximation, numerical differentiation and integration, roots of equations, systems of linear and nonlinear equations. Prereq: 2315. (Same as Computer Science 4225-35.)


4250 Elementary Complex Variables (3) Complex numbers, Cauchy's theorem and formula, Taylor and Laurent series, residues and their applications. Prereq: Multivariable Calculus and Matrix Algebra; one 4000-level mathematics course recommended.


4540 Infinite Series and Functions of Several Variables (3) General theory, power series and Taylor's formula, uniform convergence. Partial differentiation and maxima and minima for functions of several variables. L'Grange multipliers. Prereq: Multivariable Calculus and Matrix Algebra.

4550 Partial Differential Equations (3) Fourier series; Fourier integrals; orthogonal expansions; the vibrating string; solution by series; heat flow, Bessel functions. Prereq: Multivariable Calculus and Matrix Algebra. Recommended: 4610 or 4710.


4640 Calculus of Finite Differences (3) Real difference equations, application to problems in engineering and physics. Prereq or coreq: 4610.


4710 Vector Analysis (3) Fundamental operations, basis vectors, dot and cross products, directional derivatives, divergence and curl of vector fields, gradient, potential, line integrals, divergence theorem of Gauss, and Stokes' theorem. Prereq: Multivariable Calculus and Matrix Algebra.


4810 Elementary Number Theory (3) Divisibility; congruences; theorems of Fermat and Wilson, primitive roots; indices; quadratic reciprocity, quadratic forms, the Euclidean algorithm, algebraic and transcendental numbers, and the central limit theorem.

4960 Readings in Mathematics (1-3) Open to superior students with permission of department. Independent study with faculty guidance. Prereq: Consent of faculty member and consent of department.

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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. 6 Credit. Only.

5011 Elementary Functions from an Advanced Stand Point (3) Order and completeness axioms of the real numbers: limits of sequences, derivatives of functions; definitions and derivatives of the exponential, logarithmic and trigonometric functions; infinite series; convergence; Taylor's and Maclaurin's series; applications to construction of logarithmic and trigonometric tables. Prereq: Intermediate Analysis or 3110 or consent of instructor.

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, arc length of curves in the plane and curves on a surface, curvature, torsion, asymptotes, local coordinates. Prereq: Freshman and sophomore calculus; one year 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: elementary, coordinate, synthetic, and metric; models; betweenness; congruence of segments and triangles; parallel postulates; similarity; area; ruler and compass constructions; Klein's Erlangen Program. Prereq: Consent of instructor.

5014 Analysis for Teachers (3-4) A study of functions of several variables, vectors, limits and continuity, partial derivatives, directional derivatives and gradient; implicit function theorem, maxima and minima, transformation, uniform continuity. Prereq: Intermediate Analysis or consent of instructor.

5050-60-70 Mathematical Logic (3, 3, 3) Truth functions, the syntax and semantics of propositional and predicate logic; consistency, completeness, decidability.

5110-20-30 Theory of Functions of a Complex Variable (3, 3, 3) Complex numbers, infinite series, analytic functions, conformal mapping; analytic continuation; special functions: Bessel, Legendre, Chebyshev. Prereq: 4510-20 for 5110; 4530 for 5120. Must be taken in sequence.


5260-50-60 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 the viewpoint of projective geometry. Prereq: 4150-50. Must be taken in sequence.

5340-50-60 The Numerical Treatment of Algebraic and Transcendental Equations (3, 3, 3) The mathematical principles underlying such methods as those of Gauss, Newton, B. Bornouli, Graefe, and others for obtaining numerical solutions; theorems of Budan and Fourier, Sturm, and Hermite; Newton's method and Hurwitz's phenomenon for localizing roots.


5440 Calculus of Variations (3) Function spaces, the variation of a functional, strong and weak variation, Euler's equation, the Euler-Lagrange equation, the extremum—Euler's equation. Variational problems in parametric form, functionals de-pending on higher derivatives. Broken extremals—the Weierstrass-Erdmann conditions. Quadratic functionals, the second variation of a functional, Lagrange's conditions, conjugate points, Jacobi's condition, sufficient
conditions for a weak extremum. Fields, Hilbert's space, and the Weak Menger function, sufficient conditions for a strong extremum. Prereq: 4510-20-30 and 4610.

5450-50-70 Introduction to Partial Differential Equations (3, 3, 3) Linear second-order equations in two variables; properties of elliptic, hyperbolic and parabolic equations, separation of variables, and Fourier series; non-homogeneous problems, problems in higher dimensions, multiple Fourier series, Fourier and Laplace transforms. Prereq: 4510-20-30 and 4610 or consent of instructor.

5455 Finite Difference Methods for Partial Differential Equations Finite difference techniques for the solution of parabolic, elliptic, and hyperbolic equations. Computer implementation, stability, consistency and convergence; nonlinear problems; curved boundaries; solution of linear systems. Prereq: 3150 or 3155 and 4550. (Same as Computer Science 5455.)

5465 Mathematical Aspects of the Finite Element Method (3) Implementation of the Ritz-Galerkin methods for the solution of ordinary and partial differential equations. Local bases, approximation theory, rates of convergence, eigenvalues and eigenvalue problems; singularities, hybrid elements. Prereq: 3150 or 3155 and 4550. (Same as Computer Science 5465.)

5480-90 Mathematical Programming (3, 3) Optimization of functions of variables subject to constraints. Prereq: 4510, 4500 and 4550.

5510-20-30 Introduction to Higher Algebra (3, 3, 3) Survey of 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.

5550-70-90 Theory of Matrices in Numerical Analysis (3, 3, 3) 5550—Fundamental matrix identities and inequalities: Factorization theorems, generalized reciprocals, Hadamard inequalities, Lanczos reductions. 5570—Vector and matrix norms, convergence, domains of inclusion and exclusion of roots of matrices; the field of values: minimax and maximal value problems, singularities, hybrid elements. Prereq or coreq: 5510.

5580 Theory of Rings (3) Direct and subdirect sums of rings, prime and maximal ideals; modern theory of rings and modules. Prereq or coreq: 5520. (Same as Mathematics 5580.)

5610-20-30 Mathematical Methods in Physics (3, 3, 3) (Same as Physics 5610-20-30.)

5640 Numerical Methods in Physics (3) (Same as Physics 5640.)

5655-65-75 Numerical Mathematics (3, 3, 3) The numerical treatment of large systems of linear algebraic equations, systems of nonlinear equations and the algebraic eigenvalue-algebraic eigenvalue problem. Prereq: 4030 or 4230. (Same as Computer Science 5655-65-75.)

5710-20-30 Tensor Analysis (3, 3, 3) The absolute differential calculus in three-dimensional Euclidean space; differential geometry of curves and surfaces; tensors and tensor fields; extension to n-dimensional space. Prereq: Major in mathematics or physics. Must be taken in sequence.


5810-20-30 Number Theory (3, 3, 3) Arithmetic functions, distribution of primes, Diophantine equations, approximation theory, Schnirelmann density and Mann's theorem, quadratic forms, Dirichlet's theorem, prime number theorem. Prereq or coreq: 5510 for 5810; 5520 for 5820.


5980 Graduate Reading in Mathematics (1-3) Open to graduate students with permission of the 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)

6000 Doctoral Research and Dissertation

6210-20-30 Linear Analysis (3, 3, 3) Algebraic and topological properties of linear spaces, emphasis on normed spaces; linear functionals and dual spaces; linear transformations; special topics (approximation theory, ergodic theory, semi-groups of transformations); applications to problems in analysis. Prereq: 4150-60 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 preparation of students. Prereq: 5510-20-30.

6540-50-60 Theory of Semigroups (3, 3, 3) Congruences and homomorphisms; ideal theory; representations, decompositions, and extensions; free, regular, inversely simple, and completely simple semigroups. Prereq: 5520.

6570 Theory of Groups (3) Structure of groups, free groups, nipotence and solvability, extensions and semi-group foundation groups, abelian groups. Prereq: 5520.

6610-20-30 Advanced Ordinary Differential Equations (3, 3, 3) Theory of ordinary differential equations from an advanced viewpoint. Topics from the current literature. Subject matter varies according to interests and pre-participation of students. Prereq or coreq: Intro. to Differential Equations or 4610, 4150-60, and 5110-20-30 or 5210-20-30 or consent of instructor.


6910-20-30 Topological Algebra (3, 3, 3) Topics chosen from topological semigroups, topological 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) This course provides technical background to read and contribute to current literature in topology. Topics vary from year to year.

6940-50-60 Introduction to Algebraic Topology (3, 3, 3) Introduction to fundamental concepts of homology and homotopy theories. Typical topics discussed will be homology and cohomology groups, the Eilenberg-Steenrod axioms, cup and cap products, duality theorems, homology equivalence, higher homology groups, fiber spaces, spectral sequences. Prereq: 4150 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.A., Ph.D.

Professors:


Associate Professors:

J. R. Becker, Ph.D. Cincinnati; T. J. Moreau, Ph.D. Maryland; W. S. Riggs, Ph.D. Yale.

Assistant Professors:

D. A. Bryan, Ph.D., D.V.M. Michigan State; R. V. Miller, Ph.D. Illinois; G. S. Sayer, Ph.D. Idaho.

Lecturers:


Students planning to major in microbiology are expected to present, as undergraduate prerequisites, a minimum of 1 year of biology, 1 year of mathematics including calculus, 2 years of chemistry, and 1 year of physics.

The student's dissertation committee determines whether a foreign language is required for the Doctor's degree.

3000 Introduction to Microbiology (3) Eucaryotic and procaroytic protists, viruses, microbial growth, bacterial structure, bacterial and viral genetics, pathogenesis, immunity and applied microbiology. Prereq: Gen. Bio. 3 or consent of department.

3009 Introductory Microbiology Laboratory (2) Laboratory exercises designed to accompany Microbiology 3000.

3061 Pathogenic Microbiology (3) The disease producing microorganisms including bacteria, rickettsiae, chlamydia and fungi.

3069 Pathology Microbiology Laboratory (2) Techniques for the isolation, cultivation, and identification of pathogenic microorganisms.

3071 Immunology (3) Concepts of antigens and antibodies; molecular aspects of immuno-
mals, and techniques used in immunology re-
deficiency diseases; immune injury; blood

type hypersensitivity and cell-mediated
globulins; theories on immunoglobulin synthe-
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onmy, and physiology of yeasts, actinomy-
bacteria associated with food fermentation
amination, cultivation and identification of
search. Prereq or coreq: 3071.

procedures involving several species of ani-
a student uses university facilities and/or
5002 Non-Thesis Graduation Completion (3)
be repeated. S/NC only.

5810 Advanced Microbial Genetics (3)
be repeated with consent of department.

Music

majors' names and addresses. The assistant

M. Johnson, B. Music Oberlin; L. W. Michalopulos, M.A. Columbia; D. M. Pederson, Ph.D. Iowa; W. P. Scarlett, M.M. Louisiana State; S. E. Young, Ph.D. North Carolina.

Applicants who plan to pursue the
degree in performance (applied music)
are required to audition before the ap-
appropriate area committee. Applicants for

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
at Knoxville, appropriate to the prospective
area of concentration on the Master's level.

Applicants for the Bachelor of Music degree
must complete all required courses in
music and the major area of concentration.

The Department of Music offers the
degrees of Bachelor of Music with concen-
trations in performance, composition, theory,
choral conducting, Suzuki string tech-
niques, and piano literature and the
Master of Arts with a major in music
with concentrations in theory and musicology.

Applicants for admission to the program in composition

5820 Microbiology of Foods (3) Lectures and
special laboratory exercises dealing with
handling and processing. Prereq: 3810; Biochemistry 4110-20.

5820 Microbiological Ecology (3) Survey
of microorganisms in natural environments.
Prereq: 3009, one year Organic Chemistry.

5820 Medical Mycology Laboratory (2)
Prereq or coreq: 4820. 1 hr and 2 labs.

5820 Seminar in Microbial Pathogenesis (1)
Readings and discussions based on the
current literature. May be repeated.

5820 Microbiology of Foods (3) Lectures and
special laboratory exercises dealing with
students' names and addresses. The assistant

M. Johnson, B. Music Oberlin; L. W. Michalopulos, M.A. Columbia; D. M. Pederson, Ph.D. Iowa; W. P. Scarlett, M.M. Louisiana State; S. E. Young, Ph.D. North Carolina.

Applicants who plan to pursue the
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are required to audition before the ap-
appropriate area committee. Applicants for

Applicants for these degree programs
must have completed an undergraduate
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requirements to those required in degrees
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area of concentration on the Master's level.

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The Department of Music offers the
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niques, and piano literature and the
Master of Arts with a major in music
with concentrations in theory and musicology.

Applicants for admission to the program in composition

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of microorganisms in natural environments.
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of microorganisms in natural environments.
Prereq: 3009, one year Organic Chemistry.

5820 Medical Mycology Laboratory (2)
Prereq or coreq: 4820. 1 hr and 2 labs.

5820 Seminar in Microbial Pathogenesis (1)
Readings and discussions based on the
current literature. May be repeated.
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 17 of this catalog.

MASTER OF MUSIC DEGREE CURRICULA

Voice: 45 hours distributed as follows: (a) 12 hours in applied music, (b) 6 hours in area literature, (c) 3 hours in music research, (d) 6 hours in ensemble, (e) 3 hours in theory, (f) 3 hours in recital, and (g) 12 hours in music electives.

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) 7 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 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. The student must have the approval of the student's advisor.

3041 Keyboard Harmony (2) Melody harmonization, figured bass realization, and improvisation. Prereq: Harmony I, sight singing and keyboard proficiency at the 2000 level.

3051 Organ Improvisation (2) Prereq: 3041 and organ proficiency at the 2000 level.

3114-24 Choral Arranging (3, 3) Analysis of scores and writing of arrangements for choirs. 3114—male and female chorus; 3124—mixed chorus. Prereq: Instrumentation or consent of instructor.

3122 Orchestration (3) Advanced techniques in instrumental writing with emphasis on scoring for the concert orchestra. Prereq: Instrumentation or consent of instructor.

3230 The Concerto (3) Survey of music from seventeenth century to present.

3240 The Symphony (3) Survey of symphonic literature from precursors of classical symphony to present.

3260 Chamber Music (3) Survey of chamber music from 1750 to present.

3271-81 History of Opera (3, 3, 3) Dramatic, vocal and orchestral aspects of opera in Italian, French, and German schools. 3271—1600-1800; 3281—1800 to present.

3340 Oratorio (3) Choral works other than those appropriate for use in church.

4001 Organ Design (3) Historical, tonal and mechanical principles of organ design.

4041 Styles in Opera Acting (3) Study and practice of styles in opera acting based on historical and national characteristics. Prereq: Analysis I.

4045 Projects in Opera Theatre (1-3) May be repeated for credit. Prereq: Consent of instructor.

4050 Advanced Instrumental Conducting (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and relationship of different styles to the conductor's art. Prereq: Consent of instructor.

4050 Advanced Choral Conducting (3) Development of knowledge and skills in choral conducting; study of various periods and composers and relationship of different styles to the conductor's art; musical analysis and practice in conducting. Prereq: Instrumental Conducting or equivalent.

4060 Advanced Choral Conducting (3) Development of knowledge and skills in choral conducting; study of various periods and composers and relationship of different styles to the conductor's art; musical analysis and practice in conducting. Prereq: Consent of instructor.

4111-21-31-41 Analysis of Music Literature (3, 3, 3, 3) Detailed examination of music compositions by historical periods with emphasis on analysis on harmony, thematic material, form and structure. Traditional and contemporary analytical techniques. 4111—1600-1750; 4121—1750-1825; 4131—1825-1900. 4141—1890 to present. Prereq: Analysis II.

4112 Twentieth-Century Compositional Techniques (3) Study of techniques and procedures of contemporary music from Debussy to present. Analysis of scores; idiomatic writing. Prereq: Harmony II or equivalent.

4113 Pedagogy of Music Theory (3) Techniques for teaching music theory in college-level theory programs. Prereq: Consent of instructor.

4114 Stage Band Arranging (3) Analysis of scores and scoring for the marching and concert bands. Prereq: Instrumentation or equivalent.

4124 Band Arranging (3) Study and application of techniques employed in scoring for the marching and concert bands. Prereq: Instrumentation or equivalent.

4134 Band Transcription (3) Technique and application of transcription for the keyboard and orchestra music for concert band; editing and rescoring. Prereq: Instrumentation or equivalent.


4230 Contemporary Music: 1945 to Present (3) Survey of contemporary 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.

4260 Introduction to Ethnomusicology (3) Basic attitudes and techniques of ethnomusicology. Survey of music cultures of the Pacific, Near East, Asia and Africa.


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 18th through 20th century. Emphasis placed on style interpretation, rehearsal techniques, programming and musical significance, both historical and theoretical.

4348-50 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.
5000 Thesis


5002 Non-Thesis Graduation Completion (3) 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. B/NC only.

*5501 Organ Literature Seminar (3) Topics vary. Prereq: Organ Literature.

**5502 Piano Literature Seminar (3) Topics vary. Prereq: Advanced Piano Literature.

*5503 Choral Literature Seminar (3) Topics vary.

**5504 Vocal Literature Seminar (3) Topics vary.

5560 Graduate Recital (3)

5561 Opera Performance (3)

5562 Vocal Chamber Music Performance (3)

5563 Choral Conducting Performance (3)

5564 Seminar in Choral Performance (3) The study of rehearsal and performance problems and techniques as allied to score reading and preparation. Particular attention will be afforded to individual problems. Prereq: 4000 or equivalent.

*5570 Opera Production (1-3) Prereq: Consent of instructor.

**5590 Special Topics in Performance (1-3) Prereq: Consent of department head.

*5591 Independent Study in Music Theory (1-3) Prereq: Consent of department head.

5592 Advanced Harmony (3) An analytic survey of harmonic trends in compositions from 1700 to present. Exercises employing and illustrating these techniques. Prereq: Consent of instructor.

**5593 Analytical Techniques (3) A survey of analytical techniques with emphasis on contemporary approaches. Tonal and neotonal music. Prereq: Consent of instructor.

*5594 Practicum in Computers and Music Research (3) Programming languages, design, and implementation of projects in musical analysis, composition and indexing. Prereq: 5115 or consent of instructor.

**5595 Theory of Computers and Music Research (3) Theory of computer applications in music, emphasizing techniques of analysis and indexing. Prereq: Consent of instructor.

**5600 Flute (1-4)

5565 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 Viola (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) May be repeated. Maximum 9 hrs. Prereq: 3199 and consent of instructor.

5599 Composition (1-3) Prereq: Consent of instructor.

**5600 Small Ensemble (1)

5562 Brass Choir (1)

5564 Jazz Ensemble (1)

5566 Trombone Choir (1)

5567 Tuba Ensemble (1)

5561 Percussion Ensemble (1)

5562 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)

**5682 University Chorus (1)

**5684 Campus Chorus (1)

**5686 Men's Glee Club (1)

**5687 Women's Choral Ensemble (1)

**5699 Accompanying (1)

* May be repeated.
** May be repeated. Maximum 6 hrs.

Philosophy

MAJOR

DEGREES

Ph.D.

Philosophy

M.A., Ph.D.

Professors: J. W. Davis (Head), Ph.D. Emory; R. B. Edwards, Ph.D. Emory; R. D. Herrmann, Ph.D. Mainz (Germany); M. H. Moore (Emeritus), Ph.D. Chicago; D. Van de Vate, Jr., Ph.D. Yale.


Assistant Professors: J. O. Bennett, Ph.D. Tulane; G. G. Brenkert, Ph.D. Michigan; S. H. Cohen, Ph.D. Northwestern; K. A. Emmett, Ph.D. Ohio State; H. P. Hamlis, Ph.D. Georgia; R. Jones, Ph.D. Chicago; B. C. Latta, Ph.D. Yale; S. Reaven, Ph.D. California (Berkeley).

M.A.

M.A.

MAJOR

DEGREES

Philosophy

M.A., Ph.D.

Professors: J. W. Davis (Head), Ph.D. Emory; R. B. Edwards, Ph.D. Emory; R. D. Herrmann, Ph.D. Mainz (Germany); M. H. Moore (Emeritus), Ph.D. Chicago; D. Van de Vate, Jr., Ph.D. Yale.


Assistant Professors: J. O. Bennett, Ph.D. Tulane; G. G. Brenkert, Ph.D. Michigan; S. H. Cohen, Ph.D. Northwestern; K. A. Emmett, Ph.D. Ohio State; H. P. Hamlis, Ph.D. Georgia; R. Jones, Ph.D. Chicago; B. C. Latta, Ph.D. Yale; S. Reaven, Ph.D. California (Berkeley).

M.A.

M.A.
but with different subject matter, may be
taken with each separate subject descrip-
tion.

MEDICAL ETHICS
The department has an M.A. and Ph.D. pro-
gram in graduate study with a concen-
tration in Medical Ethics. Details con-
cerning 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 depart-
ments of Philosophy or Religious Studies.

3111 History of Ancient Philosophy (4) Pre-
Socratic through Aristotle.

3121 History of Hellenistic, Roman, and Medi-
eval Philosophy (4)

3131 History of Seventeenth- and Eighteenth-
Century Philosophy (4)

3141 History of Nineteenth- and Early Twen-
tieth-Century Philosophy (4)

3270 Russian Philosophical and Theological
Thought (4) (Same as Religious Studies 3270)

3311-12 American Philosophy (4, 4) 3311—
Colonial to late 19th century. 3312—Late 19th
century to present.

3315 American Ideals (4) Ideological variants
in the American scene.

3320 Philosophy of Law (4) Nature, sources,
fundamental principles of a philosophe of
law.

3330 Philosophy of History (4) Speculative and
critical aspects of the philosophy of history.

3410 Philosophical Ideas in Literature (4)
Philosophic assumptions and implications in
major literary works.

3420 Philosophy of Literature (4) Study of the
nature, functions, value and epistemic prin-
ciples of literary arts.

3430 Concepts of Woman (4) Examination of
some of the theoretical foundations of feminism and
anti-feminism.

3440 Social Ethics (4) Ethical theory as re-
lated to politics, economics, law, religion and
the family.

3510 Existentialism (4)

3550 Marxism as Philosophy (4)

3560 Seminars in the History of American
Philosophy (4, 4)

3571 Philosophy and Religion in India (4)
(Same as Religious Studies 3560.)

3600 Buddhist Philosophy and Religion (4)
(Same as Religious Studies 3600.)

3690 Philosophy of Religion (4) Analysis of
basic issues of religion. (Same as Religious
Studies 3690.)

3720 Science, Technology, and the Modern
World: A Philosophical Approach (4)

3740-50 Conceptual History of Science (4, 4)
3740—The Scientific Revolution: historical evo-
lution of thought in astronomy, mechanics and
philosophy of nature up to Newton. 3750—The
Development and Decline of Newtonian Sci-
fence: historical evolution of thought on the
nature of matter and of light, and on that of
life. Prereq: 8 hrs of physical science or
consent of instructor.

3770 Introduction to Philosophy of Science (4)
Standard topics in philosophy of science: scientific method, nature of laws and theories,

3810 Introductory Symbolic Logic (4) Tech-
niques for formal analysis of deductive reason-
ing (propositional logic and quantification theory).

3910 Contemporary Aesthetics (4) Philosophi-
cal discussion of contemporary art.

4000 Special Topics (4) A student- or instruc-
ort-initiated course to be offered at the con-
venience of the department. Subject matter to
be determined by mutual consent of students
and instructor with approval of department.
Prerequisites to be determined by department.

4111-21 Modern Religious Philosophies (4, 4)
(Same as Religious Studies 4111-21)

4310 Intermediate Ethics (4) Topics in meta-
ethics or ethics. Prereq: Elementary Ethics.

4370-71 Theoretical Issues in Medical Ethics
(4, 4) Prereq for 4370: Elementary Ethics or
Religious and Philosophical Issues of Medical
Ethics or consent of instructor. Prereq for
4371: 4370 or consent of instructor. (Same as
Religious Studies 4370-71)

4410 Plato (4) Prereq: 8 hrs of philosophy
or consent of instructor.

4420 Aristotle (4) Prereq: 8 hrs of philosophy
or consent of instructor.

4430 Medieval Philosophy (4) Prereq: 8 hrs
of philosophy or consent of instructor.

4450 Continental Rationalism (4) Prereq: 8
hrs of philosophy or consent of instructor.

4460 British Empiricism (4) Prereq: 8 hrs
of philosophy or consent of instructor.

4470 Kant (4) Prereq: 8 hrs of philosophy or
consent of instructor.

4480 Advanced Topics in Existentialist and
Phenomenological Philosophy (4) Prereq: 8 hrs of
philosophy or consent of instructor.

4490 Process Philosophy (4) Prereq: 8 hrs
of philosophy or consent of instructor.

4510 Intermediate Symbolic Logic (4) Axio-
matic development of propositional calculus
and first-order functional calculus. Prereq: 3810
or equivalent.

4511 Advanced Topics in Logic (4) Prereq:
Consent of instructor. May be repeated.

4610 Philosophical Analysis (4) Prereq: 8
hrs of philosophy or consent of instructor.

4620 Philosophy of Mind (4) Problems of mind
and body in relation to consciousness and
personal identity. Prereq: 8 hrs of philosophy
or consent of instructor.

4630 Philosophy of Language (4) Prereq: 8
hrs of philosophy or consent of instructor.

4710 Philosophy of Natural Science (4) Con-
sideration of standard topics pertinent to nat-
ural science, including reduction of theories
and teleological explanation. Familiarity with
symbolic logic is recommended. Prereq: 3770
or 2 yrs of natural science.

4720 Philosophy of Social Science (4) Ex-
amination of methods of inquiry and modes
of explanation in social sciences. Prereq: 3770
or 2 yrs of social science.

4810 Metaphysics (4) Prereq: 8 hours of phi-
losophy or consent of instructor.

5000 Thesis

5050 Symbolic Logic (4)

5080 Philosophy of Logic (4) Nature of logic:
epistemological, metaphysical and axiological

assumptions and Implications in various theo-
ries of logic. Prereq: 4510 or its equivalent.

5110-29-30-40-50-50-50 Studies in the History of
European Philosophy (4, 4, 4, 4) Intensive
critical work on a major philosopher or a
school. 5110—Greek. 5120—Hellenistic or
Medieval. 5130—Modern, before Kant. 5140—

5250 Studies in the History of American Phi-
losophy (4) Intensive, critical work on a major
philosopher or a school.

5310-20-30 Studies in Value and Normative
Theories (4, 4, 4) 5310—Axiology. 5320—Ethics
and metaethics. 5330—Aesthetics.

5370 Topics in Medical Ethics (4) Prereq:
4370-71 or permission of the Medical Ethics
Committee.

5410 Philosophy of History (4) Theories of
history and historical processes.

5420 Philosophy and Literature (4) Mutual
influence of philosophy and literature, the pos-
sibility of a philosophy of literature, the phi-
losophy of criticism.

5450 The Problem of the Self (4) Current
studies in sociology, social psychology, and
philosophy are used to amend and elucidate
traditional philosophical treatments of the prob-
lem of the self.

5460 Philosophy of Mind (4) An examination
of the relation of the mental to the physical and
of the role of words in discourse for mental
activities such as thinking and feeling.

5510-20 Studies in Epistemology (4, 4, 5510—
Modern rationalism: Descartes, Spinoza, Leib-
niz. 5520—Modern empiricism: Locke, Berkeley,
Hume.

5550-60 Philosophy of Science (4, 4) The na-
ture of the subject matter and method of the
sciences. 5550—Natural sciences. 5560—Social
sciences.

5610 Recent Developments in Philosophy of
Religion (4)

5710 Studies in Metaphysics (4) Metaphysics
of a philosopher or systematic philosophic
tradition.

5810 Social and Political Philosophy (4)

5910-20-30 Research (4, 4, 4) Independent
study for the direction of a member of the
department.

5950 Clinical Practicum in Medical Ethics
(4-12) Prereq: Permission of the Medical Ethics
Committee. Open only to students concentrat-
ing in medical ethics.

6000 Doctoral Research and Dissertation

6110-20-30 Seminars in the History of Euro-
pean Philosophy (4, 4, 4)

6150-50 Seminars in the History of American
Philosophy (4, 4)

6250 Seminar in the Philosophy of Religion
(4)

6310 Seminar in Axiology (4)

6370 Advanced Topics in Medical Ethics (4)
Prereq: 5370 or permission of the Medical Ethics
Committee.

6510 Seminar in Epistemology (4)

6550 Seminar in Philosophy of Science (4)

6950 Advanced Residence in Medical Ethics
(4-12) Prereq: Permission of the Medical Ethics
Committee. Open only to students concentrat-
ing in medical ethics.
Physics and Astronomy

MAJOR

DEGREES

Physica

M.S., M.A.C.T., Ph.D.

Professors:


Associate Professors:


Assistant Professors:


Lecturer:

R. L. Becker, Ph.D. Yale.

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, 4610-20-30 are normally required as a graduate minor. Students intending to work toward a Ph.D. must pass an examination covering the minimum courses prerequisite to graduate study.

A student who intends to present physics as a graduate minor shall, in general, have completed an undergraduate minor in physics or its equivalent. Physics 3210-20, 4210-20 constitute the minimum course work prerequisite to graduate study.

Graduate programs leading to the 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, and ultrasounds.

Departmental graduate programs providing special opportunities for academic and research work in areas pertinent to atmospheric and space flight 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.

Masters Program

The Physics department has 2 master's degree programs—thesis and non-thesis.

The thesis program is primarily designed for students intending to teach in colleges or universities on the elementary or intermediate level, or for students specifically intending to work toward a Ph.D. Students seeking an M.S. in physics by this method must apply to the department's graduate committee for permission to enroll under this program. Each candidate must present an acceptable thesis, equivalent to 9 hours of credit, and pass an oral examination on course material and thesis.

The non-thesis program is primarily designed for students intending to teach in colleges or universities on the elementary or intermediate level, or for students specifically intending to work toward a Ph.D. Students seeking an M.S. in physics by this method must apply to the department's graduate committee for permission to enroll under this program. The requirements for the M.S. under this method are the satisfactory completion of 45 hours of course work composed of 27 hours from courses numbered above 5000 (e.g., 5110-20-30, 5210-20-30, 5310-20-30, 5610-20-30) and appropriate courses in related fields. Each candidate must pass an acceptable thesis, equivalent to 9 hours of credit, and pass an oral examination on course material and thesis.

Doctoral Program

Students are expected to take Physics 5110-20-30, 5210-20-30, 5310-20-30, 5410-20-30, 5510-20-30, 5610-20-30. In addition, Physics 6210-20-30 are normally required of students specializing in nuclear physics, Physics 6500-10 of students in plasma physics, Physics 6610-30 of students in health physics. Physics 6710-20-30 of students in solid state physics...

1 Alumni Distinguished Professor.
2 Space Institute, Tullahoma.
3 Presently on leave of absence.
4 Benwood Foundation Distinguished Professor.
5 Guggenheim Research Scholar.

132 College of Liberal Arts

4040 Foundations of Physics (3) Development of concepts and principles of classical and modern physics; their use in constructing a working model of the physical environment. Hypothesis, experimentation and theory in physics. Prereq: 1 yr of general physics and consent of instructor. Required of MACT candidates.


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.

4150 Physical Acoustics (4) Considerations fundamental to detailed investigation of any branch of acoustics; propagation of acoustic waves in various types of media; audible, the infrasonic, the audible, the ultrasonic, the infrasonic, the audible, the ultrasonic, and the infrasonic. Prereq: Fundamentals of Physics, general physics, or equivalent. Prereq: 4210 or equivalent.

4160 Measurements of Physics (4) Principles of nondestructive testing (3) Electromagnetic, ultrasonic, and other techniques. Distribution functions and partition functions. Applications to gases, liquids, and solids. Special attention is devoted throughout course to problems arising in physics. Prereq: Advanced calculus and differential equations. (Same as Math 5610-20-30.)
Political Science

MAJOR

DEGREES

Political Science  M.A., Ph.D.
Public Administration  M.P.A.

Professors:
T. D. Unga (Head), Ph.D. Iowa; R. S. Avery, Ph.D. Northwestern; D. H. Garlade, Ph.D. North Carolina; L. S. Greene* (Emeritus), Ph.D.
Wisconsin; V. R. Iredell, Ph.D. Chicago; D. J. Nimmo, Ph.D. Vanderbilt; Ph.D. Utah; N. M. Robinson, Ph.D. Syracuse; D. H. Stephens, Ph.D. Johns Hopkins; D. M. Wellborn, Ph.D. Texas;

Associate Professors:
A. R. Cunningham, Ph.D. Indiana; J. Dodd, Ph.D. Tulane; A. Elliott, Ph.D. Columbia; R. A. Ph.D. Columbia; A. H. Hukins, Ph.D. Syracuse; P. S. Kronenberg, Ph.D. Pittsburgh; S. Osofsky, Ph.D. Columbia; R. A. Peterson, Ph.D. Yale; T. M. Simpson, Ph.D. Johns Hopkins; T. A. Smith, Ph.D. Ohio State.

Assistant Professors:
B. P. Greene, Ph.D. Indiana; F. R. Insoo, Ph.D. SUNY (Buffalo); W. Lyons, Ph.D. Oklahoma; G. J. Rafter, Ph.D. Michigan State; H. Robson, Ph.D. Maryland; B. Rogers, Ph.D. Indiana; P. Schuman, Ph.D. Johns Hopkins.

Registration in any courses in the 5000-6000 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 governmental administration through research, publication, and consultation. The staff is headed by J. T. (director); Professors Plaa (associate director), Kronenberg (associate director, Nashville), Robson (assistant director); Assistant Professors Insoo (Nashville), Rogers (Nashville), Greene (Nashville); Research Associates Rawson, Smith, Thomas.

MASTER'S PROGRAM

See general requirements on page 17.

MASTER'S IN PUBLIC ADMINISTRATION PROGRAM

The department offers 2 programs leading to the degree of Master of Public Administration. The first program is available through the Knoxville campus. The second is jointly offered by Middle Tennessee State University and The University of Tennessee. This program is directed primarily to career employees of federal, state and local governments in the area. Requirements for admission and graduation:

Applicants for admission to the joint degree program must have completed a Bachelor's degree from an accredited college or university and be eligible for admission to the Graduate School. (UT-MTSU applicants must gain admission to both of the participating institutions and pass a qualifying examination, if required.)

Specific requirements for graduation include:

* Distinguished Professor.

3555 Minority Group Politics in the United States (4) Content varies from quarter to quarter. May be repeated with consent of the 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. United States Government and Politics desirable as preceding course. (Same as Yater Resources Development 3565.)


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)

3655 Political Change in Developing Areas (4)

3710 State Politics (4) Focus on formal and informal setting 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.

3715 Contemporary Problems of Soviet Foreign Policy (4)

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.

3801 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 19th- and 20th-Century Political Thought (4) Political theories of industrial and technological societies; 19th and 20th 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) Powers of, procedures of, controls over administrators.

4535-36 Political Attitudes, Opinions and Communication (4, 4)

4540-50 Presidency, Congress and Public Policy (4, 4) The Presidency and Congress within framework of policy-making process.

4545-46 The Judicial Process (4, 4) The study of courts as components of political systems, and public policy formulation through judicial decision making. United States Government and Politics desirable as preceding course.

4575 Special Topics in United States Government and Politics (4) May be repeated with consent of department. Maximum 8 hrs.

4580-90 The Urban Politics (4, 4) Analysis of political institutions and processes in metropolitan areas; urban problems and politics.

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.

4630 Problems in Public Management (3) Selected problems. Emphasis on internal and external communication and information systems in government and public access to information.

4665-66 Policy Making in Democracies (4, 4)

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.

4740-50-60 Politics and Elections (3, 3) 4740-50—Structure and function of party system; nominations and campaigns. 4740-50—Structure and function of party system; nominations and campaigns. 4740-50—Structure and function of party system; nominations and campaigns.

4815—Contemporary Soviet Marxism-Leninism (4)

4831-32-33 The Systematic Study of Politics (4, 4, 4)

4875 Special Topics in Political Thought (4) May be repeated with consent of department. Maximum 8 hrs.

4900 Aspects of Urban Environment (4) Interdisciplinary course in urban problems. Prereq: Consent of instructor. (Same as Architecture 4900, Psychology 4900, Real Estate 4900.) S/NC only.

4975 Seminar 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) 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 146.

5102 Off-Campus Study (1-12) See page 148.

5103 Independent Study (1-12) See page 148.

5110-20 Seminar in Political Theory (3, 3) Selected political thinkers, schools, historical periods.
S/NC basis. May be repeated with consent of instructor and student's advisor. Maximum 9 hrs.

**Psychology**

**MAJOR**

**DEGREES**

**Psychology**  M.A., Ph.D.

**Professors:**


**Associate Professors:**

J. S. Bacon,* Ph.D. Tennessee; C. P. Cohen, Ph.D. Kansas; L. F. Dropooleman, Ph.D. Catholic; H. R. Friedman,* Ph.D. Tennessee; H. Ganzberg, Ph.D. Wisconsin; S. J. Handel, Ph.D. Johns Hopkins; M. G. Johnson, Ph.D. Michigan State; M. L. Maguire, Ph.D. Yale; J. C. Malone, Ph.D. Duke; W. G. Morgan, Ph.D. Tennessee; W. M. Simmons, M.S.S.W. Tennessee.

**Assistant Professors:**


The Psychology department emphasizes doctoral degree programs with specializations in clinical, school, industrial-organizational and general psychology. Some students complete a Master's degree as part of their doctoral program.

For students intending to complete a graduate program and admissions requirements; write: Graduate Secretary, Department of Psychology, University of Tennessee, Knoxville, TN 37916.

**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.

1407 Experience in Individualized Instruction (1-6) Supervision as an individualized instruction. Prereg: Consent of instructor. May be repeated. Maximum 12 hrs.

1420 Topics in Social Psychology (4) Intensive analysis of selected research topics. Prereg: 3120 Sociology 3130 (Same as Sociology 4120.)


4239 Laboratory in Sensory Processes and Perception (2) Prereg or coreq: 4230, 2 periods.

4460 Organizational-industrial Psychology (3)

4510 Personality Theories (4) Prereg: Abnormal Psychology or equivalent.

4519 Research in Personality (4) Discussion and demonstration of research on individual as it relates to major theoretical issues and to substantive areas of investigation. Prereg: Descriptive Statistics or equivalent.


4610 Group Processes (3) Study and experience in theory and techniques of group processing and facilitation. Those participating in 4610 are expected to continue into 4620 and 4630. Prereg: Human Relations and consent of instructor.

4620-30 Seminar in Group Processes (0, 6) Didactic and laboratory experience for those qualified for further training as group facilitators. Prereg: 4610 and consent of instructor. No credit given until sequence is completed.


4650 Symbolic Processes (4) The logic of signs and symbols; directed and associative thinking; memory, problem solving, and concept-formation; the nature, use and development of language. Prereqs: Learning and Thinking 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. Prereg: 1 year of biology or zoology and Biological Foundations of Behavior.

4719 Physiological Psychology Laboratory (4) Coreq: 4710.

4720 Comparative Animal Behavior (4) Methods and principles. (Same as Zoology 4720.)

4729 Comparative Animal Behavior Laboratory (4) Laboratory and seminar studies. Coreq: 4720. (Same as Zoology 4729.)

4750 Evolution and Ontology of Social Behavior (4) Genetic, evolutionary, ecological, and developmental processes as they apply to social organization and dynamics of vertebrates. Prereg: Consent of instructor.

4830 History and Systems of Psychology (4) Prereg: 9 hrs of upper division psychology.

4850 Learning Theories (4) Historical and theoretical development of learning models. Prereg: Learning and Thinking.

4850 Programmed Learning (3) (Same as Curriculum and Instruction 4850.)

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-Americans. Prereg: Consent of instructor. (Same as Culture Studies 4880.)

4900 Aspects of Urban Environment (4) Interdisciplinary course in urban problems. Prereg: Consent of instructor. (Same as Architecture 4900, Political Science 4900, Real Estate 4900.)

* Part-time.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Notes</th>
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<tbody>
<tr>
<td>5000</td>
<td>Thesis</td>
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<tr>
<td>5002</td>
<td>Non-Thesis Graduation Completion</td>
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<tr>
<td>5100</td>
<td>Development Psychology</td>
<td>(3, 3, 3)</td>
<td>Child Psychology or Child Study-Education Psychology. (Same as Educational Psychology 5100.)</td>
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<td>5110</td>
<td>Clinical Aspects of Human Sexuality</td>
<td>(3, 3, 3)</td>
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<tr>
<td>5140-50-60</td>
<td>Psychoeducational Assessment</td>
<td>(3, 3, 3)</td>
<td>Naturalistic, psychometric, and sociometric assessment methods in school learning environments. Must be taken in sequence. Coreq: 5479-69-99. Prereq: Admission to School Psychology program or consent of instructor. (Same as Educational Psychology 5140-50-60.)</td>
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<tr>
<td>5190-59-69</td>
<td>Practicum in School Psychology I</td>
<td>(3, 2, 2)</td>
<td>First-year School Psychology Program practicum core sequence. Coreq: 5140-50-60, S/NC only. (Same as Educational Psychology 5149-59-69.)</td>
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<tr>
<td>5170-60-90</td>
<td>Proseminar in Organizational Psychology</td>
<td>(3, 3, 3)</td>
<td>Introduction to the basic concepts and ideas required for graduate study in organizational psychology. Must be taken in sequence during the student's first year. Prereq: Consent of instructor. (Same as Industrial Management 5170-80-90.)</td>
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<tr>
<td>5210</td>
<td>Readings in Psychology</td>
<td>(1)</td>
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<td>Readings in Psychology</td>
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<td>Readings in Psychology</td>
<td>(3)</td>
<td>S/NC only.</td>
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<td>5240</td>
<td>Readings in Psychology</td>
<td>(4)</td>
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<td>5250</td>
<td>Readings in Psychology</td>
<td>(5)</td>
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<td>5260</td>
<td>Special Problems in Psychology</td>
<td>(1)</td>
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<tr>
<td>5270</td>
<td>Special Problems in Psychology</td>
<td>(2)</td>
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<td>5280</td>
<td>Special Problems in Psychology</td>
<td>(3)</td>
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<td>5290</td>
<td>Special Problems in Psychology</td>
<td>(4)</td>
<td>S/NC only.</td>
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<td>5300</td>
<td>Special Problems in Psychology</td>
<td>(5)</td>
<td>S/NC only.</td>
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<tr>
<td>5319</td>
<td>Field Work in School Psychology</td>
<td>Level 1 (2)</td>
<td>Supervised on-the-job traineeship in school psychology. Limited to students fully admitted to the doctoral program in school psychology who are assigned to program-approved field settings. May be repeated. Maximum 6 hrs. S/NC only. (Same as Ed. Psych. 5319.)</td>
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<td>5340</td>
<td>Group Dynamics</td>
<td>(3)</td>
<td>Same as Educational Psychology 5340.</td>
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<td>5350-60-70</td>
<td>Seminar in Psychology</td>
<td>(3, 3, 3)</td>
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<td>5400</td>
<td>Psychophysics and Scaling Methods</td>
<td>(3)</td>
<td>Prereq: 4293, 4490.</td>
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<tr>
<td>5420-30-40</td>
<td>Advanced Psychological Statistics</td>
<td>(3, 3, 3)</td>
<td>Must be taken in sequence.</td>
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<tr>
<td>5445</td>
<td>Advanced Correlational Methods</td>
<td>(3)</td>
<td>Bi-serial, tetrachoric, and polychoric correlation; partial and multiple correlation and regression; stepwise regression and cross-validation; simple discriminant analysis; rank correlation methods. Prereq: 5430.</td>
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<td>5450</td>
<td>Human Problems in Administration</td>
<td>(3)</td>
<td>Same as Industrial Management 5530.</td>
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<tr>
<td>5460</td>
<td>Personnel Research Seminar</td>
<td>(3)</td>
<td>Same as Industrial Management 5420.</td>
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<tr>
<td>5500</td>
<td>Fundamentals of Psychometrics</td>
<td>(4)</td>
<td>Basic ideas and orientation in psychometrics. All the graduate students who plan to take 1 or more courses in psychometrics must take the course. Prereq: 4293 or Coreq: 4640.</td>
<td></td>
</tr>
<tr>
<td>5510</td>
<td>Instrumentation for Psychological Research</td>
<td>(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5520</td>
<td>Theory of Mental Measurement</td>
<td>(3)</td>
<td>Reliability, validity, scaling and equating, norms, combining tests into batteries. Prereq: Descriptive Statistics, Interpretation of Statistical Reports, 4640, and 5500.</td>
<td></td>
</tr>
<tr>
<td>5530</td>
<td>Test Construction and Interpretation</td>
<td>(3)</td>
<td>Construction of psychological and achievement tests, criterion development, item analysis, critical evaluation of published tests and manuals. Prereq: 5520.</td>
<td></td>
</tr>
<tr>
<td>5550</td>
<td>Advanced Social Psychology</td>
<td>(3)</td>
<td>Interaction between individual and group, theories of group behavior. Prereq: Social Psychology. May be used for credit in sociology.</td>
<td></td>
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<tr>
<td>5560-70</td>
<td>Seminar in Social Psychology</td>
<td>(3, 3)</td>
<td>Prereq: 5550. May be used for credit in sociology. Must be taken. Maximum 9 hrs.</td>
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<tr>
<td>5580</td>
<td>Theories of Personality</td>
<td>(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5581-82-83</td>
<td>Clinical Psychology I: Human Development and Personality</td>
<td>(2, 2, 2)</td>
<td>First quarter of the doctoral program in clinical psychology. Take the 3 two-credit courses concurrently, each covering the content area from 1 of 3 major contemporary points of view.</td>
<td></td>
</tr>
<tr>
<td>5589</td>
<td>Psychological Techniques Laboratory</td>
<td>(2)</td>
<td>Basic techniques of psychological appraisal. Restricted to doctoral students in clinical psychology.</td>
<td></td>
</tr>
<tr>
<td>5590</td>
<td>Psychodynamics</td>
<td>(3)</td>
<td>A research-and-theory-oriented course focusing upon the origins of behavior. Prereq: 5589.</td>
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</tr>
<tr>
<td>5591-92-93</td>
<td>Clinical Psychology I: Patterns of Adaptation</td>
<td>(2, 2, 2)</td>
<td>Second quarter core of the doctoral program in clinical psychology. Students take the 3 two-credit courses concurrently, each covering the content area from 1 of 3 major contemporary points of view.</td>
<td></td>
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<tr>
<td>5600</td>
<td>Psychopathology</td>
<td>(3)</td>
<td>An extension of general personality and psychodynamics into the study of patterns of behavior deviation. Prereq: 5591.</td>
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<tr>
<td>5601-02-03</td>
<td>Clinical Psychology II: Behavioral Deviance and Psychopathology</td>
<td>(2, 2, 2)</td>
<td>Third quarter core of the doctoral program in clinical psychology. Clinical students take 3 two-credit courses concurrently, each covering the content area from 1 of the 3 major contemporary points of view.</td>
<td></td>
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<tr>
<td>5610-20</td>
<td>Psychology of Learning</td>
<td>(3, 3)</td>
<td>Prereq: 5210 or Educational Psychology 5790.</td>
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<tr>
<td>5650</td>
<td>Ethics and Professional Practices</td>
<td>(1)</td>
<td>A review and discussion of problems and questions concerning professional ethics and the practice of clinical psychology. Offered in alternate years. Prereq: M.A. in psychology or equivalent.</td>
<td></td>
</tr>
<tr>
<td>5670</td>
<td>Forensic Psychology</td>
<td>(3)</td>
<td>The psychologist's role in relation to the law, including questions concerning licensure requirements, legal restrictions, and testimony as an expert witness. Offered in alternate years. Prereq: M.A. in psychology or equivalent.</td>
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<tr>
<td>5680</td>
<td>Neuroanatomy</td>
<td>(3)</td>
<td></td>
<td></td>
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<tr>
<td>5690</td>
<td>Psychological Testing</td>
<td>(3)</td>
<td>Evolutionary and physiological basis of comparative psychology and implications for human behavior. Prereq: Introductory Biology and graduate standing.</td>
<td></td>
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<tr>
<td>5700</td>
<td>General Vertebrate Neuroanatomy</td>
<td>(3)</td>
<td>Lecture and laboratory dealing with structure and function of the central and peripheral nervous system. Prereq: 4710, 4719 or consent of instructor. (Same as Zoology 5760.)</td>
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<tr>
<td>5700</td>
<td>Advanced Techniques in Physiological Psychology</td>
<td>(3)</td>
<td>Animal and human laboratory procedures central to research in physiological psychology. Prereq: 4710, 4719 and consent of instructor. May be repeated with consent of instructor.</td>
<td></td>
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<tr>
<td>5710</td>
<td>Seminar in Psycholinguistic Concepts in Speech Pathology</td>
<td>(3)</td>
<td>Same as Speech Pathology 5790.</td>
<td></td>
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<tr>
<td>5810-20</td>
<td>Techniques of Psychological Examination</td>
<td>(3, 3)</td>
<td>Development and instruction of basic examination techniques. Intended primarily for students in fields related to psychology, including assessment procedures. Prereq or coreq: 4640 or equivalent and consent of instructor.</td>
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<tr>
<td>5819-29</td>
<td>Practicum in Techniques of Psychological Examination</td>
<td>(3, 2)</td>
<td>Coreq for 5819: 5810; Coreq for 5829: 5820.</td>
<td></td>
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<tr>
<td>5840</td>
<td>Student Appraisal</td>
<td>(3)</td>
<td>Same as Educational Psychology 5840.</td>
<td></td>
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<tr>
<td>5850-60-70</td>
<td>Psychological Appraisal</td>
<td>(3, 3, 3)</td>
<td>Objective and projective tests, clinical interviewing, case formulation, organic and functional disorders. Prereq: 5819-29; Prereq or coreq: 5580-90-990.</td>
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<tr>
<td>5850-69-73</td>
<td>Practicum in Psychological Appraisals</td>
<td>(2, 2)</td>
<td>Ordinarily to be taken concurrently with 5850-60-70.</td>
<td></td>
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<tr>
<td>5890</td>
<td>Counseling Techniques</td>
<td>(3)</td>
<td>Same as Educational Psychology 5890.</td>
<td></td>
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<tr>
<td>5950-60-70</td>
<td>Consultation in Human Development Settings</td>
<td>(3, 3, 3)</td>
<td>Study of issues, models, and evaluation of the process of consultation in settings where human developmental needs and crises are managed by persons who seek aid from psychologists. Must be taken in sequence. (Same as Ed. Psych. 5950-60-70.)</td>
<td></td>
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</tbody>
</table>
5959-69-79 Practicum in School Psychology II
(2, 2, 2) Second year School Psychology Program practicum core sequence. S/NC only. (Same as Ed. Psych. 5959-69-79.)

6000 Doctoral Research and Dissertation

6056 Experimental Methods in Sociology and Social Psychology (3) (Same as Sociology 6056.)

6100 Community Psychology (3) A survey of emerging psychological practices in intervention, evaluation and research in the community.

6210-20-30 History, Systems, and Theories in Psychology (3, 3, 3) Systems and organizational approaches in schools and other human service settings. Prereq: Consent of instructor. (Same as Ed. Psych. 6560-70-70.)

6250-60-70 Seminar in Organizational Psychology (3, 3, 3) (Same as Industrial Management 6250-60-70.)

6280-90-300 Factor Analysis (3, 3, 3) Factor analysis; component analysis; introduction to latent structure analysis. Prereq: 4640 and 5500.

* 6310 Seminar in Motivation and Emotion (3)

6319 Field Work in School Psychology: Level II (2) Supervised on-the-job traineeship in school psychology. Limited to students fully admitted to the doctoral program in School Psychology. Students who are assigned to program approved field settings. May be repeated. Maximum of 6 hrs. S/NC only. (Same as Ed. Psych. 6316.)

* 6320 Seminar in Research Methods (3)

* 6330 Seminar in Learning (3)

* 6340 Seminar in Developmental Psychology (3)

* 6350 Seminar in Thinking (3)

* 6350 Seminar in Sensation and Perception (3)

* 6370 Seminar in Theoretical Psychology (3)

* 6380 Seminar in Industrial Psychology (3) (Same as Industrial Management 6380.)

6390 Seminar in Psychotherapy (2) The treatment of a current case, focusing upon psychodynamics, psychopathology, and the therapeutic techniques employed. Prereq: M.A. in psychology or equivalent.

* 6395 Seminar in Assessment (3) Seminar for advanced graduate students in clinical psychology, to deal with current research on the methods of evaluating the status of individuals seeking clinical aid.

* 6400 Seminar on Changing Concepts in Clinical Psychology (3) New developments in the field in relation to their impact on experimentation and systems of thought. Prereq: M.A. in psychology or equivalent.

6405 Seminar in Psychopathology (3)

6410-20-30 Psychotherapy (3, 3, 3) Theories and principles of psychotherapy. Prereq: 5580-90-60. Prereq or coreq: 5580-60.

6411-12-13-14 Psychotherapy: Elective Concentration Learning Laboratory (2, 2, 2, 2) Typically four psychotherapy concentration areas offered in each quarter. Clinical program students in the core psychotherapy sequence must elect at least one of these in each quarter of the sequence. Prereq: 5580-90-60. Prereq or coreq: 5580-60. May be repeated. Maximum 16 hrs.


6450-60 Advanced Psychometrics (3, 3) Construction and standardization of psychological tests, questionnaires, and rating scales; theory of errors or measurements; item analysis; scaling, equating, and norms development. Prereq: 4680, 5440, and 5500. May be repeated. Maximum 8 hrs.

6491 Field Placement in Clinical Psychology Level-1 (1-8) Supervised clinical experience. Required of and limited to students fully admitted to the Ph.D. program in clinical psychology. May be repeated. Maximum 8 hrs. S/NC only.

6492 Field Placement in Clinical Psychology Level-2 (1-8) Supervised clinical experience. Required of and limited to students fully admitted to the Ph.D. program in clinical psychology. May be repeated. Maximum 8 hrs. S/NC only.

6493 Field Placement in Clinical Psychology Level-3 (1-8) Supervised clinical experience. Required of and limited to students fully admitted to the Ph.D. program in clinical psychology. May be repeated. Maximum 8 hrs. S/NC only.

6494 Field Placement in Clinical Psychology Level-4 (1-8) Supervised clinical experience. Required of and limited to students fully admitted to the Ph.D. program in clinical psychology. May be repeated. Maximum 8 hrs. S/NC only.

6500 Seminar in Psychometrics (3) Seminar for advanced graduate students in psychometrics or quantitative psychology, to deal with advanced theories, methodologies, and their applications. Prereq: 4640, 5500 or equivalent, and consent of instructor. May be repeated. Maximum 9 hrs.

6550 Seminar in Advanced Social Psychology (3) Prereq: Consent of instructor.

* 6550 Directed Readings in Clinical Psychology (2) Required during clinical internship; may be repeated. Maximum 3 hrs.

6575 Seminar in Mental Health Administration (3) Theory and problems in the organization and management of mental health administration.

6650-60-70 Systems Approaches in Psychological Services (3, 3, 3) Systems and organization development approaches in schools and other human services settings. Prereq: Consent of instructor. (Same as Ed. Psych. 6650-60-70.)

6659-59-79 Practicum in School Psychology III (2, 2, 2) Third year School Psychology Program practicum core sequence. S/NC only. (Same as Ed. Psych. 6659-69-79.)

* 6710 Seminar in Physiological Psychology (3)

* 6720 Seminar in Comparative and Ethological Psychology (3)

* 6730 Methods of Ethological and Naturalistic Research (3) Current laboratory and field techniques. Prereq: 4729, 5750, 6720, or consent of instructor.


6780 Advanced Psycholinguistics (3) Language from an ecological and associated points of view; methodological and theoretical problems. Prereq: Consent of instructor.


* 6870 Adult Psychotherapy (3) Prereq: 5850-90-60. Prereq or coreq: 5050-60.

* 6900 Field Work in Industrial and Organizational Psychology (1-15) (Same as Industrial Management 6900.)

*NOTE: Psychology 5210-5300, 5350-60-70, 5819-29, 6310-400, 6419-29-39, 6500, 6710-70-80, 6840-5870, and/or 6900 may be repeated for credit with the approval of the department.

Religious Studies

Professors:

F. S. Lusby (Head), B.D. Colgate Rochester; D. L. Dunigan, Th.D. Harvard; R. V. Norman, Jr., Ph.D. Yale.

Associate Professors:

B. L. Daniels, Ph.D. Duke; W. L. Humphreys, Ph.D. Union; E. D. Linpe, Ph.D. Vanderbilt; C. H. Reynolds, Ph.D. Harvard.

Assistant Professors:

J. Kim, Ph.D. Chicago; R. Lee, Ph.D. Harvard.

Instructor:


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 catalog 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.

3061-71 History of Western Religious Thought and Institutions (4, 4) 3061—first century to the 13th century. 3071—13th century to 1900. (Same as History 3061-71.)

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) A survey of the development of philosophical and theological thought in Russia from the Middle Ages to the 18th century. Special emphasis on the expression of this thought in contemporary Russian literature and literary criticism. May be repeated. Maximum 8 hrs. S/NC only. (Same as Philosophy 3270 and Russian 3270.)

3411-12-13 Renaissance and Reformation (3, 3, 3) (Same as History 3411-1-3.)

3440 Religion of Primitive Peoples (3) (Same as Anthropology 3440.)

3650 Philosophy and Religion in India (4) (Same as Philosophy 3650.)

3650 Buddhist Philosophy and Religion (4) (Same as Philosophy 3660.)

3690 Philosophy of Religion (4) (Same as Philosophy 3690.)

4111-21 Modern Religious Philosophies (4, 4) Examination of the religious implications of major thinkers and movements. 4111—Nicolas of Cusa to Hume. 4121—Kant and the 19th century. Prereq: 9 hrs of philosophy other than logic. (Same as Philosophy 4111-21.)

4210 Topics in Ancient Israelite and Ancient Near Eastern Religions (4) Prereq: Ancient Israel's Historical and Religious Traditions, The Rise of Judaism, or consent of instructor. May be repeated. Maximum 8 hrs.

4310 Jesus and Paul Compared (4) Jesus' teaching and activity in the context of first-
The Apostle Paul made of the tradition of and century Palestinian Judaism; analysis of what Barrette, Ph.D. California; C. W. Cobb, 5710-20 Topics in Religious Thought (4,4) 5510-20 Topics in the History of Religion (4,4) 5310-20 Topics in Religion and Society (4,4) 5103 Independent Study (1-12) See page 146.

4540 Social and Religious Change (4) (Same as Sociology 4540.)

4610 Topics in Western Religious Thought and Institutions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: History of Western Religious Thought and Institutions. May be repeated. Maximum 12 hrs.

4640 Topics in Early Christianity and Hellenistic Religions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: Introduction to Ancient Near Eastern Religions or permission of instructor. May be repeated. Maximum 12 hrs.

4670 Topics in Eastern Religions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: 3650-60. May be repeated. Maximum 12 hrs.

4810-20-30 Readings and Research in Religious Studies (3-4, 3-4)

4840 Readings in Selected Languages Related to Religious Studies (3-4) Prereq: Consent of the instructor. May be repeated. Maximum 12 hrs.

4940 Sociology of Religion (4) (Same as Sociology 4940.)

4950 Theory of Religion (4) Elements for construction of a theory of religion drawing on resources from fields of psycho-history, social psychology, sociology of religion, cultural anthropology, theology and comparative religion.

4960 Tradition, Change and Modernity in Asia (4) Comparative study of processes of religious and social change seen in historical context in Asian societies. Comparative focus of course will vary each year (e.g., China and Japan, India and South Asia, etc.) May be repeated. Maximum 8 hrs. (Same as Sociology 4960.)

501 Foreign Study (1-12) See page 146.

502 Off-Campus Study (1-12) See page 146.

503 Independent Study (1-12) See page 146.

5310-20 Topics in Religion and Society (4,4)

5510-20 Topics in the History of Religion (4,4)

5710-20 Topics in Religious Thought (4,4)

Romance Languages

MAJORS DEGREES

French M.A.

Romance Languages M.A.C.T.

Spanish M.A., Ph.D.

Professors:


Associate Professors:


Assistant Professors:

M. Handelsman, Ph.D. Florida; K. D. Levy, Ph.D. Kentucky; C. Pinsky, Ph.D. California. (Berkeley).

The Department of Romance Languages offers three advanced degrees: the Master of Arts in College Teaching (M.A.C.T.) in the 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 hours credit). They must also complete 6 credits in supervised instructional experience. 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 philology, and 3 hours of problems in language teaching, must be completed in it. In addition, civilization courses are strongly recommended. Spanish or French must be selected as the minor subject, and at least 18 hours of graduate work must be completed in it.

THE MASTER OF ARTS PROGRAM

The student may select either Plan A or 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. Three 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 at least 3 consecutive quarters of full-time residence, a minimum of 81 credit hours in course work beyond the Bachelor's degree (or equivalent), and a dissertation (36 credit hours).

No less than 54 quarter hours should be taken in courses pertaining to the student's major field; of these a minimum of 18 hours are to be taken in courses above 6000. A maximum of 12 hours may be taken in courses of the 4000 level and the rest in courses above 6000. 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 2 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 a student 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 his committee. The candidate is expected to defend the dissertation in a final oral examination.

For additional information on the program, consult pages 20-22.

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. 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 146.

5102 Off-Campus Study (1-12) See page 146.

5103 Independent Study (1-12) See page 146.

French

3010-20-30 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 examinations, and upper division students desiring reading knowledge of the language. Undergraduate credit only. No credit for those having had Elementary French. No auditors.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>4010</td>
<td>Masterpieces of French Literature in English Translation</td>
<td>5 hrs</td>
<td>3</td>
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<tr>
<td>4020</td>
<td>Masterpieces of French Drama in English Translation</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>4110-20-30</td>
<td>French Literature of the Seventeenth Century</td>
<td>Intermediate French (3rd quarter)</td>
<td>3</td>
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<tr>
<td>4150</td>
<td>Theatrical French (1-3)</td>
<td>Performance in one or more French plays</td>
<td>1</td>
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<tr>
<td>4160-70-80</td>
<td>Advanced Conversation (2, 2, 2)</td>
<td>Intensive training in prepared and spontaneous conversations</td>
<td>4 hrs</td>
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<tr>
<td>4210-20-30</td>
<td>Phonetics and Advanced Grammar (3, 3, 3)</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
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<tr>
<td>4240</td>
<td>Introduction to Descriptive Linguistics (3)</td>
<td>(Same as German 4250.)</td>
<td>3</td>
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<tr>
<td>4270</td>
<td>Introduction to Romance Linguistics (3)</td>
<td>A study of the development of Classical Latin through Vulgar Latin into the major romance languages. (Same as Spanish 4270.)</td>
<td>3</td>
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<tr>
<td>4310-20-30</td>
<td>French Literature of the Eighteenth Century</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
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<tr>
<td>4350-66-70</td>
<td>Medieval French Literature</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3, 3, 3</td>
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<tr>
<td>4410-20-30</td>
<td>French Civilization (3, 3, 3)</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>4510-20-30</td>
<td>The Modern Novel (3, 3, 3)</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>4530</td>
<td>The Modern Theatre (3)</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>4550-50-60</td>
<td>The Philosophes (3, 3, 3)</td>
<td>3 hrs</td>
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<tr>
<td>4610-20-30</td>
<td>The French Novel (3, 3, 3)</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>4620</td>
<td>Contemporary Poetry</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>4630</td>
<td>Contemporary Prose</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>4650-50-60</td>
<td>Hispano-Arabic Literature and Culture (3, 3, 3)</td>
<td>May be repeated with consent of department</td>
<td>3</td>
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<tr>
<td>4730</td>
<td>Advanced Syntax and Stylistics</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>4790</td>
<td>Baudelaire and the Symbolists</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>5101</td>
<td>Techniques in Literary Analysis</td>
<td>An intensive course in explication de texte.</td>
<td>3</td>
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<tr>
<td>5102</td>
<td>Off-Campus Study</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>5103</td>
<td>Independent Study</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>5109-20-30</td>
<td>Italian Civilization</td>
<td>Intermediate Italian (3rd quarter) or equivalent</td>
<td>3</td>
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<tr>
<td>5120-20-30</td>
<td>Italian Literature in English Translation</td>
<td>Intermediate Italian or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5130-20-30</td>
<td>Italian Drama in English Translation (3, 3, 3)</td>
<td>Intermediate Italian or equivalent</td>
<td>3</td>
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<tr>
<td>5150-60-70</td>
<td>Dante and Medieval Culture</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>5160-70-80</td>
<td>Advanced Conversation</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>5210-20-30</td>
<td>French Literature of the Sixteenth Century</td>
<td>Intermediate French (3, 3, 3)</td>
<td>3</td>
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<tr>
<td>5310-20-30</td>
<td>French Directed Readings</td>
<td>3 hrs</td>
<td>3</td>
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<tr>
<td>5350-40-50</td>
<td>The Modern Novel (3, 3, 3)</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5410-20-30</td>
<td>The French Novel (3, 3, 3)</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5450-60-70</td>
<td>Lyric Poetry of the Nineteenth Century</td>
<td>Intermediate French (3, 3, 3)</td>
<td>3</td>
</tr>
<tr>
<td>5490-60-70</td>
<td>The Sicilian School, Dante, Petrarch, Boccaccio, Machiavelli, Ariosto, Tasso</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5530-60-70</td>
<td>Three Italian Plays</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5550-50-60</td>
<td>Advanced Syntax and Stylistics</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5570</td>
<td>Problems in Romance Linguistics</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5610-20-30</td>
<td>Seminar in French Literature</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5650-60-70</td>
<td>Readings and written imitations of modern literary styles in the form of compositions, sketches and original stories.</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5760-50-60</td>
<td>Readings and written imitations of modern literary styles in the form of compositions, sketches and original stories.</td>
<td>Intermediate French (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5910</td>
<td>Literary Criticism</td>
<td>The Foundations of Romance Criticism</td>
<td>3</td>
</tr>
<tr>
<td>5910-20-30</td>
<td>Italian Literature in English Translation</td>
<td>Intermediate Italian (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5910-20-30</td>
<td>Italian Drama in English Translation</td>
<td>Intermediate Italian (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5930-60-70</td>
<td>Dante and Medieval Culture</td>
<td>Intermediate Italian (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5950</td>
<td>Contemporary Italian Literature</td>
<td>Intermediate Italian (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5970</td>
<td>Italian Literature in English Translation</td>
<td>Intermediate Italian (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>5980</td>
<td>Italian Drama in English Translation</td>
<td>Intermediate Italian (3rd quarter) or equivalent</td>
<td>3</td>
</tr>
</tbody>
</table>
A student uses university facilities and/or is registered during any quarter when such registration is prerequisite. 5000, 5002 Non-Thesis Graduation Completion (3) (Same as French 4500.)

Phonetics and Advanced Grammar (3, 3, 3) Prerequisite: Intermediate Spanish (3rd quarter) or equivalent. 4250 Introduction to Descriptive Linguistics (3) (Same as French 4250.)

Introduction to Romance Linguistics (3) (Same as German 4250.) 4270

A study of the development of Classical Latin through Vulgar Latin into the major romance languages. (Same as French 4270.) 4410 Spanish Civilization (3) Prerequisite: Intermediate Spanish (3rd quarter) or equivalent.

Latin American Civilization (3, 3, 3) Prerequisite: Intermediate Spanish (3rd quarter) or equivalent. 4420-30 Studies in Modern Spanish Style (3, 3, 3) Prerequisite: Independent Composition and Conversation or consent of instructor.

Intermediate Spanish (3rd quarter) or equivalent. 4450-60-70 Directed Readings in Spanish (3, 3, 3) Prerequisite: Intermediate Spanish (3rd quarter) or equivalent.

5000 or 6000. 5002 Non-Thesis Graduation Completion (3) 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 (2) Required for either Plan A or Plan B of the M.A. program. An intensive course in explication de texte. 5070-80-90 Hispanic-Arabic Literature and Culture (3, 3, 3) 5070—General culture history, A study of the development of the traditional marketplace story, or episodic prose narrative, into the modern novel of character after the invention of printing. 5090—Mutual influence of traditional Arabic poetry and the popular and native Spanish choral lyric; development of the classical Muslim, the colloquial zajel, and the later villancico. Readings in Arabic and Spanish. (Same as Arabic 5070-80-90.)

5101 Foreign Study (1-12) See page 146. 5102 Off-Campus Study (1-12) See page 146. 5103 Independent Study (1-12) See page 146. 5104-20-30 Old Spanish (3, 3, 3) Medieval Spanish language and literature. 5121 College Teaching of Romance Languages (3) Seminar on demonstrations, and practical applications of techniques and procedures for teaching, and evaluating basic language skills, and language 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 the department. 5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as French and Italian 5151-61-71.) S/NC only.

5211-21 Don Quixote (3, 3, 3) Must be taken in sequence or with consent of instructor. 5221-22-32 Golden Age Prose (3, 3, 3) 5212—La Celestina; critical study of Fernando de Rojas' life and work. The Celestinaque genre. 5222—Spanish philosophical thought; mystical prose; satirical prose. 5231-32-33 Guzman de Alfaro and the Spanish picaresque genre.

5231 The Exemplary Novels, Persiles y Sigismunda (3) 5250-60 The Generation of '98 (3, 3) Angel Gwint, Giner de los Rios, Baroja, Unamuno, Valle Inclan, Benavente, Azorin, Perez de Ayala. 5270 The Contemporary Novel (3) The Civil War and post-Civil War period. 5310-20-30 Topical Survey of Spanish American Literature (3, 3, 3) Prerequisite: Intermediate Spanish (3rd quarter) or equivalent.

4210-20-30 Phonetics and Advanced Grammar (3, 3, 3) Prerequisite: Intermediate Spanish and College Teaching of Romance Languages (3) (Same as German 4250.)

5510-20-30 The Spanish Theatre after the Generation of 1898 (3, 3, 3) Prerequisite: Intermediate Spanish (3rd quarter) or equivalent. 5520-30 The Spanish Theatre after the Golden Age (3, 3, 3) 5510—From the 18th century through Romanticism. 5520—From Realism through the Generation of 1898. 5530—Contemporary theatre.

5550-60 The Golden Age Theatre (3, 3, 3) 5550—Introduction to the Spanish theatre, Lope and Tirso. 5560—Castro, Mira de Amanua and Alarcon. 5570—Rojas Zorrilla, Moreno, and Calderon.

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)

5632 The Spanish American Short Story (3) The short story as a major literary genre in Spanish America. 5631 Spanish American Essay (3) 5630-20-30 Spanish American Lyric Poetry (3, 3)

5632 The Spanish American Short Story (3) The short story as a major literary genre in Spanish America. Reading and criticism of the works of authors such as Dario, Quiroga, Borges, Arreola, and Rulfo.

5633 Twentieth-Century Latin American Theatre and Film (3) Readings from the works of such playwrights as Carlos Solorzano, Rodolfo Usigli, Conrado Nalé Roxlo, Roberto Cossa, René Marqués and Sebastián Salazar Bondy. Presentation of films as adaptations of classical works such as Doña Bárbara, Los abuelos, and Don Segundo Sombra as well as exponents of the experimental cinema of today.

5640 Latin American Women Writers (3) An introduction to the works of Latin American women writers, focusing on the feminine point of view, the modern image of woman, male-female relationships and society as a context for woman's destiny. Readings from poetry and fiction, including such authors as Alfonsina Storni, Dolmira Agustini, Gabriela Mistral, Silvina Bullrich, Silvina Ocampo, and Rosario Castellanos.

5650-60 Advanced Syntax and Stylistics (3, 3) Readings and written imitations of modern literary styles in the form of 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 in the field of Peninsular Literature. May be repeated with consent of the department. 6310-20-30 Seminar in Latin American Literature (3, 3, 3) Topics vary. May be repeated with consent of the department.

Russian

See German

Sociology

MAJOR

DEGREES

Sociology

M.A., M.A.C.T., Ph.D.

Professors:

J. A. Black (Head), Ph.D. Iowa; D. J. Champion, Ph.D. Purdue; W. E. Cole (Emeritus), Ph.D. Cornell; L. E. Botson, Ph.D. Vanderbilt; L. Ebersole, Ph.D. Pennsylvania.

Associate Professors:

D. B. Fogel, Ph.D. Michigan State; D. Clelland, Ph.D. Michigan State; D. Hinds, Ph.D. Massachusetts; T. C. Hoob, Ph.D. Duke; N. Shover, Ph.D. Illinois; S. Wallace, Ph.D. Minnesota.

Assistant Professors:

S. Kurth, Ph.D. Illinois; S. Nordan, Ph.D. Iowa; M. Perrin, Ph.D. British Columbia; T. Weiss, Ph.D. Wisconsin.

For a full statement of departmental requirements, students are referred to the Departmental Graduate Manual.

All registration for 3000- and 4000-level courses require the consent of the Instructor.

MASTERS PROGRAM

The department offers both a thesis and non-thesis option for a Master's degree. For information concerning the Master's degree with thesis, see the General Requirements on page 17. Those interested in the non-thesis option should obtain details from the department.

DOCTORAL PROGRAM

General requirements for the degree of Doctor of Philosophy are described on page 20. 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 must 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 Social Law and Social Avulsion (4) A general treatment of the social origins and consequences of law and the legal process. Particular emphasis is placed on problems of law and social change, and on the 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) An exposition of the development of correctional movement, develops a critical sociological perspective on contemporary correctional programs, and provides an overview of evaluative research in corrections.

4310 Criminology (4)

4330 Urban Ecology (4) Examination of public, private, collective, and individual space. Classical school of ecology, its neo-classical revisions, social area analysis, and cognitive symbolic ecology emphasized.

4410 Educational Sociology (3) (Same as Curr. and Inst. 4410.)

4530 Community Organization (4) Structure; function; linkages; change and development; important community studies are reviewed and discussed. Emphasis on sociological analysis, not on the implementation of change.

4540 Social and Religious Change (4) (Same as Religious Studies 4540.)

4550 Formal Organization (4) Analysis of the bureaucratization process, division of labor, delegation of authority, channeling communication under a norm of rationality.

4820 American Minority Groups (4) Minority groups and social structure in American society; analysis of inter-group 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.)

4969 Tradition, Change and Modernity in Asia (4) (Same as Religious Studies 4969.)

5000 Thesis

5002 Non-Thesis Graduation Completion (3) Required for the non-thesis student not otherwise granted 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 Methodological Issues in Social Research (3)

5050 Seminar in Political Sociology (3) The political system from the societal, organizational, and group perspectives.

5060-70 Special Social Investigation (5, 3) Directed readings and/or research projects.

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)

5210 Seminar in Methods of Sociological Research (3) A consideration of major methodological issues in sociology; scaling techniques; validity, sampling, and qualitative methodology.

5230-30 Social Statistics (3, 3) General survey of parametric and non-parametric 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 communities.

5560-70 Field Research in Deviance (3, 3)

5580 Sociology of Mental Disorders (3) Relationship between formal sociological models and substantive theories of mental illness. Historical development of theoretical conceptualizations. Interdependence of theory and therapeutic techniques. Epidemiology of mental disorders. Review of major studies.

5590 Social Differentiation and Stratification (3) An examination of various sources of differentiation in society, their relation to conflict in society, and their relationship to class structure in society.

5610 Seminar in Occupations (3) Occupations and their relation to the individual and the society; technology and occupations; unequal rewards and occupations; social organization and occupations.

5620 Seminar in Occupations (3) A continuation from the material in Sociology 5610; the interface between occupations and the settings in which they are performed.

5630 Seminar in Occupations (3) Research participation; directed projects on subjects developed in 5620. Prereq: 5610 or 5620.

5640 Social Structure and Personality (3) Social interaction and personality; the genesis and functioning of the self; the cultural basis of personality. May be used for credit in psychology.

5670 Social Organization (3) Structure and function of human groups, with special attention to voluntary associations and administrative organizations.

5720 Small Group Theory and Research (3) A critical assessment, through reading and research on contemporary theoretical orientations to the study of small groups. Research will be designed to test selected theoretical problems. May be repeated for credit.

5730 Seminar in Research Problems in Inter-group Relations (3) Research techniques and problems as encountered in race and inter-group relations are explored; actual field research projects are performed.

5810 Seminar in Race and Culture (3) Critical examination of theoretical and conceptual approaches in the study of intergroup relations.

5910 Urban and Regional Sociology (3) Prereq: 4510 and 4520.

5920 Seminar in Social Attitudes (3)

5940 Delinquency and the Social Structure (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 Experimental Methods in Sociology and Social Psychology (3) Design and carry out experimental research projects. (Same as Psychology 6050.)

6070 Field Research (3) Prereq: 4140-50.


6090-100 Survey Design and Analysis (3, 3) Application of general methodological principles to the particular operating context of a survey. Systematic exploration of survey problems through student participation in the design and analysis of a survey (2 quarters).

6120 Selected Topics in Deviance and Law (3)

6130 Seminar in Mass Behavior and Related Topics (3)

6140 Advanced Reading in Sociological Theory (4)

6150 Advanced Reading in Sociological Methodology (4)

6160 Advanced Social Special Investigation (4)

6170 Cross-Cultural Aspects of Human Fertility (3) Historical, topical, regional, and methodological approaches to human fertility and demographic problems. Consideration of the relations obtained between socioeconomic and demographic change in various parts of the world; fertility rates and national policy; controversies on control of vital rates of growth.

6180 Theory and Method of Human Ecology (3) The theoretical perspective and research techniques of human ecology applied to selected research sites.

6190 Advanced Social Special 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: 4310 and 5520.
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 the research and current position of theory.

6810 Advanced Studies in Social Psychology (3) Social interaction and personality; the genesis and functioning of the self; the interplay of social structures and individual actions; theories of social psychology related to these problems and recent research are discussed. May be repeated. Prereq: Social Psychology or Psychology 5550.

6840-50 Social Change (3, 3) Major theories, methods and research.

6940 Advanced Studies in Urban Sociology (3) Field work projects and community studies examined and/or applied in specified areas. Prereq: 3410-20.

Spanish
See Romance Languages

Speech and Hearing Sciences
See Audiology and Speech Pathology

Speech and Theatre

MAJOR DEGREES

Speech and Theatre M.A., M.A.C.T.

Professors: R. H. Allen (Head), D.F.A. Yale; T. P. Cooke, Ph.D. Florida; M. 5440 Organizational Communication (3) May be repeated. Maximum 9 hrs.

5430 Studies in Tennessee Oratory (3) May be repeated. S/NC only.

5420 Quantitative Projects in Speech Communication (3) May be repeated. Maximum 9 hrs.

5200-5300 Studies in Rhetoric (3, 3, 3) May be repeated. Maximum 9 hrs.

5190-95 Studies in Persuasion (3, 3, 3) May be repeated. Maximum 9 hrs.

5180-85 Studies in Persuasion (3, 3, 3) May be repeated. Maximum 9 hrs.

5170-75 Studies in Persuasion (3, 3, 3) May be repeated. Maximum 9 hrs.


5140 Communications Theory (3) Analysis of contemporary theories of human communication, emphasizing similarities and differences of communication processes in interpersonal, intergroup, and mass communication systems. (Same as Communications 5140.)

5120 Topics in Group and Interpersonal Communication (3) May be repeated. Maximum 9 hrs.

5110-15-20 Socialization and Higher Education. Students seeking the M.A.C.T. degree are allowed to substitute nine quarter hours of course work for the Master's thesis.

Speech and Theatre 5110 is required of all M.A. and M.A.C.T. students.

Speech 3011 Persuasion (4) Persuasive discourse: its psychological, sociological and cultural dimensions.

3021 Group Communication (4) Communication theory in its application to small groups, especially discussion groups; communication barriers, nonverbal communication, business communication.

3031 Nonverbal Communication (4) An exploration of nonverbal communication from the human communication perspective: origins and research, usage and coding of non-verbal behavior, research strategies and theoretical approaches.

3541 Rhetorical Theory and Criticism (4) Survey of Western rhetorical theory; contemporary approaches to criticism of public address.

4222 Advanced Argumentation and Debate (4) Prereq: Argumentation and Debate or consent of instructor.

4461 Quantitative Research Methods in Speech Communication (4) Designing experiments; planning field studies; using statistical analysis.

4551 Southern Oratory (4) Historical and critical study of public address in the South.

4560 Rhetoric of the Women's Rights Movement (4) Historical and critical study of public addresses in campaign for women's rights from the 1830's to the present.

4571 British Oratory (4) Historical and critical study of British public address.

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.


4911-21 History of American Public Address (4, 4) 4911—Colonial period to 1865. 4921—1866 to present.

4999 Colloquium in Speech Communication (1) May be repeated.

5100-10 Communication in formal organizations. Prereq: 3610-20.

5120 Directed Reading and Research (3) May be repeated. Maximum 9 hrs.

5120 Directed Reading and Research (3) May be repeated. Maximum 9 hrs.

5125-60-90 Film History and Theory (3, 3, 3) Analysis of cinematic forms and styles. 4170—Narration. 4180—Expression and persuasion. 4190—Experimental forms: films and other media.

4651 Theories of Oral Interpretation (4) Theories concerning the literary, psychological, communicative, and aesthetic approaches to the methods and techniques of oral interpretation.

4661 Production Techniques for Oral Interpretation (4) Problems in collection, adaptation, and presentation of literature.

5000 Thesis

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

5110 Introduction to Graduate Research in Speech and Theatre (3)

5120 Directed Reading and Research (3) May be repeated. Maximum 9 hrs.

Theatre

3121-22 Advanced Acting (4, 4) Prereq: Consent of instructor.

3151-52 Major Productions (1-4, 1-4)

3153 Outdoor Repertory Production (4)

3221-22 Introduction to Scene Design (4, 4) Descriptive drawing as an approach to three-dimensional design; theatrical graphic standards; problems in stage design with reference to lighting; movement; scale and style. Prereq: Stagecraft or consent of instructor.


3262-63 History of American Theatre (4, 4) Development of theatre as social institution in American life. 3262—from its beginnings to 1900. 3263—from 1900 to present.

3231-22 Introduction to Lighting Design (4, 4) Mechanics of stage lighting; elementary theory; problems in basic lighting practice. Prereq: Stagecraft and consent of instructor. Must be taken in sequence.

3451-52 Play Directing (4, 4) Must be taken in sequence. Prereq: Acting.

3511-12 Introduction to Theatre Costume Design (4, 4) Costume as an expression of character on stage; the application of costume history to specific design projects. Prereq: Basic stage costuming or consent of instructor.

3533-34 Special Problems in Acting (4, 4) Advanced exercises in voice and movement; preparation of major role under performance conditions. Prereq: Advanced acting and consent of instructor.

3511-52 Major Productions (1-4, 1-4) Continuation of 3511-52. Available for credit only to theatre majors Prereq: Consent of Instructor.
4153 Outdoor Repertory Productions (4) Continuation of 3153. Available only to members of summer company by consent of instructor.

4241-42 Advanced Design (4, 4) Play interpretation through scenic means; setting as environment for dramatic action. Prereq: 3221-22 and consent of instructor.

4341-42 Advanced Lighting Design (4, 4) Relationship of light to setting in creating stage environment. Prereq: 3221-22 and consent of instructor. Must be taken in sequence.


4541-42 Advanced Theatre Costume Design (4, 4) Advanced problems in costume design and construction; pattern drafting; draping. Prereq: 3511 or 3512.

4751-52 Dramatic Theory and Criticism (4, 4) From Aristotle to Lessing. 4752—From Goethe to Ibsen. Prereq: Consent of instructor.

4951-52 Playwriting (4, 4) Prereq: Consent of instructor.

5250 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.

5620 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 the costumes for a complex play for public performance. May be repeated. Maximum 9 hrs.

5890 Studies in Theatrical Production (3) May be repeated. Maximum 9 hrs.

5912 Play Production in Secondary Schools (4) Making and methods for directing high school dramatic programs. (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

Zoology

MAJORS

DEGREES

Radiation Biology M.S., Ph.D.

Zoology M.S., Ph.D.

Professors:

J. C. Daniel, Jr. (Head), Ph.D. Colorado; D. L. Bunting, Ph.D. Oklahoma State; J. G. Carlson, Ph.D. Pennsylvania; A. C. Cole, Jr. (Emeritus), Ph.D. Ohio State; R. C. Fraser, Ph.D. Minnesota; R. F. Grall, Ph.D. Tennessee; B. Hochman, Ph.D. California (Berkeley); J. C. Howell, Ph.D. Cornell; K. W. Jeon, Ph.D. Berkeley; N. R. Kennedy, Ph.D. Iowa; H. G. Welch, Ph.D. Florida; M. C. Whiteside, Ph.D. Indiana.

Associate Professors:

P. B. Coulston, Ph.D. Illinois; A. C. Echtenach, Ph.D. Kentucky; D. J. Fox, Ph.D. Johns Hopkins; M. A. Handel, Ph.D. Kansas; A. M. Jurgens, Ph.D. Minnesota; J. A. MacCabe, Ph.D. California (Davis); M. L. Pan, Ph.D. Pennsylvania; S. E. Reichard, Ph.D. Wisconsin; J. A. Vaughan, Ph.D. Duke.

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, 2 years including 12 quarter or 8 semester hours of general inorganic; (4) 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.

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.

DOCTORAL PROGRAM

Special requirements in zoology are as follows: (1) course requirements shall be determined by the student and the student'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 degree must possess a reading knowledge of at least one foreign language in which there exists a sizeable amount of literature 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.


3071 Immunology (3) (Same as Microbiology 3071.)


3110 General Entomology (5) Introduction to insects; basic structure, development, behavior; classification of insect orders and representative families; interpretation and use of keys. Prereq: General Ecology 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: General Ecology. 3 hrs and 2 labs.

3220 Physiology of Reproduction (3) (Same as Animal Science 3220.)


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) Selected advanced topics in zoology, concentrated in time and subject matter. Consult departmental listing for actual topics to be offered. Prereq: As posted. May be repeated.


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 and government organizations and industry. Approximately 5 hours involvement per week. Prereq: General Genetics, Cell Biology, General Ecology, and senior standing.

4190 Mammalogy (4) Classification, evolution, distribution, reproduction, populations, and behavior. 2 hrs and 2 lab or field periods.

4230 Ichthyology (5) Classification, collection and identification, distribution, life histories, and economic importance of fishes. Prereq: General Ecology 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 control which examines kinetics and integration of cellular activities. Prereq: Cell Biology or any physiology and/or biochemistry. Recommended: Biochemistry. 3 lectures and 1 lab.

4240 Animal Ecology (4) Environmental factors determining the distribution and numbers of animals; infraspecific relations; problems and methods. Prereq: General Ecology. 2 hrs and 2 labs.

Comparative Animal Physiology Laboratory, I (1) Coreq: 4250.
Comparative Animal Physiology Laboratory, II (1) Prereq: Principles of Animal Physiology and consent of instructor. Coreq: 4260.
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: Principles of Animal Physiology and Hormones and Endocrine Function, 3 hrs and 1 (3 hr) lab.
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.
Ornithology (4) Morphology, physiology, behavior, reproduction, populations, evolution, field identification. 2 hrs and 2 labs or field periods.
Animal Cytology (Structure and function of cells and their components; special emphasis on mitosis and meiosis. Recommended prereq: General Genetics. 2 hrs and 2 labs.
Microtechnique (4) Prereq: 3320 recommended. 2 hrs and 2 labs.
General Genetics Laboratory (2) Experiments designed to illustrate basic principles of inheritance. Prereq: General Genetics. 2 labs.
Parasitology (4) Morphology, taxonomy and ecology of parasitic worms and protozoa, with emphasis on host-parasite relationships. 3 hrs and 1 lab.
Medical Entomology (4) Distinctive morphological features, distribution, life histories, and control of arthropods that parasitize man or other animals as vectors of human pathogens. Recommended prereq: Agricultural Biology 3210 or General Ecology. (Not open to students with credit for 3430.)
Protozoology (4) Morphology, taxonomy, and physiology of protozoa in relation to fundamental biological concepts. 2 hrs and 2 labs. Recommended prereq: Cell Biology.
Comparative Animal Pathology (2, 2) Abnormal morphological changes and their causes. 4610—Cell and tissue changes. 4620—Organ, organ system, and organism changes. Recommended: 3060, 3080, 3320.
Comparative Animal Pathology Laboratory (2, 2) 4619—Cell and tissue changes. 4620—Organ, organ system, and organism changes. Coreq: 4610-20.
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: General Chemistry, General Ecology. Recommended: General Botany and Intro. Physics. 2 hrs and 2 labs (4660); 3 hrs and 1 lab (4670). Must be taken in sequence, except with consent of instructor. Not open to students with credit for former 3640 or 4650.
Arachnology (4) Biology of spiders, mites, scorpions, and relatives. Prereq: 3110, or 3150. 2 hrs and 2 labs.
Comparative Animal Behavior (4) Methods and principles. (Same as Psychology 4720.)
Comparative Animal Behavior Laboratory (4) Laboratory and field studies. Coreq: 4720. (Same as Psychology 4720.)
Insect Morphology and Taxonomy (4, 4, 4) 4810—Internal morphology of both generalized and primitive orders. 4820—Taxonomy of major orders. 4830—Taxonomy of minor orders and immature forms. Prereq: 3110 or consent of instructor for 4820-30. 2 hrs and 2 labs.
Physiology of Exercise (4) Functions of body in muscular work; physiological aspects of fatigue, training, and physical fitness. Prereq: Human Physiology or 3080. 3 hrs and 1 lab. (Not open to students with credit for 3940.)
Graduate Research Participation (3) Advanced research techniques are studied under the supervision of a staff research director whose research area coincides with the interests of the student. Open to all graduate students in good standing. Consent of department and research director. Course may be repeated with consent of the department. S/NC only.
Special Problems (2, 2, 2) 5110-20-30
Zoological Bibliography (1) Study and practice of critical evaluation and use of zoological literature, bibliographies, and abstracts, and of preparing bibliographies and scientific papers.
Fresh Water Invertebrate Zoology (4) Ecology and taxonomy of fresh water invertebrates exclusive of insects. Laboratory and field study. Prereq: 3180.
Plant Parasitic Nematodes (4) (Same as Agricultural Biology 5210.) Advanced Vertebrate Physiology (4, 4, 4) Advanced vertebrate cellular and systemic physiology; 5220—membrane, blood, immunity, neurophysiological mechanisms and muscle physiology; 5230—respiratory, cardiovascular, renal, thermo-regulatory, and digestive physiology; 5240—endocrinology, physiological genetics, reproductive physiology, sensory physiology, and aging. Must be taken in sequence, except with consent of instructor. Prereq: 3080. Coreq: Biochemistry 4120.
Advanced Neuromuscular Physiology (5) Cellular and molecular aspects of phenomena associated with conduction of excitation and muscular contraction. Prereq: 4250. 3 hrs and 2 labs.
Insect Physiology (4) Functions and interrelationships of the systems relative to metabolism, growth, coordination, movement, and reproduction. Prereq: 4610, 1 yr General Chemistry or consent of instructor. 2 hrs and 2 labs.
Quaternary Problems (4) (Same as Geology 5290.)
Seminar in the Teaching of College Zoology (2) Seminar and workshop in the 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.
Biometry (3) Statistical methods used in analysis of quantitative biological data. Prereq: 1 quarter statistics or consent of instructor.
Advanced Parasitology (4) Life cycles, techniques of collection, preservation, and identification of parasitic worms and protozoa. Prereq: Consent of instructor.
Advanced Medical Entomology (3) Prereq: 4430.
Advanced Ornithology (4) Classification, distribution, and anatomy of birds. Prereq: 4500.
Animal Populations (3) Characteristics and methods of study of animal populations.
Foundations of Radiation Biology (4, 4) Physical, chemical, and biological mechanisms involved in the action of different kinds of radiations on the living cell and its components. Recommended prereq: 1 yr biological science, General Physics, General Chemistry, Calculus. 3 hrs and lab.
Experiments with Laboratory Animals (3) Designed to give competence in handling research mammals. Techniques of anesthesia, drug administration, radiography and surgery will be included. Prereq: 4050, or 4410, or consent of instructor.
Cellular Immunology (4) Laboratory course with emphasis on immunological phenomena at the cellular level. Includes preparation and use of immunofluorescent reagents, macrophage migration inhibition, skin allograft reactions, diffusion chamber cultures, and antibody formation at the cellular level. Recommended prereq: Immunology. 4 hrs and 2 labs.
General Vertebrate Neuroanatomy (3) (Same as Psychology 5760.)
Radiation Physiology (4) Effects of different kinds of radiations on the functions of cells, tissues, and organ systems of animals. Recommended prereq: 5610.
Methods of Taxonomy (4) Methods employed in classification of animals; rules of nomenclature; problems in priority; preparation of keys, descriptions, and figures. Prereq: Consent of instructor.
Aquatic Insects (4) Taxonomy and biology of aquatic insects. Field identification of immature forms. Offered spring quarter. 2 hrs and 2 labs.
Geographic Distribution of Animals (4) Distribution patterns of vertebrate and invertebrate animals in all major habitats. Prereq: Consent of instructor.
Insect Syneclone (4) Ecology of insect communities.
Doctoral Research and Dissertation
Seminar in Cellular Biology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
Seminar in Immunobiology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
Seminar in Physiology (2) Prereq: Two physiology courses or consent of instructor. May be repeated. Maximum 6 hrs.
Seminar in Immunobiology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
Seminar in Developmental Biology (2) Integrative course in the biology of the differentiating cell. Prereq: 3050, 4050; Biochemistry 4110-20.
Seminar in Parasitology (2) Prereq: 5410. May be repeated. Maximum 6 hrs.
Seminar in Genetics (2) Prereq: General Genetics. May be repeated. Maximum 6 hrs.
Interdepartmental Program In Radiation Biology

John R. Totter, Director

MAJOR Radiation Biology

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 lines. Included on 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, by special permission, at one of the Oak Ridge laboratories. Problems selected for thesis research shall involve the interaction of radiation or long-lived fission products with biological systems, at the molecular, cellular, organismal, or ecological level of complexity. Areas of radiation specialization include biochemistry, biophysics, cytology, ecology, electron microscopy, embryology, entomology, genetics, hematology, immunology, microbiology, molecular biology, oncology, parasitology, pathology, physiology, and tissue culture.

Requirements for Admission: The minimum academic requirements for admission to the Institute are: (1) A Bachelor's degree from an accredited college or university, (2) biological science, chemistry, physics: 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 Doctor's degree, differential and integral calculus, (4) for the Ph.D. program, Graduate Record Examination scores.

Requirements for the Master of Science Degree: Course requirements shall include: (1) Zoology 5610, (2) Zoology 5620 or 5770 or 5780, (3) Zoology 5350 or Plant and Soil Science 5810, (4) Chemistry 3810 or Botany 5240, (5) Biochemistry 4110-20. (At least one-half of the student's program must be at the 5000 level.) A thesis is required of all students.

Requirements for the Doctor of Philosophy Degree: (1) Courses: In addition to those required for the Master's degree, Chemistry 4140-50 or 5410-20; Physics 3710-20; (2) Chemistry 3810 may be substituted for Physics 3730; Zoology 5620. 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) Candidates will be required to pass, before the preliminary examination is taken, the official reading examination of the University. In only one foreign language, or must earn a B average or at least a B in the last quarter of an appropriate language sequence, but the student's faculty committee may require other levels of training or proficiency in an additional foreign language. (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.

General Information for the College of Liberal Arts

FOREIGN STUDY COURSES

Foreign study courses offered in some departments of the College provide an opportunity to undertake independent study outside the United States. Prior to departure the student must have a plan of study approved by the department head and a supervising faculty member of the department concerned. Credit will be given only upon fulfilling all requirements set by the department and may vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

OFF-CAMPUS STUDY

Recognizing that learning is not restricted to formal classroom situations, the College provides for students to earn credit toward graduation for approved off-campus study. Such study may be undertaken only with prior approval of the faculty member and the department concerned. It may include certain kinds of work experiences, community involvement, working in political campaigns, etc. Credit per quarter will vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

INDEPENDENT STUDY

Certain educational goals may best be met through independent study done by an individual under the direction of a faculty member. Students who wish to do such independent study 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.

School of Nursing

Sylvia E. Hart, Dean

4770 Comprehensive Health Assessment (4)
Principles and theories underlying health screening of children and adults, including health history, interviewing and physical examination. 20 hrs lecture and 80 hrs lab or practice.
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 United States Energy Research and Development Agency, 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 Masters and Ph.D. thesis work are biochemistry, biophysics, carcinogenesis, cell biology, genetics, and physiology. Included are such subjects as microbiology, immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation biology, virology, developmental biology, plant physiology and photosynthesis, experimental pathology, microbial and mammalian genetics, mutagenesis, and problems of aging.

ADMISSION

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, general genetics, calculus, physics, and organic and physical chemistry. It is possible to remedy deficiencies in biology, general genetics and physical chemistry during the first year of residence. All other 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.

DOCTOR OF PHILOSOPHY DEGREE 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 (5720).

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 three formal courses in the advanced area of the student's interest.

5. Pass a written preliminary examination. This examination will be given at the end of the student's first academic year, unless other arrangements are made between the student and the Director of the Biomedical Graduate School. Such arrangements should be made during the student's first quarter in attendance at the School.

6. Pass an oral examination by the end of the student's second academic year. This includes the ability to formulate specific hypotheses and experiments and to present and defend these ideas orally before a selected group of scientists.

7. A dissertation reporting the results of original and significant scientific research. A minimum of 36 quarter hours of course 6000 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
Graduate School of Biomedical Sciences

(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 (six to 15 credit hours) with electives. The student will need previous training in biology, calculus, physics, organic and physical chemistry.

2. 45 credit hours of approved graduate courses including a minimum of nine quarter hours for thesis (maximum 18 quarter hours of credit for course 5000).

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 approve faculty members upon admission to candidacy.

5. A thesis reporting results of original
   and significant scientific research.

6. Pass a final oral (or oral and written)
   examination as determined by the student's committee.

Full-Time Faculty

Professors:

D. Bilan (Director), Ph.D. Tennessee; D. E. Olins, Ph.D. Rockefeller.

Associate Professors:

F. H. Gaertner, Ph.D. Purdue; C. T. Hadden, Ph.D. Washington.

Assistant Professor:

N. W. Revis, Ph.D. Glasgow, Scotland.

Research Assistant Professor:

C. T. Hadden, Ph.D. Washington.

Shared Faculty


Courses

5000 Thesis

5070-80 Physical Chemistry for the Life Sciences (3, 3) Thermodynamics; phase equilibria; chemical equilibria; electro motive force; surface of electrolyte solutions; kinetics; conductance; viscosity; diffusion.

5110-20 Biochemistry (3, 3) Chemistry of carbohydrates, lipids, proteins, nucleic acids, and coenzymes; enzyme kinetics; intermediary metabolism; synthesis of amino acids, purines, pyrimidines, lipids, and macromolecules. Coreq: 5070-80.

5140 Biophysics (3) Energy levels and excited states of large molecules; optical instrumentation; adaptations to system perturbations; properties of macromolecules in solutions; molecular conformation; internal and nuclear force; physical principles of microscopy. Coreq: 5070-80.

5160 Genetics (5) Mendelian genetics. mitosis and meiosis. Genetics of phage, bacterial and eukaryotic organisms. Mapping and linkage; mutagenesis; cytoplasmic inheritance; mechanism of recombination; chromosome structure, replication, and segregation.

5170 Molecular Genetics (3) Molecular biology of genetic processes. Gene regulation; coding; protein synthesis; suppression of missense and nonsense mutations; mutations mechanism; complementation; recombination. Preq: 5110-20, 5160.


5200 Mammalian Physiology (4) Survey of mammalian organ systems and their functions. Nervous, muscular, endocrine, digestive, respiratory, circulatory, reproductive, and excretory systems will be included; interrelationships of these systems as related to research in contemporary biological research. Prereq: 5190.

5230 Biochemical Concepts in Medical Sciences (3) Biochemical mechanisms involved in physiological conditions and pathological processes of human body. Dynamic functions of organ systems; biochemical pharmacology; hormone actions; thermodynamics of organic reactions is placed on current biochemical advances in basic and clinical medicine. Prereq: 5200, 5110-20.

5310-20-30-40 Biomedical Sciences Laboratory (3, 3, 3, 3) Laboratory courses designed to acquaint students with both the approach and technologies in various areas of modern biology. Students will spend a quarter in each of three or four laboratories conducting research in different areas of biomedical science. Required of all first-year students.

5350-60 Biomedical Sciences Seminar (1, 1) Critical analyses of current journal publications in a selected area of modern biology. Written evaluation of paper and participation in staff discussions is required of each student. Required of all first-year students.

5370 Biomedical Sciences Seminar (1) Basic principles of scientific writing. Research articles; grant and thesis proposals; review articles; review reports. Required of all first-year students.

5430-50-60 Graduate Research Participation (3, 6, 9) Special advanced research project covering an area not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

5500-60-70-80 Special Topics in Biomedical Sciences (3, 3, 3, 3) Given either as tutorials or as formal lectures. Potential topics for such courses include: X-ray diffraction and crystallography; excited-state biophysics; physical chemistry of macromolecules; computer science; pathology; cytology and cyogenetics; mammalian genetics; human genetics; cancer research; plant physiology; radiation biology; aging research. Additional courses can be developed at the request of individual students and staff members and may be repeated.

5700 Developmental Biology (3) Principles of early embryogenesis and tissue interactions that initiate cellular differentiation. Emphasis on mechanisms of differential gene action and regulation of protein synthesis that are pertinent to cellular differentiation. Prereq: 5120, 5170, 5200.

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 limits; tests of significance for comparing samples; analysis of variance; contingency tables; chi-square tests; correlation and analysis of variance of data. Prereq: Introductory Statistics or consent of instructor.

5750 Experimental Design in Biomedical Research (3) Requirements for a valid experiment, including the reduction of error, including paired comparisons, randomized blocks, and Latin squares; use of supplemental observations to reduce errors; randomization; investigating several variables simultaneously by factorial and split-plot designs; determining the number of observations. Prereq: 5740.

5830 Physical Biochemistry (3) Methods and concepts relevant to the determination of size, volume, mass, and other properties of biological systems.
shape and molecular weight of biological macromolecules. Discussion of optical activity and light scattering of macromolecules in solution. Prereq: 5070-80, 5110-20, 5140.

5840 Biogeneric Reaction Mechanisms (3) Nature of the chemical bond, nucleophilic and electrophilic reactions, molecular rearrangements, oxidation-reduction, solvolysis, protein and nucleic acid modification reagents, reactions involving proteins and nucleic acids on polymer supports.

5860 Cryobiology (3) Physical and chemical responses of cells and bacteriophage to low temperatures and ice formation. Relation of these responses to permeability, structure of semipermeable membranes, conformation of macromolecules, and the nature and state of water in cells; and how they bear on other areas of the biomedical sciences, 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 of the organ systems of experimental mammals, especially the laboratory mouse. Prereq: 5170.

5940 Classic Experiments in Genetics (3) Examination of many of the classic experiments in genetics will be read and discussed. Prereq: 5170.

5940 Classic Experiments in Genetics (3) Original papers presenting new and lasting concepts in genetics will be read and discussed. 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 23 hrs. S/NC only.

6180 Advanced Seminar in Biomedical Sciences (1-3) Presentation, evaluation and discussion of current research in the various areas of the biomedical sciences, including cell biology, genetics, biophysics, and biochemistry. Prereq: Consent of instructor. May be repeated. S/NC only.

6190 Seminar in Animal Virology (1) Discussion of experimental data and re-examination of active research problems in virology through use of literature. May be repeated. Maximum 12 hours. S/NC only. Prereq: Microbiology 4521 or equivalent and consent of instructor.

6200 Nucleic Acid Chemistry (3) Chemistry of nucleotide-derived materials covering topics including alkylation, solvolysis, oxidation-reduction, polymerization, synthesis, denaturation and other structure perturbants. The reaction of nucleic acids in the above systems will be examined with emphasis on the relationship of structure and reactivity. Prereq: 5110-20. Coreq: 5080.

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. The latter will emphasize enzymes and will include approximation of substrate-bas, covalent catalysis, general acid-base catalysis, and strain and distortion of substrates. Prereq: 5110-20.

6220 Enzyme Regulation and Kinetics (3) Kinetics of catalysis; inhibition by product, substrate and dead-end inhibitors; stimulation and inhibition of allosteric enzymes; types of feedback regulation; role of subunits in enzyme regulation; multifunctional enzymes. Prereq: 5110-20.
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 objective of the program is to prepare responsible and competent individuals to assume a professional role in libraries and information centers. In the course of study, students are exposed to various ideas about the role of libraries and information centers in society and the processes by which knowledge is communicated through the medium of the graphic record. Students acquire a familiarity with the bibliography and the literature of various subject fields. They are expected to develop the ability to evaluate and use various types of print and non-print materials. Students are also introduced to current concepts of the management of library operations and services.

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 nine hours allowed for thesis credit. At least 36 hours must be taken in the GSLIS, 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, information science/technical information service, and library management.

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. In addition, each applicant should make arrangements to take the GRE and TOEFL exams, if applicable. A personal data sheet and three recommendations (obtained from the Graduate School of Library and Information Science) should be returned to the Director of the School.

FINANCIAL ASSISTANCE OPPORTUNITIES

Arrangements made with the University of Tennessee Libraries provide a work-study plan for selected students who wish to obtain experience in academic librarianship while pursuing the degree. Such students are expected to work at least 20 hours each week and to extend the period required for the degree to approximately two years.

Similar arrangements exist with some of the 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 (Director) Ph.D. Case Western Reserve

Associate Professor: G. E. Estes, M.S.L.S. Kent State

Assistant Professors: J. Knightly, Ph.D. Texas; W. Robinson, Ph.D. Illinois; G. M. Sinkankas, Ph.D. Pittsburgh; P. Wilson, Ph.D. Michigan

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 the 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 Audiovisual Methods and Techniques (3) (Same as Curriculum and Instruction 4750)
Within the academic or special library sphere, the design and analysis of existing systems can be examined. Primary attention will be given to the guidance of qualified librarians. Prereq: 4270.

5200 Subject Reference and Bibliography (3) General patterns of bibliographical organization and basic information sources in subject fields including non-English materials; experiences in bibliographic methods and search techniques. Prereq: 4330.

5210 Sources and Services for the Social Sciences (3) Study and use of English and non-English literature and bibliographical sources in education, economics, political science, history, geography, anthropology, psychology, sociology; emphasis on organization of collections for optimum use. Prereq: 5200.

5220 Sources and Services for the Natural Sciences (3) Use of English and non-English literature and bibliographical sources in mathematics, physics, astronomy, chemistry, geology, biology and medicine; emphasis on organization of collections for optimum use. Prereq: 5200.

5230 Sources and Services for the Humanities (3) Use of English and non-English literature and bibliographical sources in literature and language, fine arts, music, philosophy and religion; emphasis on organization of collections for optimum use. Prereq: 5200.

5240 Organization of Library Collections II (3) Construction and maintenance of the library catalog as a retrieval instrument, including indexing and subject analysis theory, comparative classification with emphasis on the Library of Congress system, and problems in reclassification. Prereq: 4270.


5260 Government Publications II (3) Acquisition, organization and utilization of the publications of foreign governments and international organizations such as the United Nations, UNESCO, and others. Prereq: 4270.

5270 Legal Bibliography (3) Introduction to the literature of Anglo-American jurisprudence. Emphasis on use of reports, statutes, administrative regulations and decisions, treatises, periodicals, and indexes as bibliographic tools. Prereq: 4270.

5300 Library Management (3) A basic overview of management and organization concepts applicable to libraries and librarians. Prereq: 4270.

5310 Library Systems and Services (3) National, state, and regional systems of library service with attention to organization and planning, the role of standards and evaluation, and problems of jurisdictional relationships brought about by organizational patterns in multi-unit public library service systems. Prereq: 5320.

5320 Library and Information Networks (3) National and regional information systems will be examined. Primary attention will be given to the design and analysis of existing systems within the academic or special library sphere.

5330 Academic Libraries (3) Discussion of persistent and current problems. Topics vary depending upon needs and interests of the group.

5350 School Libraries (3) Discussion of persistent and current problems. Topics vary depending upon needs and interests of the 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 the acquisition, organization and servicing of technical information collections.

5370 The Library in the Community (3) Public library as a social agency; its role in the education and communication systems of the community.

5380 Seminar: Academic, Public, School or Special Libraries (3) Prereq: Consent of instructor.

5400 Library Facilities (3) Problems inherent in the planning and construction of library quarters. Examination of the 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, photocopying.

5520 History of Books and Printing (3) Development of the book in its various forms. History of the alphabet and writing; early writing materials; book in manuscript; history and techniques 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 the 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 the art of storytelling including 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. 15th century to 1920.

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 Production and Use of Audiovisual Materials (3) (Same as Curriculum and Instruction 5691.)

5700 Automation of Library Processes (3) Analysis of the 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) Survey of the content and method of information science with emphasis on the application of research findings to general library practice.

5720 Information Systems Analysis and Design (3) Elements involved in the design and operation of information retrieval systems, including acquisition, indexing vocabularies, information representation, file organization, search procedures, and system evaluation.

5730 Information Retrieval Systems Laboratory (3) Comparative capabilities of various types of information retrieval systems; analyzing the performance of systems to arrive at generalizations with respect to the theory, design and operation of IR systems.

5999 Practicum (6 or 9 or 12) An opportunity to translate library theory into practice under the guidance of qualified librarians. Prereq: Completion of the 21-hour core curriculum plus approval of the director.
The Graduate School of Planning offers a two-year graduate course leading to a degree of Master of Science in 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, geography, sociology, and economics. Students in the latter quarters of the first year, and in the second year, 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 an individual thesis or through the thesis 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. Applicants are also encouraged to submit a statement of career goals in support of their application.

Applications will be acknowledged upon receipt. The applications will then be held by and reviewed in the Graduate School of Planning. The applicant should not anticipate an immediate response in regard to admissibility. All applications will be held until mid-April. Recommendations will then be made to the Graduate Office regarding the applicant's admission status. The Graduate School will then notify the applicants whether they have been admitted to the University and under what conditions the admission has been made.

All inquiries concerning admission should be addressed to:

J. A. Spencer, 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 including at least 36 hours at the 5000 level or above.

Each student will be required to demonstrate competence in individual research. This may take either of two forms.

Plan I—Complete a thesis for nine 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 and have completed at least nine 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 will be given a comprehensive written examination after approximately graduation. Approval of the documentation is a prerequisite for graduation. The proposal shall include at least 24 hours of graduate study. The student meeting these criteria may present a proposal for a major study, and have completed at least nine 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.

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:
J. A. Spencer, M.C.P. Ohio State; R. L. Wilson, M.R.P. North Carolina.

Assistant Professors:

Courses

4100 Introduction to Planning (3) History of planning, familiarity with the operations of contemporary planning, the concept of systems, current trends and issues. Emphasis on the relationship among planning and the society in which it occurs.

4200 Planning Communications (1) Graphic, oral and written communication of information and recommendations.

5000 Thesis

5002 Non-Thesis Graduation Completion (3) 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 Theory of Planning (4) Analysis of the means and objectives of the planning process. Emphasis on the role of the planner and the planning function in public decision making. Prereq: 4100.

5130 Planning Research Methods I (3) Research techniques in subject areas associated with city and regional planning. Research tools, data collection, analysis, and report writing as a basis for planning and decision making. Coreq: 4100 or consent of instructor. (Same as Water Resources Development 5150.)

5135 Planning Research Methods II (3) Application of rigorous investigation techniques in solving planning problems, including the use of statistical analysis and mathematical models. Urban and regional information systems as a resource and tool in problem identification and solution. Prereq: 5130.

5160 Planning and Utilities (3) (Same as Environmental Engineering 5160.)

5230 Urban and Site Design (2) Principles of design of small areas such as residential subdivisions, shopping centers, institutional complexes, central business districts. Brief examination of the problems of reviewing alternative designs against each other or written regulations. Extensive laboratory experience. Fees.

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: 5130.

5300 Regional Planning (3) Making the planning process operative in an intergovernmental context. Theories of regions and analysis of metro-planning, area planning, regional planning by states, single-purpose agency planning, and the TVA. Prereq: 5100.

5310 State Planning (3) Evolution of the planning function in state government, with emphasis on the institutional environment in which planning occurs. Context and scope of state planning, and the relationships with other branches and levels of government. Prereq: 5100.


5350 Urban Spatial Structure (2) An examination of present, past, and possible future patterns of urban spatial structure as determined by changing technology, interaction patterns, and socioeconomic environment, drawing on contemporary theories, models, empirical research. Prereq: Consent of instructor.

5360 New Towns (2) Historical development of planned new towns and implications for a national urbanization policy in the United States; the process by which new towns are being created, from the establishment of objectives to the development of administration process and the provision of public services; organizational alternatives for new town planning, development and administration in the context of past experience and future objectives. Prereq: 4100, and consent of instructor.

5380 Housing (2) The nature and the demand for housing in the U.S. and abroad with emphasis on the U.S. experience. The private market processes and public influences. The problems of change in the housing supply, impact of new technology, and governmental programs designed to improve the supply and quality of housing are emphasized. Coreq: 4100 or consent of the instructor.

5410-20-30 Special Topics in Planning (1-3, 1-3) Lecture, group discussion, and individual research and study on specialized topics in planning not covered in depth in other courses. These courses may be repeated for credit. Prereq: Consent of instructor.


5450 Urban Renewal (2) The use of urban renewal as a device for rebuilding the central city. Programming in relation to the general plan and budget. Familiarization with techniques and procedures insofar as is necessary to gain insight into major problem areas. Prereq: 4100.

5500 Synthesis (9) Problem-oriented experience designed to integrate knowledge from previous courses. Interrelationships will be stressed and the student will be required to use judgment in evaluation and creation of plans and policies addressed to real world situations. Extension laboratory experience. Fees. Prereq: 5340.

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, etc.). Prereq: Consent of instructor. (Same as Social Work 5670.)
welfare service organizations must focus on preventive as well as restorative roles. Social work practice experience, and the student must be able to think independently and analytically in order to use the skills and knowledge for purposeful and effective intervention at all societal levels.

THE PROFESSIONAL CURRICULUM

The curriculum offered during the first two quarters of the first year, the Core Curriculum, is required for all students. This Core Curriculum is designed to provide students with knowledge and skills that are common to social work practice at the social treatment and at the administration and planning levels of intervention. The Core Curriculum also provides students in social treatment with knowledge and skill about administration and planning and vice versa. The Core Curriculum is composed of the following units: (1) human behavior and social environment, (2) social welfare policy and services, (3) research, (4) social work practice, (5) field instruction. Human behavior and social environment courses focus on community structure and process, systems theory, culture and ethnicity, role theory, small group theory, personality theory, the family, and social deviance. The social welfare policy and services courses focus on the social work profession's interest in the analysis and formulation of contemporary social policy, and the analysis of organizations that implement policy and deliver services. The research courses focus on methodology as applied to problems in social welfare. Social work practice courses, which may include a skills laboratory, focus on interviewing, formulating objectives, observing and reporting behavior, managing group discussion, and other practice skills. Field instruction is a practicum that provides students with experience in a social welfare agency or program.

At the beginning of the third quarter of the first year, the student selects a specialization—Social Treatment or Administration and Planning. Students are required to take 12 credit-hours in their specialization. Students may take electives in the other specialization. The first-year curriculum is on a concurrent class and field plan, with students participating in the classroom study program two or three days per week and spending two days in field instruction in a social welfare agency.

In the second year, students are involved full-time in classroom courses during the fall quarter, and a block field placement in the winter and spring quarters with at least one concurrent classroom course per quarter. The availability of second-year field placements in social agencies in principal cities in Tennessee and in areas immediately adjacent to the state enables the student to have some choice as to field instruction assignments. The School of Social Work recognizes and accepts the cultural pluralism of society and seeks to prepare the student for practice through the planned inclusion of significant and pertinent racial and ethnic content throughout the curriculum. Such knowledge and its application should provide the student with the educational background to take a creative and objective role in the efforts of the social work profession toward the elimination of racism, poverty, and other social ills.

A special bulletin describing the facilities, admission, fees, and degree requirements is obtainable from The School of

ACCELERATED PROGRAM

The University of Tennessee School of Social Work has a special accelerated program which enables eligible candidates to complete the MSSW degree in twelve consecutive months. This Accelerated Program is approved by the Council on Social Work Education.

Students who qualify for the Accelerated Program must:
1. Have maintained a 3.0 or above grade point average (on a 4.0 scale) in undergraduate work.
2. Have an undergraduate major in social work which included a supervised field practice component, or have two years full-time practice in the field of social work.
3. Pass a qualifying examination administered by the UTSSW faculty.

The twelve-month program begins in June with an intensive ten-week term from which students proceed in the fall into the regular second-year curriculum. Application for admission to the Accelerated Program is through the regular admissions process.

GENERAL REQUIREMENTS FOR ADMISSION

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 falling below the average to be admitted on supplemental evidence of ability to perform at a satisfactory level.
3. Personal qualifications acceptable for entrance into the professional practice of social work.

Preference is given to applicants with a B average in undergraduate work and substantial preparation in the social sciences.

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 course applied toward the degree, except in cases where permission to update courses has been granted.
7. The minimum number of credit hours required for a degree shall be 72 hours including a maximum of 36 S/NC hours.

PART-TIME STUDENTS

Courses in the regular curriculum of the School are open to persons who meet the admission requirements for full-time study and who are planning to complete the work for the degree within the next two or three years. Application should be made to the School in the regular way, but the applicant should inform the Director of Admission of the wish to begin part-time study on a planned basis.

TRANSFER CREDITS

Courses completed in another accredited school of social work are usually accepted for the University of Tennessee School of Social Work degree requirement if the courses meet the admission requirements of the Graduate School and the University of Tennessee School of Social Work, and if previous courses are equivalent to required or elective courses offered here. 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 course work must be completed within the six-year period prior to the receipt of the degree. In addition, Pass/Fail credit earned for the field practicum is also accepted.

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.

The Core Curriculum

The core curriculum is essentially the same for all students.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>5070</td>
<td>Social Work Research I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>5110</td>
<td>Social Welfare Policy and Services I</td>
<td>3</td>
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<tr>
<td></td>
<td>5210</td>
<td>Human Behavior and Social Environment I</td>
<td>3</td>
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<tr>
<td></td>
<td>5410</td>
<td>Social Work Practice I</td>
<td>3</td>
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<tr>
<td></td>
<td>5910</td>
<td>Field Practice</td>
<td>3</td>
</tr>
<tr>
<td>Winter</td>
<td>5080</td>
<td>Social Work Research II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>5120</td>
<td>Social Welfare Policy and Services II</td>
<td>3</td>
</tr>
</tbody>
</table>

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5220 Human Behavior and Social Environment II | 3 |
5420 Social Work Practice II | 3 |
5520 Field Practice | 4 |
TOTAL QUARTER HOURS | 15

The Specialization

The curriculum outlined below for the spring quarter, first year, and for the second year shows typical programs for students after they have completed the Core Curriculum. A student may earn nine hours of elective credit through completion of a Master's thesis.

Spring Quarter, First Year
5390 Field Practice | 4 |
5930 Specialization Courses and Electives | 10 |
TOTAL QUARTER HOURS | 14

Fall Quarter, Second Year
Specialization Courses and Electives | 12 |

Winter Quarter, Second Year
5940 Field Practice | 8 |
5990 Specialization Courses or Electives | 2 or 3 |
TOTAL QUARTER HOURS | 10 or 11

Spring Quarter, Second Year
5950 Field Practice | 8 |
5961 Integrative Seminar | 2 |
One Elective | 2 or 3 |
TOTAL QUARTER HOURS | 12 or 13

AREAS OF SPECIALIZATION

A specialization is a focus within the student's program involving intensive study, through class and field instruction. The University of Tennessee School of Social Work offers specializations in the following areas:

Social Treatment

Social 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 varied individual, family, and group methods applicable in the social treatment of diverse client problems.

Social Work Administration and Planning

Social work administration and planning deals with the design, implementation, and continued operation of effective programs for client service. Specifically, the method deals with assessment of client characteristics, development of environmental resources, design of effective organizational structures, management, staff development, program evaluation, social planning, neighborhood and community development, financing, and coordination of services.

Preparations for Fields of Practice

Within the curricular specializations described above, the School offers opportunities for preparation for careers in fields of social work practice such as the following: corrections, including work with children and adults in courts,
An advanced research course. Topics will include the socio-political and organizational context of research design and methodology appropriate to evaluative research, and the utilization of research findings. Prerequisite: Completion of core or consent of instructor.

5082 Practicum in Social Work Research (3-3) Supervised practice in the application of research methods and tools to a social welfare program. Problems may be generated by the faculty, a social work student, or a social welfare agency or organization. Prerequisite: 5070-80 and consent of the faculty member conducting the investigation. 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 (2-3) Individual study or research on problems of special significance to the student's program, under supervision of the major professor. May be repeated.

5110 Social Welfare Policy and Services I (3) The focus is on the interests of the social work profession in the development and growth of the field in various settings such as mental health clinics, schools, and hospitals; mental health services, work with individuals and groups in mental health programs including comprehensive mental health clinics, rehabilitation services in a variety of settings to individuals with disabilities, social services and treatment modalities. Prerequisite: Completion of core or consent of instructor.

5151 Family and Child Welfare (3) Application of practice theory designed to make social workers better able to deal with clients with sexual problems. Prerequisite: Completion of core or consent of instructor.

5171 Mental Health and Employment (3) Explodes work as a major life task and value, attitudes toward work, patterns of employment, and a view of work as a means to individuation and community, interdependence of individual and organization, meaning of work in a changing society. Prerequisite: 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 social attitudes toward sexual behavior, clinical problems and approaches designed to make social workers better able to deal with clients with sexual problems. Prerequisite: Completion of core or consent of instructor.

5316 Social Policy Analysis (2-3) Field study upon successful completion of this course. Examination of the usefulness of the knowledge and appreciation of every person's humanism. Adaptive and maladaptive response to ordinary and extraordinary life situations and events, as portrayed by creative writers, is considered. The artistic representation of the molding of the human personality and spirit through the interaction of persons with one another and with society are analyzed. Prerequisite: Completion of core or consent of instructor.

5317 Comparative Theories of Personality (2-3) An examination of complex theories of personality during the most relevance for social work practice with the most significant modern theories. Prerequisite: Consent of instructor. Taught at branches only. Available at UTK as Psychology 4510.

5318 Development and Social Deviance (2-3) Deals with theories and recent research into the etiology of social dysfunction and social variance. The categorical approach to social pathology will be examined and differentiated from other approaches to human behavior. Prerequisite: Completion of core or consent of instructor.

5319 Human Behavior and Social Environment (2-3) Deepsens and extends the student's knowledge of the categorical approach to the understanding of the continuum of behavior from optimum social functioning through pathology. Prerequisite: Core or consent of instructor.

5320 Human Behavior and Social Environment (2-3) Deepsens and extends the student's knowledge of the categorical approach to the understanding of the continuum of behavior from optimum social functioning through pathology. Prerequisite: Core or consent of instructor.

5321 Imaginative Perspectives on the Human Condition (2-3) Examination of the usefulness to social work students of prose, drama, and poetry, which may illuminate and expand the knowledge and appreciation of every person's humanism. Adaptive and maladaptive response to ordinary and extraordinary life situations and events, as portrayed by creative writers, is considered. The artistic representation of the molding of the human personality and spirit through the interaction of persons with one another and with society are analyzed. Prerequisite: Completion of core or consent of instructor.

5322 Psychopathology and Social Deviance (2-3) Deals with theories and recent research into the etiology of social dysfunction and social variance. The categorical approach to social pathology will be examined and differentiated from other approaches to human behavior. Prerequisite: Completion of core or consent of instructor.

5323 Deviant Behavior of Children and Youth (2-3) An examination of deviant behavior and conduct disorders in children and youth, the etiology of deviant behavior and the treatment of the individual. Prerequisite: Completion of core or consent of instructor. Taught at branches only. Available at UTK as Sociology 4510.

5324 Comparative Theories of Personality (2-3) Deepsens and extends the student's knowledge of the categorical approach to the understanding of the continuum of behavior from optimum social functioning through pathology. Prerequisite: Consent of instructor. Taught at branches only. Available at UTK as Psychology 4510.

5325 Human Capital Problems (2-3) Desensitization and desensitization of personal and social attitudes toward sexual behavior, clinical problems and approaches designed to make social workers better able to deal with clients with sexual problems. Prerequisite: Completion of core or consent of instructor.

5326 Mental Health and Employment (2-3) Explodes work as a major life task and value, attitudes toward work, patterns of employment, and a view of work as a means to individuation and community, interdependence of individual and organization, meaning of work in a changing society. Prerequisite: Completion of core or consent of instructor. Taught at branches only. Available at UTK as Psychology 4510.

5327 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.

5328 Social Work Practice II (3) Assessment, planning, methodology and skills development fundamental to social work intervention. Combines classroom skills and laboratory experiences.

5329 Family Therapy in Social Work Practice (2-3) Application of practice theory designed to understand and intervene in the family system. Taught at branches only. Available at UTK as Psychology 4510.
5443 Seminar on Behavior Therapy (2-3) Behavior modification methodology as applied to clinical assessment, choice of designs to assess treatment interventions, skill in evaluating data on effectiveness of treatment interventions. May be repeated. Maximum 6 hrs. Prereq: Completion of core or consent of instructor.

5444 Social Work Practice with the Poor (2-3) Examines some of the problems, issues, and dilemmas as practice in social work with the poor and considers the attributes of service-delivery systems which make that practice possible. Prereq: Completion of core or consent of instructor.

5660 Social Work Practice with Groups (3) Focuses on the development of knowledge and skill in the use of group methods in social work practice with emphasis on organizing and managing the group, structuring group tasks and experiences, understanding and enhancing group functioning, enabling problem-solving effectiveness, and evaluating individual change and group effectiveness. Prereq: Completion of core or consent of instructor.

5661 Interpersonal Skill Development (2-3) A training group is employed to enhance interpersonal competence in the application of human relations skills in social work practice. Prereq: Completion of core or consent of instructor.

5570 Contemporary Treatment Modalities: Individual and Family (2-3) Well-established and developing treatment modalities are examined in terms of their essential concepts. Emphasis on differential facets and theory-based linkages. Prereq: Completion of core or consent of instructor.

5571 Administrative Practice in Social Welfare (2-3) Introduction to the role of social welfare professional as it relates to social work purpose and values and the development of administrative principles that make for the effective provision of welfare services.

5702 Organizational Design of Social Welfare Agencies (2-3) Critical 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 personnel for maximum effectiveness and efficiency. Emphasis on integration of theory and experience in development of practical skills for coping with a variety of situations. Prereq: Second-year administration or community organization students, or consent of instructor; Social Work 5761 or equivalent.

5741 Supervision in Social Work (2-3) Dual roles of the supervisor in various settings, and supervision will be distinguished from direct supervision and from consultation and from direct practice. Types of consultation considered in relation to various settings and levels of responsibility to be practiced. Prereq: Second-year status or consent of instructor.

5742 Consultation in Social Work (2-3) Constellation of roles, relationships, and behaviors required of a consultant. Consultation as distinguished from supervision, administration, and direct practice. Types of consultation considered in relation to various settings and levels of responsibility to be practiced. Prereq: Second-year status or consent of instructor.

5743 Management of Human Resources in Social Welfare (2-3) Examination of the personnel function in administration of human services programs and agencies. Topics include 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) Examines philosophies and practices of teaching and learning as they relate to adult learning and to welfare education. Topics include: distinctions between teaching and training; education; unique aspects of welfare education; models and styles of education. Prereq: Completion of core or consent of instructor.

5745 Professional Leadership in Social Work (2-3) Examination of leadership in social welfare. Consideration is given to various theories of leadership: the 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.

5761 Social Welfare Administration and Planning (3) An initial sequence course in social welfare administration and planning which examines organizational roles 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) Designed to assist students in acquiring specific administrative and planning techniques appropriate for social welfare delivery. Prereq: Completion of core or consent of instructor.

5771 Information Systems and Decision Making (2-3) Explores decision making in human services organizations, the utilization of information in policy formulation, delivery of services, and evaluation of performance. Information generation, collection, processing, storage, retrieval, and utilization as considered in relation to management control, evaluation and forecasting. Prereq: Completion of core or consent of instructor.

5772 Financial Management for Social Welfare Administration (2-3) Focuses on centralized decision making related to the allocation of scarce resources in social services organizations. Technical aids to budgetary choices and other aspects of financial management will be examined for the utility, parsimony, and feasibility. Prereq: Completion of core or consent of instructor.

5800 Management of Residential Settings (2-3) Legal and ethical issues related to personal management and programming in residential institutions for children, the aged, mentally ill, mentally retarded, juvenile and adult offenders, and other groups. Prereq: Completion of core or consent of instructor.

5812 Organizational Perspectives to Juvenile Justice (2-3) Aspects of the Juvenile Justice System: overview of juvenile delinquency, introduction to the operation of the various branches of police in detecting delinquency and apprehension of delinquent offenders, police procedures, roles of the juvenile court, various in 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 the individual, the family, and the 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 the social, cultural, medical, and psychological factors underlying alcoholism and drug abuse, recent research and treatment innovations, social work with the user and the family. Prereq: Completion of core or consent of instructor.

5826 Social Work Treatment for Marital Adjustment (2-3) Focuses on theories regarding social and cultural values and personality patterns that influence attitudes toward marriage, conceptual approaches 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 management and programing in residential institutions for children, the aged, mentally ill, mentally retarded, juvenile and adult offenders, and other groups. Prereq: Completion of core or consent of instructor.

5860 Social Gerontology (2-3) Physical, psychological, and social aspects of aging; economic and health status of the aging; the role of the family; community programs for aging; retirement—phenomenon of modern society.

5865 The Roles of Women (2-3) Roles and statuses of women, with the emphasis on the contemporary American scene. Includes a study of empirical research as well as the popular literature. Ascribed and achieved facets of women's statuses are explored.

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; 5910 concurrently or prior to 5920; 5910 is a prerequisite. 5920. Required course. S/NC only.
5930-40-50  Field Practice (4, 8, 8) Specialized instruction and supervised practice in methods of social work treatment, administration, and planning in community health and welfare programs and agencies. Prereq: Admission to the school. To be taken in sequence. S/NC only.

5961 Integrative Seminar (3) Required seminar facilitates integration of the two year MSSW program; attention is given to current issues in the profession and to pressing social problems. Student participation in symposia, discussions, simulations, and gaming situations prepares the graduating student to assume positions of responsibility and leadership within the profession. The graduating student is helped 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 appraisal 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.

5980 Practicum in Governmental Social Welfare Policy Making (2-3) Practical introduction to the process of legislative and/or administrative policy making at the state or local governmental level, through assignment of students to the offices of elected or appointed proximate policy makers. Limited social welfare policy research activities. Seminar used to present normative and descriptive theory about the policy-making process, and models of policy analysis. May be repeated. Prereq: Social Work 5110 and consent of instructor.
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