The University of Tennessee, Knoxville does not discriminate on the basis of race, sex, color, religion, national origin, age, handicap, or veteran status in provision of educational opportunities and benefits.

UTK does not discriminate on the basis of sex or handicap in the education programs and activities which it operates, pursuant to the requirements of Title IX of the Education Amendments of 1972, Pub. L. 92-318; and Section 504 of the Rehabilitation Act of 1973, Pub. L. 93-112; respectively.

Inquiries concerning Title IX and Section 504 should be directed to the Office of the Director for Affirmative Action, 405E Andy Holt Tower, Knoxville, TN 37996-0144, phone: 974-2498. Charges of violation of the above policy should also be directed to the Office of the Director of Affirmative Action.
### AGRICULTURAL CAMPUS

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### The University of Tennessee

#### Board of Trustees

**Ex Officio Members**
- The Governor of Tennessee
- The Commissioner of Education
- The Commissioner of Agriculture
- The President of the University
- The Executive Director, Tennessee Higher Education Commission

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**Student Member**

Tina Lobetti

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<td>Edward J. Boling</td>
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**From Davidson County**

Michael Graves

June 1, 1993

**From Hamilton County**

Paul J. Kinser

June 1, 1987

**From Knox County**

Ann Baker Furrow

June 1, 1989

James A. Haslam, III

June 1, 1989

**From Shelby County**

Sam Cooper

June 1, 1990

Jack Craddock

June 1, 1990

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Phil A. Scheurer, B.A., M.S., Vice Chancellor for Student Affairs

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Joseph P. Goddard, B.S., M.S., Ph.D., Dean of the Division of Continuing Education

Gerald D. Bowker, B.A., M.A., Dean of Admissions (Undergraduate) and Records

Kenneth E. Harwell, B.S., M.S., Ph.D., Dean of the UT Space Institute

Raymond Popp, B.S., M.A., Ph.D., Acting Director of the UT-Oak Ridge Graduate School of Biomedical Sciences

Ann E. Prentice, B.A., M.L.S., D.L.S., Director of the Graduate School of Library and Information Science

James A. Spencer, B.A., M.C.P., Director of the Graduate School of Planning
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University Calendar for 1987-88

**Fall Quarter, 1987**
- September 20 (Sunday) Graduate Student Orientation
- September 21-23 (Monday-Wednesday) Registration
- September 24 (Thursday) Classes Begin
- October 28 (Wednesday) Change of Registration Deadline
- November 14 (Saturday) Homecoming (No Classes)
- November 26-28 (Thursday-Saturday) Thanksgiving (No Classes)
- December 3 (Thursday) Classes End
- December 5-9 (Saturday-Wednesday) Final Evaluation Period
- December 11 (Friday) Commencement

**Winter Quarter, 1988**
- January 4-5 (Monday-Tuesday) Registration
- January 6 (Wednesday) Classes Begin
- January 18 (Monday) Martin Luther King's Birthday (No Classes)
- February 9 (Tuesday) Change of Registration Deadline
- March 9-12 (Wednesday-Saturday) Classes End
- March 15 (Tuesday) Final Evaluation Period
- March 17 (Thursday) Commencement

**Spring Quarter, 1988**
- March 21-22 (Monday-Tuesday) Registration
- March 23 (Wednesday) Classes Begin
- April 1-2 (Friday-Saturday) No Classes
- April 26 (Tuesday) Change of Registration Deadline
- May 25-26 (Wednesday-Saturday) Classes End
- June 1 (Wednesday) Final Evaluation Period
- June 11 (Wednesday) Commencement

**Summer Quarter, 1988**
- June 7-8 (Tuesday-Wednesday) Registration, First or All Terms
- June 9 (Thursday) Classes Begin
- June 23 (Thursday) Independence Day (No Classes)
- July 6-8 (Wednesday-Friday) Change of Registration Deadline, First Term
- July 11 (Monday) Registration, Second Term
- July 11 (Monday) Classes End, First Term
- July 12 (Tuesday) Change of Registration Deadline, Full Term
- July 26 (Tuesday) Classes Begin, Second Term
- August 10 (Wednesday) Change of Registration Deadline, Second Term
- August 12 (Friday) Classes End
- August 12 (Friday) Commencement

**NOTE:** Deadlines for degree requirements on pp. 23-24.

**NOTICE:** Beginning in the fall of 1988, the University of Tennessee, Knoxville's academic programs will be conducted under a semester calendar. Students entering under this catalog, or previous quarter calendar catalogs, will not graduate under the same curricula. However, the University is committed to intensive academic advising such that no student's program will be delayed due to the change to the semester calendar.
University Calendar for 1988-89

Fall Semester 1988
- August 21 (Sunday)
- August 24 (Wednesday)
- September 5 (Monday)
- November 24-25 (Thursday-Friday)
- December 6 (Tuesday)
- December 7-8 (Wednesday-Thursday)
- December 9-14 (Friday-Wednesday)
- December 16 (Friday)

Spring Semester 1989
- January 11 (Wednesday)
- January 16 (Monday)
- March 20-24 (Monday-Friday)
- May 1 (Monday)
- May 2-3 (Tuesday-Wednesday)
- May 4-9 (Thursday-Tuesday)
- May 12 (Friday)

Summer Term 1989
- May 17 (Wednesday)
- June 27 (Tuesday)
- June 28 (Wednesday)
- July 4 (Tuesday)
- August 9 (Wednesday)
- August 11 (Friday)

Graduate Student Orientation
Classes Begin
Labor Day (No Classes)
Thanksgiving (No Classes)
Classes End
Study Period
Final Exams
Commencement
Classes Begin
First Session Ends
Second Session Begins
Independence Day (No Classes)
Second Session Ends
Commencement

Note: Deadlines for degree requirements on pp. 23-24.
## Majors and Degree Programs

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*Non-degree and provisional students must obtain permission from the department/program head to register for courses in these fields.

All documents required for admission are submitted to the Office of Graduate Admissions & Records unless noted otherwise.

a International applicants only.
b American applicants only.
c G.S. Rating Form submitted to Department.
d Forms obtained from & returned to Department.
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C.W. Minkel, B.A., M.A., Ph.D., Vice Provost and Dean of The Graduate School
Linda R. Painter, B.S., M.S., Ph.D., Assistant Dean of The Graduate School
Wayne T. Davis, B.S., M.S., Ph.D., Assistant Dean of The Graduate School
Diana C. Lopez, B.S., M.S., Director, Graduate Admissions and Records
Rose Ann Trantham, Assistant Director, Graduate Admissions and Records
S. Kay Reed, B.S., M.S., M.A., Ph.D., Graduate Recruitment Coordinator
Ann L. Lacava, Thesis/Dissertation Coordinator
Richard Roberts, B.S., Ph.D., Associate Dean, UT Space Institute
Marvin Goodman, B.S., M.S., Director, Kingsport Graduate Program
Jerry D. Westbrook, B.E., M.S., Ph.D., Director, Nashville Graduate Engineering Program

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Membership June 1, 1987

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Max Wortman, Chairman of the Research Council
Kermit Duckett, College of Human Ecology
Mildred Fenske, College of Nursing

Elected Members

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GRADUATE STUDY
Rules, policies, fees, and courses described in this catalog are subject to change without notice.
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Wayne T. Davis, Assistant Dean of The Graduate School
Linda R. Painter, Assistant Dean of The Graduate School
Diana Lopez, Director, Graduate Admissions and Records
Rose Ann Trantham, Assistant Director, Graduate Admissions and Records
S. Kay Reed, Graduate Recruitment Coordinator
Ann L. Lacava, Thesis/Dissertation Coordinator

The University of Tennessee, Knoxville, is the official land-grant institution for the State of Tennessee. It is a comprehensive institution offering a wide range of graduate programs leading to the Master’s and doctoral degrees. The University offers Master’s programs in 93 fields and doctoral work in 52. Approximately 6,700 graduate students are enrolled both on and off campus. Administration of graduate student policies and procedures, and associated record keeping is the responsibility of the Dean of The Graduate School. Much of the day-to-day administration of graduate study is conducted by department heads or faculty advisors and committees responsible for particular programs. In addition to departmental units, numerous interdisciplinary programs, institutes, and centers have been developed on campus and in locations throughout the state.

The Graduate School brings together faculty and graduate students as a community of scholars with a common interest in creative work and advanced study. Programs are available to students desiring work toward the Master’s and doctoral degrees or professional certification, those interested in continuing education for updating and broadening knowledge, and those pursuing postdoctoral research. Traditionally, universities have provided graduate programs primarily for full-time, degree-oriented students. Serving the needs of students engaged full-time in intensive study and pursuit of a degree continues to be a major emphasis of UTK’s graduate effort. At the same time, the University employs a variety of modes, traditional and non-traditional, in offering quality programs designed to serve students.

The policies of The Graduate School are developed by the Graduate Council, a body composed of elected representatives from each college, the Space Institute, and the Graduate Student Association. Ex-officio members include the Dean, Assistant Deans of The Graduate School, the Chair of the Research Council, the Director of Libraries, the Dean of Continuing Education, and the administrative officer having primary responsibility for graduate curriculum in each college or school. The Graduate Office develops procedures to carry out the policies formulated by the Council, and has primary responsibility for Graduate School admissions and records.

Admission and Registration

Admission to The Graduate School requires a Bachelor’s degree with a satisfactory grade point average from a college or university accredited by the appropriate regional accrediting agency. Admission to The Graduate School does not ensure acceptance into a specific degree program nor admission to candidacy for the degree desired.

When a student is admitted to The Graduate School prior to having received the baccalaureate degree, that degree must be awarded before the date of first registration in The Graduate School. If a student does not enroll within one year after the requested admission, the application process must be repeated.

Types of Admissions

To earn graduate credit, a student must be enrolled in one of the categories listed below. Course work taken in any other status is unacceptable for graduate credit and cannot be changed to graduate credit.

ADMISSION TO A GRADUATE DEGREE PROGRAM

Admission to a degree program requires a minimum grade point average of 2.5 out of a possible 4.0, or a 3.0 during the senior year of undergraduate study. However, many departments require a higher average. The equivalent of a minimum B average is required for international students. The graduate application, a $15 fee, and one (1) official transcript from each institution previously attended are required for consideration as a potential degree candidate.

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 graduate studies, achievement on admission tests for graduate studies, letters of recommendation from professors familiar with the applicant’s capabilities, and other evidence of scholarly achievement.

Refer to pages 8-9 and to descriptions of programs for specific requirements for admission.

NON-DEGREE ADMISSION

Applicants may apply for non-degree status who, for example:
1. do not desire to pursue a degree program; or
2. need additional time to fulfill application requirements for a degree program.

There is no specific limit on the number of courses that a student may take in non-degree status. However, before accumulating 15 hours of graduate course work in this status, the student must either:
1. apply and be admitted to a specific degree program (see Change of Program, p. 20, for instructions); or
2. file a Plan of Study form with the Office.
of Graduate Admissions and Records for approval to continue taking courses in non-degree status. The plan of study must include a stated educational objective and a list of courses proposed to achieve that objective.

A maximum of 15 graduate hours taken before acceptance into a degree program may be applied toward a graduate degree, if approved by the student's committee. Courses applied toward any graduate degree must fall within the time limit specified for the degree.

The graduate application, a $15 application fee, and one (1) official transcript from each institution previously attended are required for consideration as a non-degree student. The minimum requirements are a Bachelor's degree with a 2.5 grade point average on a 4.0 scale (or a 3.0 the senior year) from a college or university accredited by the appropriate regional accrediting agency. A major area need not be declared, but some departments do not permit non-degree students to register for graduate courses (see pages 8-9 for information on restricted programs).

Every graduate student must meet an academic advisor at least once a semester to discuss his/her program. For students with a declared major, the advisor must be from the appropriate academic unit. If no advisor has been assigned, the department head or designee is the advisor. For a non-degree student who has no declared major, the Assistant Dean of The Graduate School or designee is the advisor. Admission to non-degree status does not assure admission to a degree program. The student who seeks to enter a degree program will be directed to the appropriate department. Students must maintain a 3.0 grade point average to continue enrollment in non-degree status (see Academic Standards).

An international student on a non-immigrant visa may not enroll in the non-degree status.

PROVISIONAL ADMISSION

Applicants may be admitted as provisional students for one semester (or for one course in each of two semesters) who, for example:

1. do not meet the minimum grade point average requirements; or
2. wish to register for graduate courses while meeting any additional requirements for non-degree admission; or
3. desire graduate credit for a limited number of courses (one semester only).

The graduate application, a $15 application fee, and proof of a Bachelor's degree from a college or university accredited by the appropriate regional accrediting agency are required. Copies of official proof are acceptable. A major area need not be declared, but some departments do not permit provisional students to register for graduate courses (see pages 8-9 for information on restricted programs).

Every graduate student must meet with an academic advisor at least once a semester to discuss his/her program. For students with a declared major, the advisor must be from the appropriate academic unit. If no advisor has been assigned, the department head or designee is the advisor. For a provisional student who has no declared major, the Assistant Dean of The Graduate School or designee is the advisor.

Any student admitted to the provisional status who has exceeded six hours of graduate credit must receive permission from The Graduate School to register for a second or succeeding semester if admission to the non-degree or degree status has not been obtained. To be admitted to the non-degree or degree status, the student must earn at least a 3.0 grade point average in all course work (graduate and undergraduate) taken in provisional status, to include at least six hours of graduate work. Provisional students failing to meet this requirement will be denied registration.

The Office of Graduate Admissions and Records will process the change to non-degree status if all requirements are met. To apply for a specific degree program, the student must submit the Request for Change of Graduate Program form to the Office of Graduate Admissions and Records.

Provisional admission does not assure admission to a non-degree or degree program. A student who hopes to enter a degree program will be directed to the appropriate department.

The student who fails to complete provisional admission within seven weeks after registration will NOT be permitted to register again NOR receive a copy of the transcripts showing the course work taken, until all admission requirements are met.

An international student on a non-immigrant visa may not enroll in the provisional status.

INTERNATIONAL STUDENT ADMISSION

The Graduate School accepts only students who have superior records. An international student must have an equivalent Bachelor's degree with at least a B average on undergraduate course work and a B+ average on the Graduate Record. On various grading scales, this would indicate:

a. 3.0 and 3.5 on 4.0 scale;

b. 14 and 15 on 20 point scale;

c. 80.0 from Chinese institutions;

d. 1st Class or Division from Indian institutions;

e. Upper 2nd Class Honors on various British systems.

Other grading systems will be evaluated upon receipt of transcripts. An international student may apply for admission any semester, but normally enters the summer or fall semester. Deadlines for submission of applications are:

Fall: March 1
Spring: July 15
Summer: Nov. 15

The Office of Graduate Admissions and Records must be notified of any change in entering date after admission has been granted. Individual departments and colleges may have further restrictions on admission dates. For this information, students should contact the department whose program they wish to enter.

The following items must be received before admission will be considered:

1. A completed application form with a $15 non-refundable processing fee.
2. Official or attested university records, with certified translations if the records are not in English (Notarized copies are not acceptable).

Every student whose native language is not English must either submit a score of 525 or above on the Test of English as a Foreign Language (TOEFL) taken within the past two years or have received a degree from an accredited U.S. institution.

4. Documented evidence of financial resources sufficient to support the student as stated on the financial statement form supplied to the applicant.

5. Results of the Graduate Record Examination (GRE) or Graduate Management Admission Test (GMAT), if required. (See pages 8-9.)

Letters of recommendation or rating forms, if required. (See pages 8-9.)

Admission must be granted and financial documentation and degree confirmation must be received prior to the close of an I-20 or IAP-66 form needed to obtain a visa. The Graduate School will not issue these forms after the following dates:

Fall: June 15
Spring: Nov. 15
Summer: March 15

The University will not enroll any student who has not been approved initially or for transfer by the Immigration and Naturalization Services (INS) to attend UTK.

An international student may not enroll as a provisional or non-degree student.

All students whose native language is not English must take an English proficiency examination after arrival at UTK. Refer to section on English Proficiency, page 19.

TRANSIENT GRADUATE STUDENT ADMISSION

A student who has been enrolled in a graduate degree program at another institution and who wishes to take courses for transfer to that institution may be admitted after submitting a completed Graduate Application for Admission, the $15 application fee, and a Transient Student Certification 10 days prior to registration. Only one semester, or a maximum of 12 hours, of course work can be taken in transient status. Necessary forms may be obtained from the Office of Graduate Admissions and Records.

ELIGIBILITY OF SENIORS

Subject to approval by The Graduate School, a senior at UTK who needs fewer than 30 semester hours to complete the requirements for a Bachelor's degree and has at least a B average (3.0) may enroll in graduate courses for graduate credit provided the combined total of undergraduate and graduate course work does not exceed 15 credit hours per semester. Approval must be obtained each semester at the Office of Graduate Admissions and Records during registration. A maximum of 15 hours of graduate credit can be obtained in this status.

ENROLLMENT OF VETERINARY MEDICINE STUDENTS IN GRADUATE COURSES

A student in good standing in the College of Veterinary Medicine may enroll in UTK graduate courses without being admitted to The Graduate School under the following conditions:

1. The student's advisor must approve in advance the student's enrollment in each course.
2. The student may take a maximum of 10 semester hours of graduate courses during the D.V.M. program.
3. Approval must be obtained each
semester at registration through the Office of Graduate Admissions and Records. The student's progress is subject to review and approval each semester by the Associate Dean, College of Veterinary Medicine.

ADMISSION OF FACULTY MEMBERS
Faculty members of UTK or the Institute of Agriculture at the rank of assistant professor or above, and employees of the administrative staff at UTK, the UT Central Administration, and the Institute of Agriculture will not normally be admitted to candidacy for a doctoral degree at UTK. Exceptions may be granted on an individual basis. Further information is provided in the Faculty Handbook. Possible conflict of interest will be a major factor considered in the review of an application. Requests should be directed to the Dean of The Graduate School.

Admission Procedures
Anyone with a Bachelor's degree from a regionally accredited institution wishing to take courses for graduate credit, whether or not the person desires to become a candidate for a degree, must make formal application for admission to The Graduate School or apply for transient status. No action is taken until a file is completed. The applicant will be notified by mail of the action taken.

To apply for admission the following materials must be sent to The Graduate School:
1. The completed Graduate Application for Admission (inside front cover of Graduate Catalog).
2. A $15 non-refundable application fee.
3. One official transcript from all colleges and universities attended.
4. Reference letters or rating forms (pages 8-9). Forms obtained from the college or department should be returned to the same source.
5. Scores from examinations which may be required for admission. Graduate programs which require scores from the Graduate Record Examination or the Graduate Management Test are shown on pages 8-9. The TOEFL is required of all students whose native language is not English, unless they have graduated from a regionally accredited U.S. Institution.

Application forms for the above tests can be obtained by writing:
Educational Testing Service
Princeton, NJ 08450

UTK is an approved testing center for all examinations. Examination results reach the University in approximately six weeks.

The student who fails to gain admission within seven weeks after registration will not be permitted to register again until all admission requirements are met.

All of the above documents become the property of the University and will not be returned. For international graduate student admission procedures, see International Student Admission (page 14).

Readmission
A student who has not attended The Graduate School at UTK for more than three semesters (including summer) must apply for readmission. A readmission application should be submitted to the Office of Graduate Admissions and Records at least two weeks prior to the desired reentry date. A student who has attended another institution since enrollment at UTK must submit one official transcript showing all course work and any degrees earned at that institution. The student will be notified when action has been taken by its department/program and The Graduate School. A student who is permitted to enroll and is subsequently denied readmission will receive credit for courses completed successfully. Future registration will not be allowed until readmission is granted.

Registration Procedures
Registration is required of all graduate students when using University facilities and/or faculty time. The minimum number of hours for registration is 3. Registration allows use of services such as library checkout, laboratories, and recreation facilities not open to the public. Dates of registration are listed in the University Calendar (front of Catalog). To register, students should:
1. Report to the Office of Graduate Admissions and Records to obtain registration materials (scan form and Timetable of Classes).
2. Confer with an advisor assigned by the department to obtain approval of a schedule of courses, if not done previously.
3. Sign the scan form certifying approval of the advisor and return it to the Office of Graduate Admissions and Records or alternate location designated in Timetable.
4. Consult Timetable to complete registration.

Non-degree or provisional students in unrestricted programs (see pages 8-9) may obtain permission to register from the Office of Graduate Admissions and Records. Students in these categories with no declared major must obtain permission from the department/program head to register for courses in restricted fields.

A preregistration period is scheduled each semester for a subsequent semester (see University Calendar). Any graduate student who has applied for admission can preregister. Information can be obtained from the Office of Graduate Admissions and Records. A late fee of $10.00 is assessed to any student in attendance at the University who fails to preregister for the following semester(s). A student who participates in preregistration should obtain the computerized class schedule and pay fees on the first day of registration.

Failure to pay tuition and fees before the deadline listed each semester in the Timetable of Classes will result in the assessment of a late registration fee. Retroactive registration is not permitted.

Family Educational Rights and Privacy Act
The Family Educational Rights and Privacy Act provides for confidentiality of student records. However, it also provides for basic identification of persons at UTK without the consent of the individual. Release of information to third parties includes directory information such as contained in the campus telephone book and sports brochures. Such information may include name, address, telephone number, date and place of birth, major, dates of attendance, degrees and awards, the most recent previous educational or institutional attended, participation in school activities and sports, and weight and height (for special activities).

Notice of the categories to be contained in a publication will be given in advance. A period of one week is provided during which a student may request that such information not be released.

Student Identification Number
UTK requires assignment of an individual student number for internal identification of each student's record. The University began using the social security number as the student identification number prior to 1 January 1975; therefore, federal law allows continued use of this number. However, if a student does not desire to use the social security number, notification to the University must be made at the time of application for admission. A student identification number will then be assigned instead. For prompt and accurate retrieval of records and for conducting business about their own records, students and alumni must give their student identification number. Student identification numbers, whether social security numbers or assigned numbers, are used administratively within the University only and are not given to third parties without expressed consent of the student.

Fees, Residency Classification, and Financial Aid
University Fees
University fees are determined by the Board of Trustees and are subject to change without notice. The general fees in effect for graduate students are as follows:

APPLICATION FEE ...........................................$15
Each graduate application for admission must be accompanied by a non-refundable fee of $15 before it will be processed (fee not required if: (1) former UTK graduate student; or (2) previously paid to UTK Graduate School within past 12 months).

If a student applies but does not enter graduate school within twelve months after date of requested admission, the file will be destroyed and it will be necessary to resubmit the $15 application fee and a new application. This fee is not refundable.

MAINTENANCE FEE (in-state students) ..............$755
PER SEMESTER ..............................................$755
TUITION (out-of-state students) ..................$2,057
PER SEMESTER ..............................................$2,057
NOTE: In lieu of the above charge for tuition
and/or maintenance fee, part-time students may elect to pay fees computed by the semester hour credit (or audit) as follows:

**In-State**
- $110 per semester hour or fraction thereof; minimum charge $330.

**Out-of-State**
- $239 per semester hour or fraction thereof; minimum charge $717.

**UNIVERSITY PROGRAMS AND SERVICES FEE**

| PER SEMESTER | $98 |

The fee for the summer semester is $78. Part-time students taking fewer than nine semester hours will be assessed at the rate of $6 per semester hour or fraction thereof; minimum charge $12.

Graduate, teaching, and research assistants, teaching associates, and fellowship students, who may have waivers of fees (tuition and/or maintenance), must pay the appropriate University Programs and Services Fee.

Knoxville campus students taking a course load of 6-8 hours may elect to pay the full programs and services fee.

Knoxville campus day students taking a course load of 3-8 hours may elect to pay the student health fee, plus the appropriate part-time programs and services fee. The student health fee is included in the full $98 programs and services fee.

The University programs and services 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 date scheduled for this purpose will be charged a late registration fee of $2 up to $70. See the University Undergraduate Catalog for application of this fee. Doctoral students who must register retroactively for dissertation credit will be charged a late fee of $35 for each semester of retroactive registration. The payment of fees with a check which is not honored by the bank will incur a service charge of $10 to $45, depending on the day the check is redeemed.

**MUSIC FEE**

- One half-hour lesson per week: $45 per semester
- One-hour lesson per week: $90 per semester
Payable at registration by students receiving individual instruction in music.

**GRADUATION FEE**

- Masters degree candidates: $30
- Doctoral degree candidates: $70
- Doctoral hood rental (optional): $5

There are no additional charges for diploma, binding, or microfilming. The graduation fee is non-refundable and is valid for two semesters after the semester in which it is paid.

**PROFICIENCY FEES**

Fees for proficiency examinations are $22 per credit hour for graduate students. See page 19 for other information on proficiency examinations.

**TUITION PAYMENT PLANS**

All student fees are due in advance and should be paid in full at registration each semester.

**Prepayment Plan**

A prepayment plan has been developed to assist students with planning and budgeting their academic year expenses. Under the plan, students may choose the expenses they wish to prepay including room, board, tuition, and fees. Expenses can be prepaid over a period of eight months. Students and/or parents wishing to participate in the prepayment plan should contact the Bursar's Office for details.

**Deferred Payment Policy**

Although fees, rent, and University expenses are due and payable at the beginning of each semester, a full-time student in good financial standing with the University may request a deferment of up to 30% of the total charges for a period of up to four weeks from the first day of registration. All financial aid monies must be applied to fees before a deferment will be considered. For more details, contact the Bursar's Office.

**Room and Board Payment Plan**

Semester room and board charges may be paid in monthly installments. The first month's rent plus a deposit of one month's rent is due at registration. The remaining installments are due every four weeks. For more information and an application, contact the Bursar's Office.

**DEFERRED PAYMENT SERVICE FEE**

$10 (See Tuition Payment Plans)

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) is not paid within five regular business days after the date it was incurred.

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

**FEES FOR COURSES NOT TAKEN FOR CREDIT**

Fees for courses audited are the same as for courses taken for credit. For fee purposes, courses listed for 0 credit hours are considered as one-hour courses.

**REFUND OF FEES FOR WITHDRAWAL**

Once a schedule has been received by the student, withdrawal for the semester must be by official notification to the Withdrawal Office, 212 Student Services Building, whether or not fees have been paid, classes have been attended, or the schedule is incomplete. Failure to attend class does not automatically withdraw or drop a student from college or class.

The effective date of withdrawal is the date the Withdrawal Office is notified by completion of the official withdrawal request form. The appropriate percentage of fees will be charged unless this action is completed by the close of the last day designated for regular registration and before the first official day of class. Failure to notify the Withdrawal Office promptly when withdrawing could result in a larger fee assessment. Withdrawal does not cancel fees and charges already incurred.

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

For a regular academic semester, withdrawal within 7 calendar days beginning with the first day of regular registration permits a 90 percent fee refund. Withdrawal between 8 and 14 calendar days following regular registration permits a 70 percent fee refund. Withdrawal between 15 and 21 calendar days following regular registration permits a 50 percent fee refund. Withdrawal between 22 and 28 calendar days following regular registration permits a 30 percent fee refund. The above withdrawal refund policy does not apply to the off-campus Graduate Centers. Refunds, in accordance with the withdrawal refund policy, will be made after the drop deadline.

Part-time students may pay fees computed at the appropriate semester-hour rate as indicated above. No charge is made for courses dropped during the first 5 calendar days following regular registration. A 40 percent charge is made for courses dropped between 6 and 21 calendar days following regular registration, and a 100 percent charge is made for courses dropped after 21 days. Students who drop courses are eligible for a refund only if the sum of the charges computed at the semester-hour rate for the hours continued plus the percentage assessed for the hours dropped results in an amount less than that paid. A course on a student's schedule is officially dropped, and the drop becomes effective, on the date that the change of registration form is processed on a drop/add terminal. Any refund due for dropped courses will be made after the final audit at the end of the semester. Rental charges and adjustments will be determined by the Office of Residence Halls in accordance with the terms of the housing agreement or contract.

**SUMMER SEMESTER FEES AND EXPENSES**

Fees and expenses for the summer semester are the same as for other semesters during the academic year with the exception of the University programs and services fees as noted above.

Although the summer semester is divided into terms of varying lengths, tuition and fees are assessed at the regular semester-hour rate up to the maximum charge for a complete regular semester.

The refund policy covering withdrawals and dropped courses for the summer semester is based on the length of the term for the course(s) dropped. No refund is applicable to terms courses dropped later than 14 calendar days after the regular registration day for the course(s) involved.

**WAIVER OF FEES**

Graduate assistants, teaching assistants and associates, research assistants, and others whose fees are billed, prepaid, waived, or partially waived must complete their registration with the Bursar's Office, where they should have their fee receipts validated and supply necessary details concerning fee payment waiver. Fee receipts must be validated before classes begin to avoid late registration fees.

**NOTE:** All fees are subject to change. All charges and refunds will be made to the nearest dollar. All charges are subject to subsequent audit and verification. The Uni-
Residency Classification for Tuition Purposes

When a prospective student applies to The Graduate School, he/she is notified of residency classification (in-state or out-of-state) for tuition purposes. Classification is based on information supplied on the Graduate Application for Admission. A student cannot acquire in-state residency status on the basis of full-time enrollment at a higher educational institution in Tennessee. Proof of in-state residence is the responsibility of the individual.

A student who is classified out-of-state and (1) works full-time in the state or at Fort Campbell, Kentucky, and (2) desires to attend UTK on a part-time basis (maximum 6 hours of course work per semester), is eligible for a waiver of out-of-state tuition. The student must apply for a waiver prior to the date of registration each semester. Forms are available from the Residency Clerk in the Office of Graduate Admissions and Records.

Academic Common Market

The Academic Common Market is an interstate agreement among Southern states for sharing unique programs. Participating states can make arrangements for their residents who are fully admitted to specific programs at UTK on an in-state tuition basis where these programs are not available in the state of residence.

Cooperating states in the Academic Common Market are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, South Carolina, Tennessee, Texas, Virginia, and West Virginia. Twenty doctoral, one Specialist in Public Administration, and twenty-five Master's programs at UTK are approved by the Academic Common Market for students of these states to enroll in at-state tuition rates.

Residents of member states who seek further information should contact the Residency Clerk in the Office of Graduate Admissions and Records or the Southern Regional Educational Board in Macon, Georgia.

Financial Aid

UTK offers several types of financial assistance for which graduate students may apply.

ASSISTANTSHIPS AND FELLOWSHIPS
Graduate assistantships, scholarships, and traineeships are offered through many departments. Information concerning these types of assistance can be obtained from the department in which the student plans to study.

The Hilton A. Smith Graduate Fellowships and The National Alumni Association Graduate Fellowships for full-time study at UTK are awarded on the basis of scholarly performance as evidenced by grades and faculty recommendations. Candidates from any field of study are invited to apply if they have a 3.6 grade point average or above in all previous academic work. The fellowships include monthly stipends, tuition, and maintenance fees. Application packets are available from the Office of Graduate Admissions and Records in November. Completed applications, including all supporting materials, must be submitted to the Assistant, Office of Graduate Admissions and Records, by February 15. Offers of awards are announced by March 15.

EMPLOYMENT
Three sources of student employment are coordinated by the Financial Aid Office: (1) The federally-sponsored College Work-Study Program provides part-time jobs for U.S. citizens or permanent residents who have demonstrated financial need by the Financial Aid Form (FAF) or Family Financial Statement (FFS); (2) Job Location and Development lists off-campus, part-time, and full-time job opportunities with agencies and companies throughout the Knoxville area. Job interviews and minimal processing are required. Off-campus jobs are limited to U.S. citizens or permanent residents; (3) On-campus, part-time job opportunities are listed by the Student Employment Service. This listing of part-time jobs is based upon requests from on-campus agencies. Referrals are made in accordance with a student's skills and interests regardless of financial need.

Students needing either part-time or summer employment are urged to contact the Financial Aid Office.

LOANS
Four types of loan programs are administered by the Financial Aid office: 1) Perkins Loan, formerly National Direct Student Loan, (FAF or FFS must be on file); 2) Guaranteed Student Loan (FAF and FFS must be on file with appropriate Guaranteed Student Loan forms); 3) PLUS/SLP Loan (requires appropriate loan papers on file); and 4) The University of Tennessee Loan.

Vehicle Operation and Parking

The University of Tennessee endeavors to provide adequate facilities for vehicles operated by students and staff. However, areas available for parking are necessarily limited. To reduce traffic congestion within the University, students are encouraged to carpool.
are welcome to drop in at their convenience. Problems are treated confidentially and are dealt with expeditiously. The office does not replace any course title indicating the content to be covered.

Prerequisite courses must be taken prior to or concurrently with the specific course. Recommended prerequisites should be taken previously but are not mandatory.

Some courses may be repeated for a maximum number of hours allowable toward a degree program. This number is stated for each repeatable course with the exception of Thesis 500, Dissertation 600, and Registration for Use of Facilities 502. Courses may be cross-listed with two or more departments, an arrangement indicated by a parenthetical statement (Same as Psychology 543). The course description is given only under the primary department.

"SyS/only" indicates that the course may be taken only for Satisfactory/No Credit grading. Refer to section on Grading System. A symbol indicating the semester or frequency that the course is normally offered is included at the end of many course descriptions.

- F-Fall
- E-Every semester
- Sp-Spring
- A-Alternate years
- Su-Summer

Course Loads
The maximum load for a graduate student is 15 hours, and 9 to 12 hours is considered a full load. Students receiving financial aid should consult with the department/program head concerning appropriate course loads. Courses audited do not count toward minimum graduate hours required for financial assistance. Registration for more than 15 hours during any semester is not permissible without prior approval of The Graduate School, which may allow registration of up to 18 hours if the student has achieved a cumulative grade point average of 3.6 or better in at least nine hours of graduate work with no outstanding incompletes. Students may enroll in only one course during a mini-term session.

Change of Registration
The permanent record will show all courses for which the student has registered except those audited and those from which the student has withdrawn during the first ten consecutive instructional days after the beginning of classes.

Students who fail to attend the first class meeting without prior arrangement with the department MAY BE DROPPED from the course to make space available to other students. Students have the responsibility to assure that they have been dropped. Otherwise they may receive a grade of F in the course.

The deadline for change of registration (e.g. from graduate to undergraduate, undergraduate to graduate, withdrawal) is approximately 35 calendar days after the first day of classes each semester. (See Graduate School News each term for exact date.) A student may change registration for...
a course at any time prior to and including this date by executing a change of registration form and submitting it to the Office of Graduate Admissions and Records. The student must sign the form certifying approval of the advisor. The instructor's signature is required if the course is closed and/or after the first two weeks of classes. If the student withdraws from a course or from the University after the first ten instructional days of classes and before the change of registration deadline, he/she will receive a grade of F. The course will not be recorded in his/her grade average until a final grade is assigned.

After the change of registration deadline, a student withdrawing from a course or from the University will receive a grade of F unless it can be demonstrated that the request for withdrawal is based on circumstances beyond the student's control. In the latter case, a grade of W will be entered on the permanent record.

Course registration may not be changed from credit to audit after the first ten consecutive instructional days after the beginning of classes.

To change registration in any way after the deadline, a student must present the request, together with documentary evidence of extenuating circumstances, to the Office of Graduate Admissions and Records. In addition, the student must complete a change of registration form and questionnaire signed by the advisor as evidence of their knowledge of the request. If the request is approved, the Office of Graduate Admissions and Records will notify the Office of Admissions and Records to enter the change on the student's permanent record.

Grading System

A cumulative grade point average of 3.0 is required on all graduate course work taken at UTK to receive any graduate degree from the University. Grades in The Graduate School have the following meanings:

- A (4 quality points per semester hour), superior performance.
- B+ (3.5 quality points per semester hour), better than satisfactory performance.
- B (3 quality points per semester hour), satisfactory performance.
- C+ (2.5 quality points per semester hour), less than satisfactory performance.
- C (2 quality points per semester hour), performance well below the standard expected of graduate students.
- D (1 quality point per semester hour), clearly unsatisfactory performance and cannot be used to satisfy degree requirements.
- F (no quality points), extremely unsatisfactory performance and cannot be used to satisfy degree requirements.
- I (no quality points), a temporary grade indicating that the student has performed satisfactorily in the course but, due to unforeseen circumstances, has been unable to finish all requirements. An I is not given to enable a student to do additional work to raise a deficient grade. All incompletes must be removed within one semester, excluding the summer semester. If a supplementary grade report has not been received in the Office of Graduate Admissions and Records at the end of the semester, the I will be changed to an F. The course will not be recorded in his/her grade average until a final grade is assigned.

No student may graduate with an I on the record.

- S/NC (carries credit hours, but no quality points), S is equivalent to a grade of B or better, and NC means no credit earned. Courses where NC is received may be repeated for a grade of S. A grade of S/NC is allowed only where indicated in the course description in the Graduate Catalog. The number of S/NC courses in a student's program is limited to one-fourth of the total credit hours required.
- P/NP (carries credit hours, but no quality points), P indicates progress toward completion of a thesis or dissertation. NP indicates no progress or inadequate progress.
- W (carries no credit hours or quality points), indicates that the student withdrew from the course.

No graduate student may repeat a course for credit. Applications for proficiency examinations are available in the Office of the Registrar, 209 Student Services Building. To be eligible, a student must be admitted to The Graduate School. The request for examination must be approved by the head of the department offering the course. A student applying for this privilege must present evidence to the department head that they have the knowledge and abilities expected of graduate students who have taken the same course. Upon passing the examination with a minimum grade of B, the student will receive graduate credit. A maximum of one-fourth of the total credit hours in a Master's degree program may be counted in the cumulative grade average by this method, subject to the approval of the student's graduate committee. A fee of $22 per credit hour must be paid before each examination. Proficiency examinations may not be used to raise the grade or change credit hours in a course previously completed, nor may such an examination be repeated. Proficiency examinations taken at other institutions are not transferable.

English Proficiency

Any student whose native language is not English must present a TOEFL score of at least 525 unless he/she has received a Bachelor's or Master's degree from an accredited institution in the United States. Some departments require a higher minimum TOEFL score. The student must also pass an English proficiency examination given by the University prior to initial registration. Students whose performance on the examination indicates a need for additional English study must enroll immediately for English 121—English Grammar Review for Foreign Students (or another course assigned by the English Department) for undergraduate credit and pass with a grade of C or better. A student may not take more than 6 additional hours of course work while enrolled in English 121. Those students whose scores indicate that they are not prepared to enter English 121 will be referred to a program of intensive English study prior to taking the course.

Persons whose native language is not English may pass an oral test in English (the SPEAK Test) before they can be assigned to classroom duties in connection with their assistantships. The SPEAK Test is administered on campus by the Learning Research Center. Scores from the Test of Spoken English (TSE) are also accepted in place of the SPEAK Test.

Law Courses

A graduate student may take up to 6 semester hours of law courses and apply them toward a graduate degree upon approval of the College of Law and the student's major professor. The graduate student must register for law courses during the registration period at the College of Law and request an S/NC grade. If the student earns a 2.0 or better, an S will be recorded on the transcript. Below 2.0, an NC will be recorded and the course cannot be used toward meeting degree requirements.

Grades for law courses will not be reflected in the cumulative grade point average as law courses do not carry graduate credit.

Different rules apply to students enrolled in the Dual J.D.-MBA program. Grades must be earned according to the grading system of the respective colleges, e.g. numerical grades for law courses, letter grades for graduate courses. Refer to page 55 for grades acceptable to meet degree requirements. Only one cumulative GPA (law or graduate) will be carried on the student's transcript until graduation, at which time both the graduate and law cumulatives will be added to the permanent record.

A student enrolled in the Ph.D. in Business Administration program may use 8 semester hours or more of law courses for the supporting area under the arrangement described on page 55.

Auditors and Audited Courses

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 an auditor, and paying regular fees. Graduate students paying regular fees also are entitled to audit courses.

The names of all auditors properly registered will appear on the intermediate class rolls, but they will be removed from the final grade report. No record of audited course work will appear on the permanent record.
Correspondence Study
No graduate credit is accepted at UTK for work done by correspondence study at any university.

Transfer Credits
Official transcripts must be sent directly to the Office of Graduate Admissions and Records from all institutions previously attended before any transfer of credit will be considered. A student may be transferred into a graduate program at UTK if a course meets the following requirements:
1. be taken for graduate credit;
2. carry a grade of B or better;
3. be a part of a graduate program in which the student had a B average;
4. not have been used for a previous degree; and
5. be approved by the student's graduate committee and The Graduate School on the Admission to Candidacy form.

Courses transferred to any graduate program will not affect the minimum residence requirements for the program, nor will they be counted in determining the student's grade point average. Credits transferred from universities outside The University of Tennessee system cannot be used to meet the 500- or 600-level course work requirements. Credit for extension courses taken from other institutions is not transferable, nor is credit for any course taken at an unaccredited and/or foreign institution.

MAster's Degree
A minimum of one-half of the total hours required for a Master's degree must be taken at UTK. A maximum of one-third of the total hours may be transferred from institutions outside The University of Tennessee system, upon request by the academic unit. In addition, the student may transfer courses taken at other campuses of The University of Tennessee. Transferred courses must have been completed within the six-year period prior to receipt of the degree. They will be placed on the student's UTK transcript only after admission to candidacy.

E.D.S. Degree
A maximum of six semester (nine quarter) hours of course work beyond the Master's degree may be transferred to an E.D.S. program. Transferred courses in the last 30 hours taken for the degree must have been completed within the six-year period prior to the receipt of the degree. They will be placed on the student's UTK transcript only after admision to candidacy.

Doctoral Degree
The number of hours the student may transfer to a doctoral program will be determined by the student's doctoral committee. Although the courses transferred may be used as part of the requirements toward the degree, they will not be placed on the student's UTK transcript.

Change of Program
A student who wishes to change a major program of study must complete a Request for Change of Graduate Program form which can be obtained from the Office of Graduate Admissions and Records. The form requires the signature of the head of the department in which admission was previously granted. No signature is needed if a student requests to change from non-degree or provisional status to a degree program, or from one degree to another within the same department. Acceptance into a new degree program is contingent upon a review and approval by that department. If the student is not accepted into the program requested, he/she remains in the former program. The results of each request for program change are communicated to the student by mail.

Residence Requirements
Residence is defined as full-time registration for a given semester on the campus where the program is located. The summer semester is included in this period.

Master's Degree: no general Graduate School residency requirement.

Ed.D. Degree: one semester of residence if the student has a Master's degree; two consecutive semesters of residence if the student lacks a Master's degree.

Doctoral Degree: minimum of two consecutive semesters of residence. Individual doctoral programs may have additional residence requirements.

Theses and Dissertations
All theses and dissertations are submitted to The Graduate School Thesis/Dissertation Consultant for examination. The Thesis/Dissertation Consultant will review the materials and assure that it is attractively presented, free of technical errors in format, suitable for binding, and reflects credit upon the University and The Graduate School. If the thesis or dissertation is not accepted, the student must make corrections and resubmit the materials.

The student and major professor together share responsibility for the accuracy and professionalism of the final product of the student's research. The student should confer with the Thesis/Dissertation Consultant regarding problems and questions in advance of preparing the final copy. The UTK Guide to the Preparation of Theses and Dissertations lists the correct format for theses or dissertations. Workshops are held periodically throughout the academic year.
The date for each workshop is announced in the Graduate School News. The thesis should be written in English. Under exceptional circumstances, however, another language may be used if prior approval is obtained from The Graduate School. A request to write in a language other than English should be submitted to The Graduate School by the student's thesis committee, with the endorsement of the Department Head and the Dean of the College, prior to Admission to Candidacy for the degree sought. The request should include a proposal and justification for the exception. In all cases, one thesis abstract must be written in English.

Academic Standards
Graduate education requires continuous evaluation of the student. This evaluation includes not only periodic objective evaluation, such as the cumulative grade point average, performance on comprehensive examinations and acceptance of the thesis or dissertation, but also judgements by the faculty of the student's progress and potential. Continuation in a program is determined by consideration of all these points by the faculty and the head of the academic unit.

The academic records of all graduate students are reviewed at the beginning of each semester, including the summer term. Graduate students must maintain a cumulative grade point average (GPA) of at least 3.0 on all graduate courses taken for a letter grade of A-F. Grades of S/N/C, P/NP, and I, which have no numerical equivalent, are excluded from this computation. These policies do not apply to provisional students (see section on provisional admission).

Academic Probation
Upon completion of nine hours of graduate course work, a graduate student will be placed on academic probation when his/her cumulative GPA falls below 3.0. A student will be allowed to continue graduate study in subsequent semesters if each semester's grade point average is 3.0 or greater. Upon achieving a cumulative GPA of 3.0, the student will be removed from probationary status.

Dismissal
If a student is on academic probation, the degree or non-degree status will be terminated by The Graduate School if the student's semester GPA falls below a 3.0 (required for graduation) in a subsequent semester. When the particular circumstances may be deemed to justify continuation, and upon recommendation of the appropriate academic unit and approval of The Graduate School, a student on probation whose semester GPA is below a 3.0 may be allowed to continue on a semester-by-semester basis.

Dismissal of a graduate student by a department or program is accomplished by written notice to the student, with a copy to The Graduate School. When the department's requirements for continuation are more stringent than Graduate School requirements, The Graduate School will evaluate the student's record to determine whether the student is eligible to apply for a change of status and register in another area of study. Registration for courses in a department from which a student has been dismissed will not be permitted, except by written authorization from the department.

Departments and programs may have requirements for continuation or graduation in addition to the minimum requirements set forth in this Catalog by The Graduate School. It is the student's responsibility to be familiar with the special requirements of the department or program.

Appeals Procedure
The student handbook, Hill Topics, published and distributed annually, contains
statements of UTK standards of conduct and of all disciplinary regulations and procedures. Normally, grievances should be handled at the departmental level through the student’s advisor or the department or program head. Further appeal may be made to the Dean of The Graduate School, the Graduate Council, and the Chancellor. The By-Laws of the University (Article V, section 7) provide that any individual may ultimately appeal to the Board of Trustees, through the President. A copy of the Appeals Procedure is available in the Office of Graduate Admissions and Records.

**Requirements for Advanced Degrees**

**Master’s Degrees**

Master’s degree programs are available with thesis and non-thesis options. These programs require 30 or more graduate hours of course work. In addition to the M.A. and M.S. degrees, a number of other degrees are offered, including the MBA, and the M.S.S.W. A complete list is found under “Advanced Degrees” on pages 8-9. For specific degree requirements, consult individual program descriptions listed by college and field of instruction in this Catalog. See also the chart, page 23, for a summary of procedures for the degrees.

**COURSE REQUIREMENTS**

A candidate for a Master’s degree must complete a minimum of 30 hours of graduate credit in courses approved by the student’s Master’s committee. In thesis programs, a minimum of 6 semester hours of credit in the major must be earned in course 500 while the student is preparing the thesis. Hours applied to the Master’s degree may be entirely from one major subject or may be distributed to include one or two minor areas. In a 30-hour program, the major subject must include at least 12 hours of graduate course work, exclusive of course 500, and a minor must include not fewer than 6 nor more than 12 hours of graduate credit.

At least two-thirds of the minimally required hours in a Master’s degree program must be taken in courses numbered at or above the 500 level. Only 6 thesis hours can be counted toward this requirement.

**MASTER’S COMMITTEE**

A committee composed of the major professor and at least two faculty members at the rank of assistant professor or above should be formed as early as possible in a student’s program, and must be formed by the time a student applies for admission to candidacy (refer to Advisor/Major Professor, page 18). The responsibility of this committee is to assist the student in planning a course of study and carrying out research, and to and to fulfill the degree requirements. If the student has a minor, one member of the committee must be from the minor department.

**ADMISSION TO CANDIDACY**

Application for admission to candidacy for the Master’s degree is made as soon as possible after the student has completed any required prerequisite courses and nine hours of graduate course work with a 3.0 average or higher in all graduate work. The student must submit the Admission to Candidacy form, with appropriate signatures, to the Office of Graduate Admissions and Records no later than commencement day of the semester preceding the semester in which he/she plans to graduate.

**THESIS REGISTRATION**

A student must be registered for course 500 each semester during work on the thesis, including a minimum of 3 hours the semester in which the thesis is accepted by The Graduate School. At least 6 hours of 500 are required for the thesis option. After receiving the Master’s degree, a student is no longer permitted to register for Thesis 500.

**FINAL EXAMINATION FOR THESIS AND PROBLEMS IN LIEU OF THESIS STUDENTS**

A candidate presenting a thesis or problems must pass a final oral (or oral and written) examination on all work offered for the degree. The examination, which is concerned with course work and the thesis or problems, measures the candidate’s ability to integrate material in the major and related fields, including the work presented in the thesis or problems. This examination, scheduled through the Office of Graduate Admissions and Records, must be held at least three weeks before the final date for approval and acceptance of thesis by The Graduate School. Final examinations not properly scheduled must be repeated. The final draft of the thesis must be distributed to all committee members at least two weeks prior to the date of the final examination. In case of failure, the candidate may not apply for reexamination until the following semester. The result of the second examination is final.

**THESIS**

The thesis represents the culmination of an original research project completed by the student. It must be prepared according to the UTK Guide to the Preparation of Theses and Dissertations. Two copies of the thesis must be approved and accepted by The Graduate School on or before the deadline specified each semester in the Graduate School News. Each copy must include an approval sheet, signed by the members of the Master’s committee, certifying that they have examined the final copy of the thesis and judged it to be satisfactory.

**REGISTRATION FOR USE OF FACILITIES**

Students using University facilities or faculty time must be registered for course 502 if not registered for other courses.

**FINAL EXAMINATION FOR NON-THESIS STUDENTS**

With the exception of students pursuing the MBA, each non-thesis student must pass a final written examination. A department may require an additional oral examination. The examination is not merely a test over course work, but a measure of the student’s ability to integrate material in the major and related fields. It must be scheduled through the Office of Graduate Admissions and Records in accordance with the deadlines specified in the Graduate School News and will be conducted by the Master’s committee. Final examinations not properly scheduled must be repeated. Students taking the final examination but not otherwise using University facilities may pay a fee of $146 instead of registering. In case of failure, the candidate may not apply for reexamination until the following semester. The result of the second examination is final.

**TIME LIMIT**

Candidates have six calendar years from the time of enrollment in The Graduate School to complete the degree. Students who change degree programs during this six-year period may be granted an extension after review and approval by The Graduate School. In any event, courses used toward a Master’s degree must have been taken within six calendar years of graduation.

**Specialist in Education Degree**

The Specialist in Education (Ed.S.) degree is offered with majors in Curriculum and Instruction, Educational Administration and Supervision, Educational Psychology and Guidance, Safety Education and Service, and Vocational-Technical Education. Admission to the Ed.S. program requires acceptance by The Graduate School, and review and acceptance by the department or area in which the student is majoring. It is recommended that students who apply for the Ed.S. have at least one year of related work experience. Additional information on admission requirements can be obtained from the departments offering the degree. Also see the chart, page 23, for a summary of procedures for this degree. All deadlines are published each semester in the Graduate School News.

**ED.S. COMMITTEE**

A committee of at least three faculty members is assigned to each student. A minimum of two members of this committee must represent the department or major area. Its responsibilities include advising the student’s program of course work, supervising progress, recommending admission to candidacy, directing research, and coordinating the qualifying and final examinations.

**COURSE REQUIREMENTS**

The student’s program involves a minimum of four semesters of study totaling not fewer than 60 semester hours of graduate credit beyond the baccalaureate degree. A minimum of 6 hours is required outside the major department or area. A student admitted to the program with a Master’s degree, or with acceptable work beyond the Master’s degree, may have program requirements modified upon recommendation of the student’s committee. However, no modifications will be permitted in examination or reexamination requirements, nor in the minimum 6 graduate hours required outside the major. All prior course work accepted toward the degree must be related to the student’s program objectives. A maximum of 6 hours beyond the Master’s degree may be transferred from another institution to an Ed.S. program. See Transfer Credits, page 20.
Courses numbered at the 400 level required for certification through UTK may not be taken for graduate credit and used as part of the course work in the major. At least one-half of the last 30 semester hours of work, exclusive of thesis courses, must be in 500- or 600-level courses.

ADMISION TO CANDIDACY

To the Admission to Candidacy form, signed by the student's committee, is submitted to the Office of Graduate Admissions and Records before the student has completed 15 hours of course work in the Ed.S. program. A qualifying examination may be required for Admission to Candidacy if the student has a Master's degree earned six years or more prior to admission to the program. This examination may be written and/or oral.

RESEARCH REQUIREMENTS

See the program descriptions of individual departments for listings of thesis, problems in lieu of thesis, and non-thesis options. Some departments offer only a thesis program.

1. In the non-thesis program, a candidate will study research methods and findings and will demonstrate skill in adapting them to professional needs as defined by the major department.

2. In the thesis program, or problems in lieu of thesis, 6 hours of research credit (518 and 519) must be earned in the preparation of an acceptable piece of work. The student must continue to register for thesis or problems while working on the project, including the thesis. It is accepted by The Graduate School. The thesis must be prepared according to the guidelines in the UTK Guide to the Preparation of Theses and Dissertations, and approved by the student's committee prior to submission to The Graduate School for final approval and acceptance.

FINAL EXAMINATION

A candidate presenting a thesis, or problems in lieu of thesis, must pass an oral examination covering the student's research and program of study. A non-thesis student must pass a written, or oral examination, or all work offered for the degree. The examination is not merely a test over course work, but a demonstration of the candidate's ability to integrate materials in the major and related fields. Each examination must be scheduled through the Office of Graduate Admissions and Records before the deadline and will be conducted by the student's committee. Final examinations not properly scheduled must be repeated. In case of failure, the candidate may not be reexamined until the following semester. The result of the second examination is final.

TIME LIMIT

Candidates have six calendar years from the time of entry into the last 30 hours of their degree programs to complete the Ed.S. degree.

Doctoral Degrees

Two doctoral degree programs are available:

- Doctor of Philosophy (Ph.D.) and

Programs are listed under "Majors and Degree Programs."

pages 8-9: For specific degree requirements, consult individual program descriptions listed by college and field of instruction in this Catalog. See also the chart, page 24, for a summary of procedures for doctoral degrees.

Doctoral programs include a major field or area of concentration and, frequently, one or more cognate fields. The latter are defined as a minimum of 6 semester hours of graduate course work in a given area outside the student's major field.

COURSE REQUIREMENTS

Each doctoral student must take an appropriate number of 600-level courses, usually a minimum of 6 semester hours, at UTK. Normally a doctoral program includes a minimum of 24 hours of graduate course work beyond the Master's degree, graded A-F. In addition, a minimum of 24 hours of dissertation work in course 600 is required. Additional work taken for S/NC grading may comprise up to one-fourth of the student's total graduate hours.

DOCTORAL COMMITTEE

The student and the major professor identify a doctoral committee composed of at least four full-time, teaching faculty members of Assistant Professor or above, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be from a department other than that of the student's major field. This committee is nominated by the department head or college dean and approved by The Graduate School.

The committee should be formed during the student's first year of doctoral study. Subject to Graduate Council policies and individual program requirements, the committee must approve all course work applied toward the degree, certify the student's mastery of the major field and any cognate fields, direct the research, and recommend the dissertation for approval and acceptance by The Graduate School.

CONTINUOUS REGISTRATION

The student must register continuously for course 600 (minimum of 3 hours) from the time the doctoral research proposal is approved, admission to candidacy is accepted, or registration for course 600 is begun, whichever comes first, including summer semester and the semester in which the dissertation is approved and accepted by The Graduate School. A minimum total of 24 hours of course 600 is required before the dissertation will be accepted. A student who will not be using faculty services and/or university facilities for a period of time may request leaves of absence from dissertation research up to a maximum of six semesters. The request will be considered by The Graduate School upon written recommendation of the department head.

DOCTORAL EXAMINATIONS

Departments may, at their option, administer diagnostic and/or qualifying examinations in the early stages of the student's doctoral program. Successful completion indicates that, in the judgment of the faculty, the student has demonstrated knowledge of the field and the speciality, knows how to use academic resources, and is deemed capable of completing the dissertation. The comprehensive examination must be passed prior to admission to candidacy. A written examination is required and an oral examination is encouraged.

The faculty of the graduate program and/or the student's doctoral committee will determine the content, nature and timing of the comprehensive examination and certify its successful completion. The department or committee may at its discretion subdivide the examination, administering portions of the examination at several times during the student's course of study. Students should review carefully the written statement from each doctoral degree program which details the timing, areas covered, grading procedures, and provisions for repeating a failed examination.

Defense of Dissertation Examination

A doctoral candidate must pass an oral examination on the dissertation. The defense of dissertation will be administered by all members of the doctoral committee after completion of the dissertation and all course requirements. This examination must be passed at least three weeks before the date of acceptance and approval of the dissertation by The Graduate School. The examination must be scheduled through the Graduate Admissions and Records Office. Final 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 examination is announced publicly and is open to all faculty members.

LANGUAGE REQUIREMENTS

Candidates for the Ph.D. degree may be required to demonstrate a reading knowledge of at least one foreign language in which there exists a significant body of liter-
Summary of Procedures for Master's and Specialists in Education Degrees

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<tr>
<th>PROCEDURES</th>
<th>UNDER DIRECTION OF</th>
<th>DATE</th>
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<tbody>
<tr>
<td>Admission as a potential degree candidate</td>
<td>Office of Graduate Admissions and Records and Major Department</td>
<td>Prior to completing 15 hours of graduate courses</td>
</tr>
<tr>
<td>Formation of Master's/Ed.S. committee</td>
<td>Advisor/Major professor</td>
<td>Prior to application for admission to candidacy</td>
</tr>
<tr>
<td>Submission of application for admission to candidacy</td>
<td>Master's/Ed.S. committee</td>
<td>At least one semester prior to graduation*</td>
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<tr>
<td>Approval of admission to candidacy</td>
<td>The Graduate School</td>
<td>Prior to graduation</td>
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**GRADUATION REQUIREMENTS FOR NON-THESIS OPTION**

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<tbody>
<tr>
<td>Placement of name on graduation list</td>
<td>Student</td>
<td>Indicate on registration materials</td>
</tr>
<tr>
<td>Application for diploma</td>
<td>Office of Graduate Admissions and Records</td>
<td>Deadline available at registration*</td>
</tr>
<tr>
<td>Payment of graduation fee</td>
<td>Bursar's Office</td>
<td>Deadline available at registration*</td>
</tr>
<tr>
<td>Scheduling of Final Examination</td>
<td>Student and Office of Graduate Admissions and Records</td>
<td>Not later than one week prior to Final Examination*</td>
</tr>
<tr>
<td>Final Examination(s)</td>
<td>Master's/Ed.S. committee</td>
<td>Not later than three weeks prior to Commencement*</td>
</tr>
<tr>
<td>Removal of incomplete(s)</td>
<td>Instructor of course</td>
<td>Not later than one week prior to Commencement*</td>
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**GRADUATION REQUIREMENTS FOR THESIS/PROBLEMS OPTIONS**

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</tr>
<tr>
<td>Submission of thesis/problems to Master's/Ed.S. committee</td>
<td>Student</td>
<td>At least two weeks prior to Final Examination</td>
</tr>
<tr>
<td>Scheduling of Final Examination</td>
<td>Student and Office of Graduate Admissions and Records</td>
<td>Not later than one week prior to Final Examination*</td>
</tr>
<tr>
<td>Final Examination(s)</td>
<td>Master's/Ed.S. committee</td>
<td>Not later than three weeks prior to thesis deadline*</td>
</tr>
<tr>
<td>Approval and acceptance of final copy of thesis and thesis card</td>
<td>Master's/Ed.S. committee and The Graduate School</td>
<td>After Final Examination and not later than two weeks prior to Commencement*</td>
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<tr>
<td>Removal of incomplete(s)</td>
<td>Instructor of course</td>
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*Deadlines are printed in the Graduate School News each semester.
method of presentation, and subject matter of the dissertation are important in conveying to others the results of such research. A student should be registered for the number of dissertation hours representing the fraction of effort devoted to this phase of the candidate's program. Thus, a student working full time on the dissertation should register for 12 hours of 600 per semester. Two copies of the dissertation (prepared according to the regulations in the UTK Guide to the Preparation of Theses and Dissertations) must be submitted to and accepted by The Graduate School. Each copy must include an approval sheet, signed by all members of the doctoral committee, which certifies to The Graduate School that they have examined the final copy and found that its form and content demonstrate scholarly excellence. 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.

**TIME LIMIT**

Comprehensive examinations must be taken within five years, and all requirements must be completed within eight years, from the time of a student's first enrollment in a doctoral degree program.

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### Summary of Procedures for Doctoral Degrees

<table>
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<td>Prior to completing 15 hours of graduate courses</td>
</tr>
<tr>
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<td>The Graduate School on recommendation of department head</td>
<td>Preferably during the first year of graduate study but, at the latest, prior to admission to candidacy</td>
</tr>
<tr>
<td>*Comprehensive Examination</td>
<td>Major department</td>
<td>Prior to admission to candidacy</td>
</tr>
<tr>
<td>&quot;Foreign language examination(s)&quot;**</td>
<td>Office of Graduate Admissions and Records</td>
<td>Prior to admission to candidacy</td>
</tr>
<tr>
<td>Submission and approval of application for admission to candidacy</td>
<td>Doctoral committee and The Graduate School</td>
<td>At least one semester prior to graduation***</td>
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**GRADUATION REQUIREMENTS**

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</tr>
<tr>
<td>Submission of dissertation to doctoral committee</td>
<td>Student</td>
<td>At least two weeks prior to Defense of Dissertation Examination***</td>
</tr>
<tr>
<td>Scheduling of Defense of Dissertation Examination</td>
<td>Student and Office of Graduate Admissions and Records</td>
<td>Not later than one week prior to Defense of Dissertation Examination***</td>
</tr>
<tr>
<td>Defense of Dissertation Examination</td>
<td>Doctoral committee</td>
<td>Not later than three weeks prior to dissertation deadline***</td>
</tr>
<tr>
<td>Approval and acceptance of final copy of dissertation, doctoral forms, and dissertation card</td>
<td>Doctoral committee and The Graduate School</td>
<td>After Defense of Dissertation Examination and not later than two weeks prior to commencement***</td>
</tr>
<tr>
<td>Removal of incomplete(s)</td>
<td>Instructor of course</td>
<td>Not later than one week prior to commencement***</td>
</tr>
</tbody>
</table>

* The order of these items varies with individual programs.
** Not required in some programs.
*** Deadlines are printed in the Graduate School News each semester.
COLLEGES
College of Agriculture

O. Glen Hall, Dean
Gary Schneider, Associate Dean

Departments
Agricultural and Extension Education
Agricultural Economics and Rural Sociology
Agricultural Engineering
Animal Science
Entomology and Plant Pathology
Food Technology and Science
Forestry, Wildlife and Fisheries
Ornamental Horticulture and Landscape Design
Plant and Soil Science

Facilities for Research and Service
Institute of Agriculture
Agricultural Experiment Station
Agricultural Extension Service

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

The general rules of The Graduate School apply to all graduate work in the College.

MASTER OF SCIENCE PROGRAMS
Programs of graduate study leading to the Master of Science are offered through all departments in the College of Agriculture. The graduate program may be entirely in one major subject or may include subject matter areas related to the major. Both majors and minors are available in Agricultural Economics, Agricultural Engineering, Agricultural and Extension Education, Agricultural Engineering Technology, Animal Science, Entomology and Plant Pathology, Food Technology and Science, Ornamental Horticulture and Landscape Design, and Plant and Soil Science. Majors only are available in Forestry and Wildlife and Fisheries Science, and minors are available in General Agriculture and Rural Sociology. The minor in General Agriculture requires 12 hours of course work. A complete listing of majors is shown on pages 8-9.

DOCTORAL PROGRAMS
Graduate study programs leading to the Doctor of Philosophy in Animal Science, Agricultural Economics, Agricultural Engineering, Food Technology and Science, and Plant and Soil Science are offered in the college.

College of Business Administration

C. Warren Neel, Dean
John R. Moore, Associate Dean
Roger L. Jenkins, Associate Dean for Graduate Programs
Richard C. Reizenstein, Associate Dean for Undergraduate Programs
Clyde Keller, Associate Dean for External Affairs
David A. Hake, Director, Center for Business and Economic Research
John E. Riblett, Director, Management Development Programs

Departments
Accounting and Business Law
Economics
Finance
Management
Management Science
Marketing
Marketing Science
Statistics

Facilities for Research and Service
Center for Business and Economic Research
Management Development Center
MBA Center of Excellence in New Venture Analysis and Entrepreneurship

Graduate programs of the College of Business Administration are designed to prepare men and women to assume positions in the increasingly complex world of business and industry, teaching and research, and government.

Viewing the business firm as operating in dynamic social, political, and economic environments that demand leaders capable of dealing with innovation and rapid change, the College places central importance on development of students' thought processes. Emphasis is focused on flexibility of mind, receptivity to new ideas, and capacity to adapt one's reasoning powers. Our objective is to encourage the student to develop the ability to reason analytically and logically. Above all else, we strive to instill the irresistible desire to continue to learn and grow in knowledge throughout the student's life.

CENTER OF EXCELLENCE
The Tennessee Higher Education Commission (THEC) has designated a Center of Excellence for New Venture Analysis and Entrepreneurship within UTK's College of Business Administration. The primary goals and benefits of the center are threefold: to coordinate the resources needed to provide an MBA concentration in new venture analysis and entrepreneurship, to provide a centralized entity in the college for quality research in the field of new ventures, and to provide support and development programs for existing new ventures. Information on the
first of these goals, the MBA concentration, is located under Business Administration. Information on the two latter goals may be obtained by contacting the Center for New Venture Analysis at 608 Stokely Management Center, Knoxville, TN 37996-0563 or by calling (615) 974-1739.

GRADUATE PROGRAMS
The College of Business Administration offers programs leading to five advanced degrees: the Doctor of Philosophy with majors in Business Administration, Economics, and Management Science; the Master of Arts with a major in Economics; the Master of Science with a major in Statistics; the Master of Accountancy; and the Master of Business Administration. The Department of Management and the Department of Psychology in the College of Liberal Arts jointly offer an intercollegiate program in Industrial and Organizational Psychology leading to the Master of Science and Doctor of Philosophy. (See Industrial and Organizational Psychology.) Also, the Department of Management Science coordinates an intercollegiate program leading to the Master of Science. (See Management Science.)

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UTK on an in-state tuition basis. Programs in the College of Business Administration available to residents of the states indicated include: M.A. (Business Administration) West Virginia; MBA (Transportation and Logistics) Virginia and West Virginia; M.S. and Ph.D. (Industrial and Organizational Psychology) Alabama, South Carolina, and Virginia. Additional information may be obtained from the Graduate Programs Office of this college.

ADMISSION REQUIREMENTS
General admission requirements for The Graduate School are stated beginning on page 13. M.Acc., MBA, and Ph.D. in Business Administration and application blanks may be obtained from the office of the Associate Dean for Undergraduate Studies or from the office of the Associate Dean for Graduate Programs. Applications must be received by January 1 for consideration of assistantships and fellowships to be awarded for the following fall term.

College of Communications

B. Kelly Leiter, Dean
Herbert H. Howard, Assistant Dean for Graduate Studies and Research
Paul G. Ashdown, Assistant Dean for Undergraduate Studies

Departments and Schools
Advertising
Broadcasting
Journalism

Facility for Research and Service
Communications Research Center (CRC)

The College of Communications offers the Master of Science and the Doctor of Philosophy with a major in Communications. 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 M.S. program is accredited by the Accrediting Council on Education in Journalism and Mass Communication. The College is a member of the Association of Schools of Journalism and Mass Communication and the Broadcast Education Association.

The doctoral program in Communications is listed in the Academic Common Market of the Southern Regional Education Board. Students residing in Alabama, Arkansas, South Carolina, Virginia, and West Virginia can normally qualify for in-state fee status by applying to the Academic Common Market coordinators in their state capitals.

For application forms and other information about the M.S. and Ph.D. programs in Communications, write to:

Assistant Dean for Graduate Studies
College of Communications
98 Communications Building
The University of Tennessee
Knoxville, Tennessee 37996-0313

ADMISSION REQUIREMENTS
Applicants must meet admission requirements of The Graduate School. In addition, they must complete the Graduate Record Examination and application forms as required by the College of Communications. Minimal requirements for admission to full potential candidate status normally include a 3.0 (4.0 system) grade point average in undergraduate studies and scores above the fiftieth percentile in verbal and quantitative aptitude on the Graduate Record Examination. All application materials are screened by an admissions committee authorized by the faculty of the College of Communications.

New students normally are admitted to the program only at the beginning of fall semester. However, under special circumstances, a student may be admitted at the beginning of spring semester in a temporary non-degree status. Applications for fall admission must be received by May 1.

A baccalaureate degree in communications or a related field is recommended. Admission is possible with other baccalaureate degrees; however, all applicants without the appropriate background are required to take up to 18 semester hours of prerequisite and corequisite courses as determined by the department in which the student is enrolled. Students may take a proficiency test on any prerequisite course, subject to review by the Master's Committee of the College of Communications.

Students who have had no courses in their major area of concentration may expect to spend four or more full-time semesters in the program, including a media internship.

ACADEMIC STANDARDS
A student in the College of Communications whose graduate grade point average, not including incomplete grades, is below 3.0 at any time after the end of 12 hours of graduate course work will be placed on probation. A student on probation will 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 semester hours of graduate course work attempted that is specified in the student's degree program. Exceptions to this policy may be made only with the approval of the Assistant Dean for Graduate Studies of the College of Communications on the recommendation of the student’s faculty committee.

College of Education
Richard Wisniewski, Dean
C. Glennon Rowell, Associate Dean for Graduate Studies
Thomas W. George, Associate Dean for Undergraduate Studies
Timothy J. Pettibone, Associate Dean for Research

Departments
Art and Music Education
Curriculum and Instruction
Educational and Counseling Psychology
Educational Leadership
Health, Leisure, and Safety
Physical Education and Dance
Special Services Education
Technological and Adult Education

Facilities for Research and Service
Bureau of Educational Research and Service
Center for Physical Activity and Health
College of Teacher Education
Mid Atlantic/Appalachian Race Desegregation Center
Reading Center
Safety Center

The faculty of the College of Education is committed to performing three major functions: (1) to provide professional preparation for teachers, administrators, school service personnel, and other professionals such as health and recreation personnel at the undergraduate and graduate levels; (2) to collaborate with school personnel, educational agencies, and groups, and others interested in the evaluation and improvement of educational opportunities, programs, and services; and (3) to promote and conduct research and development in education and other areas of responsibility.

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 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 Science, the Specialist in Education, the Doctor of Education, and the Doctor of Philosophy.

TEACHER CERTIFICATION
Applicants for initial teacher certification and those applicants previously certified who are seeking initial institutional recommendation for certification must gain admission to the college's Teacher Education Program. A complete explanation of the admission process appears in the Undergraduate Catalog.

MASTER OF SCIENCE PROGRAM
On the Master's level, professional study may be planned (1) in one of the areas listed on page 8-9, (2) in appropriate combinations of these areas, or (3) in combinations of one or more of the areas with appropriate subjects or areas in other colleges.

Students in the College of Education's five-year preparatory program must meet all criteria for admission to The Graduate School in order to earn 12 hours credit toward their Master's degrees. Admission to Graduate School must be prior to or during the semester that the first graduate credit is to be earned. Internship cannot be used for graduate credit.

SPECIALIST IN EDUCATION PROGRAM
This degree may be earned in Educational Administration and Supervision, in Educational Psychology and Guidance, in Curriculum and Instruction, in Safety Education, and in Vocational-Technical Education.

DOCTORAL PROGRAMS
The College of Education offers programs of advanced study leading to the Doctor of Education in the major areas listed on page 8-9.

Ph.D. in Education requirements are available under Education, Fields of Instruction.

College of Engineering
William T. Snyder, Dean
William L. Grecco, Associate Dean
Andrew W. Spickard, Associate Dean

Departments
Chemical Engineering
Civil Engineering
Electrical and Computer Engineering
Engineering Science and Mechanics
Industrial Engineering
Materials Science and Engineering
Mechanical and Aerospace Engineering
Nuclear Engineering

Facilities for Research and Service
Center for Computer Integrated Engineering and Manufacturing
Center for Measurement and Control Engineering
Center of Excellence for Materials Processing

Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science, the Master of Engineering, and the Doctor of Philosophy. For a listing, consult majors and degrees available on page 8-9.

GRADUATE PROGRAM AT THE UT SPACE INSTITUTE
At the University of Tennessee Space Institute near Tullahoma, graduate-level courses are offered in engineering fields such as aerospace, chemical, electrical and computer, engineering science, industrial, mechanical engineering, engineering management, and mathematics and physics. All programs lead to the Master of Science. Also, Ph.D. degrees are available in many of these fields. Information may be obtained from the Registrar, The University of Tennessee Space Institute, Tullahoma, TN 37388.

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

CENTER OF EXCELLENCE FOR MATERIALS PROCESSING
The Center for Materials Processing is one of the 'Centers of Excellence' created by the State of Tennessee. It is an inter-disciplinary program designed to bring together individuals with appropriate expertise to solve important materials processing problems. It emphasizes (1) the development of desirable materials properties through the control of composition, molecular structure and microstructure, (2) measurement of process variables, and (3) control and optimization of those variables to ensure proper processing. The Center conducts basic research and teaching in materials processing and carries out research to improve existing processing technologies and transfer of research results to private industry. A major aspect of the Center is student participation in industry-sponsored research programs.

College of Human Ecology
Jacquelyn O. DeJonge, Acting Dean
Kermit Duckett, Associate Dean of Graduate Studies

Departments
Child and Family Studies
Nutrition and Food Sciences
Textiles, Merchandising and Design

Graduate study in Human Ecology prepares the student for teaching, research, and public service in colleges and universities or managerial positions in government, business, and industry. The Master of Science is offered with majors in Child and Family Studies, Home Economics, Interior Design, Food Science, Food Systems Administration, Nutrition (including public health nutrition), and Textiles and Apparel; the Doctor of Philosophy is offered with a major in Human Ecology and concentrations in child development, family studies, food science, nutrition science, and textiles and apparel. For addi-
College of Law

Mary Jo Moores, Associate Dean

N. Douglas Wees, Assistant Dean

Current information regarding admission, financial aid, course requirements, academic policies, extracurricular activities, and student services is available in the College of Law Bulletin from the Admissions Office, The University of Tennessee, College of Law, 1505 West Cumberland Avenue, Knoxville, Tennessee 37996. Completed application should be received before February 1 of the year of requested admission.

The University of Tennessee College of Law commenced operation in 1890 and has continuously sought to provide high-quality legal education in a university community. While the principal objective of the college is to prepare students for the private practice of law, its total mission is more broadly conceived. The college exposes students to the legal issues of our society enabling them to develop the critical skills with respect to decisional law and statutes, the ability to communicate effectively their knowledge of the law, and the ability to use law as an implement of societal control and development. Students are thus equipped to serve their community not only as advocates and counselors, but as policy makers and active, responsible citizens.

The coordinated program of the college has three dimensions: teaching and learning, research into and contribution of our legal systems and institutions, and service to the community. Each plays a significant role in the college as a modern law center.

The teaching and learning element of legal education at the college involves a cooperative classroom interaction between faculty and students in the analytical study of a host of questions and problems found in today's legal profession. These involve decisional law, statutory interpretation, administrative regulation, techniques of trial and appellate advocacy, and the roles and responsibilities of the lawyer in advising and representing clients. While proper consideration is given to the problems of Tennessee law, the course of study is conducted with a view toward providing an awareness and understanding of the regional and national perspective in order to prepare our students for service in any state.

The college is also directly involved in providing service to the community of which it is a part. A major element of public service is centered in the Legal Clinic where students, under the guidance of skilled and experienced licensed practitioners, provide legal services to clients. Additionally, through research, consultation, and other services to legal institutions and groups within the state, the college seeks to participate in the development and improvement of the society in which its students may eventually practice law. The Public Law Institute is a primary example of this function.

In combination, the direction and objectives of the college lead to the development of both to the law of the perspective, breadth, and understanding necessary to accomplish the many tasks assigned by society to the legal profession.

THE COLLEGE OF LAW BUILDING

Since 1950 the college has occupied a building designed especially for teaching, study, and research in the law. In the spring of 1971 the college occupied the new wing, doubling the available facilities. The library, the classrooms, and the offices are air-conditioned. Classrooms, courtrooms, seminar rooms, offices for full-time faculty members, the offices of the Legal Clinic, and a Law Library are contained in the building.

LEGAL CLINIC

The University of Tennessee Legal Clinic was established in 1947. Though the Legal Clinic provides legal assistance to indigent persons, it is designed primarily as a teaching device to correlate theory and practice. It introduces the student, under faculty supervision, to the law in practice through personal contact with clients and their problems. The Legal Clinic functions as a large law office in which the student gains experience in interviewing clients, writing legal letters, investigating and evaluating facts, preparing memoranda of law, preparing cases for trial or adjustment, and briefing cases. Classroom work supplements the handling of actual cases. The student is thus trained in the technique of law practice and the management of a law office. The ethical responsibilities of lawyers and their function as public servants are stressed. Under present rules of the Tennessee Supreme Court, third year students, under the direct supervision of the Legal Clinic staff, are certified to practice before all the courts of Tennessee.

THE LAW LIBRARY

The Law Library contains the official state reports of all states, the complete National Reporter system that covers all states and the federal courts, the Annotated Reports, standard sets of miscellaneous reports, the reports of the Canadian cases and of English cases from the yearbooks to date. In addition to these, there are adequate encyclopedias, digests and dictionaries, standard textbooks, law reviews, and current loose-leaf services, totaling together more than 260,000 catalogued volumes and microform volume equivalents. The library is under the supervision of a law librarian who is trained in law and library science. Law students also have the use of the collections in the University Main Library, a few blocks away, and other branch libraries.
College of Veterinary Medicine

Hyram Kitchen, Dean
Charles F. Reed, Jr., Associate Dean
William H. Grau, Jr., Associate Dean

Departments
- Animal Science-Veterinary Medicine
- Environmental Practice
- Microbiology-Veterinary Medicine
- Pathobiology
- Rural Practice
- Urban Practice

The College of Veterinary Medicine, established in 1974, offers a professional curriculum leading to the Doctor of Veterinary Medicine (D.V.M.). The college offers graduate studies leading to the Master of Science and the Doctor of Philosophy. Residency training programs in the various clinical specialties are also offered. The college is organized into six academic departments: Animal Science (jointly with the College of Agriculture), Environmental Practice, Microbiology (jointly with the College of Liberal Arts), Pathobiology, Rural Practice, and Urban Practice.

The primary objective of the college is to educate veterinarians for private practice. However, the professional curriculum provides an excellent basis for medical education, in addition to training in diagnosis, disease prevention, medical treatment, and surgery. Graduates are qualified to pursue careers in many facets of veterinary medicine and related health professions.

Most veterinarians are engaged in private practice. The majority of these are in general practices which deal with the diseases of all kinds of animals. About one-fourth of the veterinarians in the United States are engaged exclusively in pet or companion animal practice. A growing number are concerned with the health problems of zoo animals, laboratory animals, wildlife, and aquatic species.

Veterinarians also find rewarding careers in the U.S. Public Health Service, the U.S. Army and Air Force, and in state, county, or local health agencies. A large number of veterinarians are engaged exclusively in pet or companion animal practice. A growing number are concerned with the health problems of zoo animals, laboratory animals, wildlife, and aquatic species.

Most veterinarians are employed by the U.S. Department of Agriculture and by state governments. The majority of these are in general practices which deal with the diseases of all kinds of animals, about one-fourth of the veterinarians in the United States are engaged exclusively in pet or companion animal practice. A growing number are concerned with the health problems of zoo animals, laboratory animals, wildlife, and aquatic species.

Veterinarians also find rewarding careers in the U.S. Public Health Service, the U.S. Army and Air Force, and in state, county, or local health agencies. A large number of veterinarians are employed by the U.S. Department of Agriculture and by state governments. The majority of these are in general practices which deal with the diseases of all kinds of animals. About one-fourth of the veterinarians in the United States are engaged exclusively in pet or companion animal practice. A growing number are concerned with the health problems of zoo animals, laboratory animals, wildlife, and aquatic species.
Excellent opportunities exist for veterinarians interested in research, both for the direct benefit of animals and research conducted with animals but for the benefit of humans. Such opportunities are available at colleges and universities and with governmental agencies, private research institutions, and biological and pharmaceutical companies.

**COLLEGE FACILITIES**

Administrative offices of the College of Veterinary Medicine are located in Morgan Hall on the agricultural campus. The Department of Animal Science is housed in Brehm Animal Science Building, also on the agricultural campus, and the Department of Microbiology is located in Walters Life Sciences Building on "The Hill" of The University of Tennessee, Knoxville.

The Veterinary Medicine Building on the agricultural campus houses the departments of Environmental Practice, Rural Practice, Urban Practice, and Pathobiology. Additionally, the Veterinary Teaching Hospital, clinics, and the Agriculture/Veterinary Medicine Library are contained within this modern structure of 246,000 gross square feet.

The college has research facilities on Cherokee Farm adjacent to the UT Hospital. Satellite teaching-research facilities are located in Middle and West Tennessee.

**ADMISSION REQUIREMENTS**

Admission to the professional program of the College of Veterinary Medicine is limited to that number for which an education of high quality can be provided with the resources available to the College.

To qualify for admission, a candidate must have completed at least the minimum pre-veterinary requirements as listed.

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>6</td>
</tr>
<tr>
<td>Humanities and Social Sciences*</td>
<td>18</td>
</tr>
<tr>
<td>Mathematics</td>
<td>6</td>
</tr>
<tr>
<td>Physics</td>
<td>8</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>8</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>8</td>
</tr>
<tr>
<td>Biochemistry**</td>
<td>4</td>
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<td>General Biology</td>
<td>8</td>
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<tr>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>Cellular Biology***</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
</tr>
</tbody>
</table>

*May include, for example, courses in English literature, speech, music, art, philosophy, religion, language, history, economics, anthropology, political science, psychology, sociology and geography. **Exclusive of laboratory. ***It is expected that this requirement will be fulfilled by a course in cellular or molecular biology. An appropriate microbiology course may be approved if cellular or molecular biology is not offered.

**ADMISSION PROCEDURES**

Admission of new students will be for the fall semester each year. Applicants will be considered in the following order of priority: (1) residents of Tennessee, (2) residents of other states.

Forms and instructions for making application for admission may be obtained, after September 1 each year, from:

Director of Admissions 201 Student Services Building The University of Tennessee Knoxville, TN 37996-0200

Applications must be completed and mailed to reach the UTK Director of Admissions by January 15 each year. All supporting documents, official transcripts, Veterinary College Admission Test (VCAT) (formerly VAT) (results from a test taken within 24 months of the January 15 application deadline date), and letters of reference must be submitted to arrive not later than 30 days after the application deadline date. NON-TENNESSEE APPLICANTS MUST HAVE A MINIMUM CUMULATIVE GRADE POINT AVERAGE OF 3.2 ON A 4.0 SCALE.

Applications are accepted only from U.S. citizens or permanent residents of the U.S.

**EXTRAMURAL PROGRAMS**

The opportunity to participate in off-campus learning experiences may be available for a limited number of students during the latter half of the final year of the professional curriculum. Selection of an extramural learning experience requires approval by the department concerned and the College of Veterinary Medicine Curriculum Committee. The extramural program identified by the student must represent a learning experience not available within The University of Tennessee, Knoxville.
FIELDS OF INSTRUCTION
Fields of Instruction

Accounting and Business Law
(College of Business Administration)

MAJORS DEGREES
Accounting ........................................ M.Acc.
Business Administration.................... MBA, Ph.D.

Jan R. Williams, Head

Accounting

Professors:
N. E. Dittrich, Ph.D. Ohio State, C.P.A.;
J. E. Kiger (Distinguished Professor of Accounting), Ph.D. Missouri, C.P.A.;
W. H. Read (Emeritus), MBA Northwestern, C.P.A.;
J. H. Scheiner, Ph.D. Missouri, C.P.A.;
W. H. Read (Emeritus), MBA Northwestern, C.P.A.;
K. G. Stanga, Ph.D. Louisiana State, C.P.A.;
J. R. Williams (Ernst and Whinney Professor), Ph.D. Arkansas, C.P.A.

Associate Professors:
H. C. Herring, III, Ph.D. Alabama, C.P.A.;
C. D. Izard, Ph.D. Mississippi, C.P.A.;
J. M. Reeve, Ph.D. Oklahoma State, C.P.A.;
H. P. Roth, Ph.D. Virginia Polytechnic Institute, C.P.A.;
W. L. Slagle, M.S. Tennessee, C.P.A.;
R. L. Townsend, Ph.D. Texas, C.P.A.

Assistant Professors:
K. E. Anderson, Ph.D. Indiana, C.P.A.;
A. F. Borthick, D.B.A. Tennessee, C.M.A.
C. I. S. A.; M. C. Lotsinger, M.S. Tennessee, C.P.A.;
R. A. Turpen, Ph.D. Alabama, C.P.A.

Distinguished Lecturer:
S. B. Wolfe, B.S. Virginia Polytechnic Institute.

THE MASTER OF ACCOUNTANCY PROGRAM
The objective of the Master of Accountancy (M.Acc.) program is to provide persons having an undergraduate accounting background and a high level of ability and motivation with the depth and understanding of accounting which will enhance their probability of success in a career in professional accounting. Moreover, the student's educational experience should develop perspective toward the discipline of accounting in a manner that will enable the student to spearhead innovation and change in response to needs in public accounting, business, industry, or government.

Foundation Requirements
Application deadlines for international students are: Fall, March 1; Spring, July 15; Summer, November 15. Application deadlines for U.S. citizens and permanent residents are: Fall, June 1; Spring, October 1; Summer, February 1. Although the program is designed for students who have completed an accredited baccalaureate degree program in Accounting, those with outstanding undergraduate records in any area may earn the M.Acc. degree by completing prerequisites in accounting and by including courses in other business and related disciplines to supplement the applicant's undergraduate background. Students entering the program are expected to have completed course work in calculus and computer science. For students with no previous exposure to calculus, Mathematics 305 is available.

Course Requirements for the M.Acc. Program
A student's program encompasses a minimum of 30 semester hours of graduate course work. Specifically, the student must complete courses in accounting and other areas as indicated below. Each course is 3 semester hours of graduate credit.

Accounting Core (9 hours): 511, 513, 521.
Accounting Concentration (12 hours): Three concentrations are available:

1. Financial Auditing: 512, 531, 519, one accounting elective.
3. Taxation: 531, 532, 533, 539.

Non-accounting Electives (9 hours): Non-accounting courses taken in other AACSB accredited institutions that otherwise conform to University policy (page 20) may be credited toward M.Acc. degree requirements.

Other Requirements
To qualify for the degree, a student must maintain a B average (3.0) or above in the core and concentration area accounting courses and a B average or higher in the overall program. The student must satisfactorily demonstrate his/her ability to recognize, analyze, and solve accounting policy problems and integrate concepts from the various areas of accounting by passing a comprehensive written examination. This examination is included in the capstone courses in each concentration as follows: 519, Research in Financial Accounting and Auditing; 539, Tax Policy and Special Topics; and 549, Systems Policy.

BUSINESS ADMINISTRATION CONCENTRATIONS
For complete listing of MBA and Ph.D. program requirements, see Business Administration.

MBA Concentration
Controllership: The concentration in controllership provides added accounting skills appropriate for those seeking employment in the controllership or general management functions of a variety of organizations. Although the controllership concentration provides broad preparation for the Certified Management Accountants' examination, it is not designed to meet the minimum educational requirements to take the Certified Public Accountants' examination.
Minimum Course Requirements for MBA: 504, 505, 522, 541.

Ph.D. in Business Administration Concentration

This degree provides a research-oriented terminal qualification for those seeking entry-level faculty positions at universities in accounting education and research. Students take approximately three years to complete this program beyond the bachelor's degree, including a doctoral sequence designed to expose students to various areas of accounting research. Courses in accounting and other areas are selected to supplement the student's individual background and to prepare the student in an area of accounting specialization (financial, managerial, auditing, tax or systems). The final year is normally spent completing the doctoral dissertation.

Minimum Course Requirements for Ph.D.: 12 hours including 611, 612, 619, and one other accounting course to be approved by Ph.D. (accounting) program advisor.


502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeatable. S/NC only. E.

503 Managerial Accounting (3) Concepts and analyses relevant to internal decision-oriented users of accounting information for planning, decision-making, controlling, and product costing. Prereq: 501.


505 Taxation for Business Decisions (4) Conceptual framework and analysis of current issues in taxation; impact on use and management of financial and investment information applied to individual, corporate, partnership, and fiduciary taxpayers. Prereq: 504 and Finance 501.


512 Selected Topics in Current Accounting Theory and Practice (3) Critical in-depth consideration of current research or alternative solutions to emerging topics. Prereq: 511.

513 Seminar in Advanced Auditing (3) Theory and concepts underlying application of philosophy of auditing to current auditing issues. Prereq: 411.

519 Seminar in Accounting and Auditing Research (3) Problem-oriented research design in financial accounting and auditing. Research methodologies and approaches to particular research questions. Research project. Prereq or coreq: 512 and 513.

521 Seminar in Advanced Managerial Cost Accounting (3) Analysis of conceptual and current issues; impact on development and practice of managerial and cost accounting. Approaches to management accounting, decision and control models, and planning and control under conditions of uncertainty. Prereq: 321.

522 Budgetary Planning and Control Systems (3) Alternative approaches to formulation and use of planning and control systems to meet organizational objectives. Control systems and corporate structure, discretionary expense centers, profit centers, transfer pricing, and control in manufacturing, service, and not-for-profit organizations. Prereq: 321 or 503.

531 Tax Research and Planning (3) Development of expertise in tax research utilizing authoritative sources of tax law and advanced study of tax alternatives available to minimize tax liability compatible with achieving taxpayer objectives. Prereq: 431.

532 Corporate Taxation and Reorganizations (3) Organization and structure, distributions, liquidations, reorganizations, and special problems in taxation of corporations and shareholders. Prereq or coreq: 531.

533 Taxation of Partnerships and S Corporations (3) Formation, operation, termination, and other special problems of partnerships. Election for S Corporations, and comparison of partnerships and S Corporations. Prereq or coreq: 531.

534 Unified Estate and Gift Transfer Taxation (3) Taxation of wealth transfers; transfers at death, inte vivos transfers, and generation skipping transfers. Income taxation of estates and trusts. Determination and payment of state and federal wealth transfer and income taxes. Prereq: 431.

539 Tax Policy and Special Topics (3) Basic concepts of tax policy, current issues in tax policy, and selected topics in taxation. Topics vary. Prereq: 531. Prereq or coreq: 532. 533.

541 Database Systems (3) Design, implementation, and use of database systems for collection, organization, and distribution of economic information about organization. Prereq: 312 or 501; 321 or 503; 341 or Business Administration 506.

542 Systems Analysis and Design (3) Analysis and design of information systems for management and distribution of economic information about organizations. Prereq: 541.

543 Systems Policy (3) Seminar in emerging topics in management systems and knowledge-based systems. Prereq: 541. Prereq or coreq: 542.

590 Seminar in Advertising Issues (3) Salient issues in advertising, response functions. Prereq: Consent of instructor or admission to program. Sp.

593 Individual Research in Accounting (3) Directed research in topic of mutual interest. Prereq: Consent of M.Acc program advisor. May be repeated. Maximum 6 hrs.

594 Graduate Seminar in Accounting (3) Topics vary. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only. E.

611-12 Doctoral Seminar in Accounting (3-3) Analysis of issues reflected in accounting literature. Prereq: Consent of Ph.D. program advisor.

619 Doctoral Research in Accounting (3) Study of research methodology and application of various research methods in accounting literature. Prereq: Consent of Ph.D. program advisor.

621-22 Accounting Colloquium (1,1) Research and discussion of contemporary issues in practice of accounting. Prereq: Consent of Ph.D. program advisor. May be repeated. S/NC only.

Business Law

Professors:

B. D. Fisher, L.L.M George Washington;
M. L. Townsend, J.D. Tennessee (Emeritus).

Associate Professor:


501 Legal, Ethical, and Societal Environment (3) Legal/ethical environment: recognized sources of jurisprudence (legislative, judicial, executive), sources of law, anatomy of civil and criminal lawsuits; how regulations are made and enforced; constitutional rights and duties of business; antitrust law; Federal Trade Commission; product liability; consumer protection; employer-employee relations, securities regulation, environmental law, and international business law.

Advertising

( College of Communications)

MAJOR DEGREE

Communications..................................................M.S.

Ronald E. Taylor, Head

Associate Professors:

D. Jackson, M.S. Tennessee; R. E. Taylor, Ph.D. Illinois.

Assistant Professors:

R. Howland, Ph.D. Illinois; M. J. Stanley, Ph.D. Illinois.

Instructor:

D. Kerr, M.A. North Carolina.

The Department of Advertising offers a concentration area for the Master's with a major in Communications. See Communications for additional information.

490 Special Topics (3) Topics vary: advanced media strategy, advanced creative strategy, direct marketing, and advertising and social issues. E.

510 Advertising and Society (3) Analysis of advertising as an institution in free-enterprise democratic society and its relation to social, legal, cultural, and economic institutions. F.

520 Advertising and Communications Theory (3) Application of contemporary communications theories of attitude change, information-processing, and persuasion as applied to creative strategy decisions. Prereq: Consent of instructor or admission to program. F.


546 Advertising Planning (3) Analysis of decision-making in budgeting, creative strategy, media strategy, research, evaluation, and agency-client relationships. Advertising response functions. Prereq: Consent of instructor or admission to program. Sp.

590 Seminar in Advertising Issues (3) Salient issues in advertising. Topics vary. Prereq: Consent of instructor or admissions to program. May be repeated. Maximum 6 hrs. Su.

597 Independent Study (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E.

598 Internship (3) Professional work in advertising supervised by advertising manager with faculty approval. No retroactive credit for previous work experience. Prereq: Completion of core courses. Su.
Aerospace Engineering
See Mechanical and Aerospace Engineering

Agricultural and Extension Education (College of Agriculture)

MAJOR DEGREE
Agricultural and Extension Education...M.S.
Roy R. Lessly, Head

Professors:
Cecil E. Carter, Ph.D. Ohio State; Lewis Dickson, Ed.D. Cornell.

Associate Professors:

The Department of Agricultural and Extension Education offers a program leading to the Master of Science degree with a major in Agricultural and Extension Education. The program is designed primarily for teachers of Vocational Agriculture and staff employed by the Agricultural Extension Service. However, due to the flexibility of the program, it would be of value to any student interested in agriculture or adult and continuing education. The program may be completed under a thesis or non-thesis option with a concentration in either agricultural education or agricultural extension education. Candidates for the Master's degree must meet the general requirements of The Graduate School and those stipulated by the department.

THE MASTER'S PROGRAM

Thesis Option
A candidate for the Master's degree who elects the thesis option must successfully complete:
1. A minimum of 30 hours of graduate credit in courses approved by the student's advisory committee. Only 6 hours of thesis credit in courses numbered at or above the 500 level.
2. A minimum of 24 hours of graduate credit in courses numbered at or above the 500 level.
3. A minimum of 12 hours of graduate credit in courses appropriate to the area of concentration taught in the department and a minimum of 6 hours taught from outside the department.
4. A minimum of 3 hours of graduate credit in course work in either research methodology or statistics.
5. A creative component designed by the student and approved by the student's advisory committee for 3 hours of graduate credit.
6. A written and oral comprehensive examination.

Non-Thesis Option
A candidate for the Master's degree who elects the non-thesis option must successfully complete:
1. A minimum of 36 hours of graduate credit in courses approved by the student's advisory committee.
2. A minimum of 3 hours of graduate credit in courses numbered at or above the 500 level.
3. A minimum of 12 hours of graduate credit in courses appropriate to the area of concentration taught in the department and a minimum of 6 hours taught from outside the department.
4. A minimum of 3 hours of graduate credit in course work in either research methodology or statistics.
5. A creative component designed by the student and approved by the student's advisory committee for 3 hours of graduate credit.
6. A written and oral comprehensive examination.

411 Fundamentals of Agricultural Extension (3) History, philosophy, organizational structure, clientele served, major areas of program objectives, teaching methods, and relationships with other educational agencies. Graduate credit for non-majors only. Sp

500 Thesis (1-15) P/NP only. E & S502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

521 Extension Program Planning (2) Methods of developing county extension programs: sources of essential basic information, determination of problems and needs of people, functions of lay people and various groups of extension workers. Use of committees, step-by-step planning procedures, coordinated county and state plans and characteristics of effective programs. Prereq: 411 or consent of instructor. Sp

522 Extension Teaching Methods (2) Teaching/learning methods and techniques applicable to extension work, interrelationships and relative effectiveness. Result demonstrations, method demonstrations, meetings, tours, audio-visual aids. Prereq: 411 or consent of instructor. Sp

523 Extension Program Evaluation (2) Principles, instruments, and techniques of identifying, gathering, analyzing and using data to appraise program planning and teaching and to determine progress of clientele. Prereq: 411, 521, or consent of instructor. Sp

524 Research Methodology (3) Social research design, hypothesis testing, sampling, survey construction, scaling, interviewing, data coding, basic descriptive and relational statistics, and presentation of results. Prereq: 436, 523, or consent of instructor.

525 Curriculum Planning in Agricultural Education (3) Models, principles and procedures for developing curricula in agricultural education and scheduling learning activities for planned instructional program. Prereq: 405, 436, or consent of instructor.

526 Agricultural Education for First-Year Teachers (2) Developing competences needed by first-year teachers for planning, organizing and conducting program of vocational agriculture in local community. Group meetings in selected centers and visits by instructor. Prereq: 435, 436. Sp

527 Adult Education and Strategies for Teaching (3) Psychological, philosophical and sociological theories for adult education in agriculture; methods and strategies for organizing classes and teaching adults. Prereq: 411, 436, or consent of instructor.

528 Advanced Techniques for Teaching Agricultural Mechanics (3) Teaching techniques; determining needed competencies, organizing and managing agricultural mechanics facilities. Prereq: 435, 436 or consent of instructor.

529 Supervised Occupational Experiences in Agricultural Education (3) Historical and philosophical bases for supervised occupational experience programs and organizational patterns and procedures for conducting programs for farm and off-farm agricultural occupations. Prereq: 435, 436 or consent of instructor.

530 Special Topics in Agricultural and Extension Education (1-3) Current issues. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

531 History, Philosophy and Objectives (3) Historical and philosophical foundation of adult education in American agriculture, key figures, issues, legislative movement, farmer organizations and programs. Cooperative Extension Service, origin, legislation and growth and nature of present objectives and programs. Prereq: 411 or consent of instructor. Sp

532 Managing Extension Organizations, Programs and Personnel (3) Theory and principles of management for individual and organizational effectiveness. Prereq: 521, 531, or consent of instructor. Sp

533 Special Problems in Agricultural and Extension Education (1-4) Special research and/or special reports based on supervised independent study. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Agricultural Economics and Rural Sociology (College of Agriculture)

MAJOR DEGREES
Agricultural Economics...........M.S., Ph.D.
Joe D. Martin, Head

Professors:
M. B. Badenhop, Ph.D. Purdue; J. R. Brooker, Ph.D. Florida; C. L. Cleland, Ph.D. Wisconsin; I. Dubov, Ph.D. California (Berkeley); D. B. Eastwood, Ph.D. Tufts; L. H. Keller, Ph.D. Kentucky; T. H. Kindt (Asst. Dean), Ph.D. Kentucky; F. O. Leithold, Ph.D. Wisconsin; D. L. Mclemore, Ph.D. Clemson; B. R. McManus, Ph.D. Purdue; J. A. Martin, Ph.D. Minnesota; S. D. Mundy, Ph.D. Tennessee; B. H. Pentecost (Asst. Vice Pres.), J. D. Tennessee; W. P. Ramsey (Emeritus), Ph.D. Minnesota; C. B. Sappington, Ph.D. Illinois; T. J. Whately (Emeritus), Ph.D. Purdue.

Associate Professors:

Assistant Professors:

The Department of Agricultural Economics and Rural Sociology offers programs of graduate study leading to the Ph.D. and M.S. The doctoral program includes concentration in agricultural marketing and price analysis, agricultural policy, farm management and production economics, natural resource economics, and rural development. The M.S. program may be completed under a thesis option with concentrations in agricultural economics or rural sociology. A non-thesis option is available with a concentrat-
tion in agricultural economics only. For specific information, contact the department head.

THE MASTER'S PROGRAM

Thesis Option
A candidate for the Master's degree must complete a minimum of 30 hours of graduate credit in courses approved by the student's Master's committee. Only 6 hours of thesis may be counted toward this requirement. At least 24 hours of graduate credit must be earned in courses numbered at or above the 500 level. In the agricultural economics concentration, 12 hours of agricultural economics, 6 hours of economic theory and 6 hours of quantitative methods are required. In the rural sociology concentration, 12 hours in the department (9 hours rural sociology), 6 hours of sociological theory, 3 hours of research methods and 3 hours of statistics are required. Each student must successfully complete a final oral examination.

Non-Thesis Option
A minimum of 36 hours of graduate course work is required. At least 27 hours must be in courses numbered at or above the 500 level. The program must include a minimum of 18 hours in agricultural economics, 6 hours of economic theory, and 6 hours of quantitative methods. Each student must successfully complete both written and oral comprehensive exams.

Minor
A minor will include 6 hours of course work in the department, with at least 3 hours in 500- or 600-level courses. The student's committee must include a member of the faculty from the department who will be responsible for designating courses required for the minor.

THE DOCTORAL PROGRAM

A minimum of 78 hours of graduate credit beyond the B.S. degree, including 24 hours of dissertation research, but excluding any Master's research credit, is required. A minimum of 24 hours in agricultural economics, 15 hours of economic theory, and 9 hours of quantitative methods are required. The program must include a minimum of 8 hours in courses numbered at or above the 600 level (excluding dissertation credits).

Comprehensive exams include four written exams and one oral exam. The written exams are in general agricultural economics, economic theory, quantitative methods, and the area of concentration. Provisions exist for waiving the economic theory exam with a sufficient academic record in specific economic theory courses.

Minor
A minor will consist of a minimum of 9 hours of course work taken in the department and approved by the minor professor. At least 6 hours of credit in the minor area must be in 500- and 600-level courses.

Agricultural Economics

412 Agricultural Finance (3) Macro-finance, financial objectives, acquisition of debt and equity funds, capital investments, capital allocation, credit analysis, borrower and lender loan application analysis, insurance strategies, contracts and sources of agricultural credit, and financial intermediation. Prereq: Economics 201; junior standing or consent of instructor.

430 Agricultural and Trade Policy (3) Values, goals, and policy process; historical development and current characteristics of commodity, credit, food, and trade policy; relationship between domestic and international agricultural policy. Prereq: 510 or consent of instructor.


442 Farm Business Management II (3) Advanced topics and methods for farm business analysis using micro and mainframe computers; linear programming applications in farm planning; spreadsheet analysis of whole farm business; systems analysis and management control; risk analysis and management; income tax management; farm growth and intergenerational transfer. Prereq: 342.

450 Agricultural Price Analysis (3) Analysis of demand and supply mechanisms in agriculture; price determination; spatial equilibrium; temporal price patterns; pricing institutions. Prereq: 350 and Economics 311.


460 Rural Economic and Community Development (3) Historical and theoretical perspectives on problems facing rural communities; linkages between farm and nonfarm sectors; models and tools for analyzing rural development. Prereq: 210 or consent of instructor.

470 Natural Resource Economics (3) Nature of natural resources; economic efficiency as basis for natural resource use, externalities in natural resource use; factors influencing environmental quality; alternative public policy tools for influencing natural resource use or improving environmental quality. Prereq: 210 or consent of instructor.

453 Independent Study in Agricultural Economics (1-12) Directed individual or team research and report writing. Off-campus intern experience and reporting. Special courses in specific topics. Student must arrange with instructor prior to registering. Graduate credit for non-majors only. Prereq: Junior standing. May be repeated. Maximum 6 hrs. E

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

520 Research Methodology (1) Nature of scientific method and research processes; role of assumptions, hypotheses, theory and models; methodological problems of social sciences; establishing research priorities. Prereq: Consent of instructor.

522 Mathematical Programming Methods in Agricultural Economics (3) Linear, integer and quadratic programming techniques with empirical applications to problems of firm and region; profit maximization, cost minimization; transportation, risk allocation over space and time. Prereq: Consent of instructor.

524 Econometric Methods in Agricultural Economics (3) Application of statistical methods to agricultural economic models; common of supply, demand and production functions; microeconomic forecasting models; interpretation of results. Prereq: Statistics 461 or consent of instructor.

540 Advanced Agricultural Production Economics (3) Theoretical and empirical concepts in agricultural resource allocation; evaluation of both static and dynamic issues; decision theory with application to agricultural firms; aggregate impact of firm decisions on industry. Prereq: 440 or equivalent.

550 Advanced Agricultural Marketing (3) Analysis of structure, conduct and performance of agricultural marketing system; application of price theory concepts to existing circumstances in agricultural industries; examination of methods used to evaluate conduct and performance; analysis of transportation issues and location theory. Prereq: Economics 311 or consent of instructor.

560 Advanced Rural Economic Development (3) Theoretical and historical perspectives on process of economic development; analysis of role of agriculture, sectoral interdependence and trade in development; application of theory to specific development issues. Prereq: 480 or consent of instructor.

570 Advanced Natural Resource Economics (3) Analysis of natural resource allocation issues; applied welfare economics, external effects and evaluation of public policy. Prereq: 470 and Economics 511 or consent of instructor.

593 Special Topics in Agricultural Economics (1-3) Topics to be assigned. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

600 Doctoral Research and Dissertation (3-15) P/NP only. E

620 Agricultural Policy Analysis (3) Evaluation of public policy as related to agricultural industry and rural areas. Prereq: Economics 510 and 513 or consent of instructor.

640 Agricultural Supply Analysis (3) Critical evaluation of both theoretical basis and empirical procedures used for estimating agricultural supply relationships using regression techniques, production functions, mathematical programming, firm growth models and simulation in supply analysis. Prereq: 540 or consent of instructor.

650 Operations Analysis in Marketing (2) Components and functions of marketing system, levels of analysis and tools, operational efficiency, interregional competition. Prereq. 450 and 550 or consent of instructor.

652 Consumer Demand and Food Consumption (2) Simultaneity of consumer decision making; food demand. Constraints on demand. Complete demand system models. Prereq: Economics 511 and 512 or consent of instructor. S, A

660 Seminar in Rural Economic Development (2) Current topics in economic development of rural areas. Current literature; evaluation of issues in both international and domestic development. Prereq. 560 or consent of instructor. Sp, A

670 Seminar in Natural Resource Economics (2) Issues in natural resource economics. Current literature; evaluation of theory, methodology and public policy as related to allocation of natural resources. Prereq. 570 or consent of instructor. F, A

Rural Sociology

480 Diffusion of Agricultural Technology (3) Analysis of diffusion and communication processes involved in the way new technology spreads from scientists to change agents and then to farmers, innovation-decision process; communication behavior, mass media, role of professional change agents, opinion leadership and consequences of technological change. Prereq: 380 or consent of instructor. (Same as Sociology 480).

580 Advanced Rural Sociology (3) Application of sociological concepts and theory to analyze changing structure and function of rural life in U.S. and developing countries. Demographic changes, rural social and political organization, major social change agents, and rural development processes. Prereq. 380 or equivalent. (Same as Sociology 580).

593 Special Topics in Rural Sociology (1-3) Current sociological issues involving application of sociologi-
Agricultural Engineering

(Graduate School)

MAJORS

DEGREES

Agricultural Engineering ..... M.S., Ph.D.
Agricultural Engineering Technology ..... M.S.

D. Houston Luttrell, Head

Professors:


Associate Professors:

R. D. von Bernewith, Ph.D. Nebraska, P.E.; C. R. Mote, Ph.D. Ohio State, P.E.

Assistant Professor:

D. O. Baxter, M.S. Missouri.

Graduate programs leading to the Master of Science and Doctor of Philosophy with a major in Agricultural Engineering are available to graduates of a recognized curriculum in engineering, mathematics, or one of the physical or biological sciences. A graduate program leading to the Master of Science in Agricultural Engineering Technology is available to graduates in a recognized curriculum in agriculture or other related fields. Each applicant will be advised of any prerequisites 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.

A completed departmental data sheet and three completed Graduate School Rating Forms are required in addition to the Graduate School application.

THE MASTER'S PROGRAMS

Agricultural Engineering Requirements

1. A total of at least 24 hours credit in graduate course work in agricultural engineering and related areas. The minimum requirements are 12 hours in agricultural engineering; 9 hours in other engineering, mathematics, physical or biological sciences; and 6 hours required for the degree may be taken in agriculture or related fields. Each applicant will be advised of any prerequisites 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.

2. Active participation in graduate seminars conducted by the department. Resident students must register for a minimum of 2 hours in Agricultural Engineering 610 and must attend the graduate seminar each semester whether registered or not.

3. A Master's thesis comprising at least 6 hours of Agricultural Engineering 500.

4. A final oral examination covering the thesis, related areas, and graduate course work.

Agricultural Engineering Technology Requirements

1. A total of at least 24 hours in graduate course work in Agricultural Engineering Technology and related areas. Minimum requirements are 12 hours in agricultural engineering technology, 9 hours in other agricultural, business, physical and biological science, or engineering-related areas (as approved by the graduate committee) and 3 optional hours from either one of these categories.

2. Active participation in graduate seminars conducted by the department. Resident students must register for a minimum of 2 hours in Agricultural Engineering Technology 530 and must attend the graduate seminar each semester whether registered or not.

3. A Master's thesis comprising at least 6 hours of Agricultural Engineering Technology 500.

4. A final oral examination covering the thesis, related areas, and graduate course work.

5. A minor in another subject area can be included in the program.

THE DOCTORAL PROGRAM

Concentrations for the doctoral program in Agricultural Engineering include agricultural power and machinery, agricultural structures and environment, agricultural electrical and electronic systems, food and process engineering, and soil and water conservation engineering. Students applying for entrance into the doctoral program must submit 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. Scores on the GRE aptitude and engineering tests also are required.

Departmental Requirements

1. A minimum of 72 hours credit beyond the Bachelor's degree, excluding credit for the Master's thesis. Of this, 24 hours must be 600 Doctoral Research and Dissertation. Two hours in Agricultural Engineering 510 are required in addition to the Graduate School application.

2. Graduate courses in agricultural engineering comprising a minimum of 18 hours credit.

3. Supporting graduate courses (outside the Agricultural Engineering Department) in related engineering, agricultural, mathematical, and other scientific fields comprising at least 24 hours. The remaining minimum of 6 hours required for the degree may be taken either in agricultural engineering or related fields.

4. A minimum of 24 hours from course work numbered greater than 500, of which at least 9 hours must be in courses numbered greater than 600.

5. Active participation in graduate seminars conducted by the department. Resident students must register for a minimum of 2 hours in Agricultural Engineering 610 and must attend the graduate seminar each semester whether registered or not.

6. Satisfactory performance in both written and oral comprehensive examinations prior to admission to candidacy. A final oral examination also is required which includes a defense of the dissertation and subject matter that the student's graduate advisory committee considers appropriate.

Agricultural Engineering

430 Mobile Hydraulic Power System Design (2) Functional and operational characteristics of mobile hydraulic system components; pumps, valves and actuators; analysis and synthesis of power transmission and control circuits. Prereq: Engineering Science and Mechanics 341. 1 hr and 1 lab. Sp, A

435 Design of Mechanisms for Agricultural Machines (2) Types of mechanisms; transmission angles; synthesis of plane mechanisms; introduction to space mechanisms. Prereq: Mechanical Engineering 465 or equivalent. 1 hr and 1 lab. Sp, A

440 Irrigation and Drainage Design (2) Design of irrigation and drainage systems; crop response, climate, water quantity and quality, and system characteristics. Prereq: 340 or equivalent. 2 hrs and 1 lab. Sp, A

445 Processing and Materials Handling Design (2) Development of equipment for process utilization and product characteristics, engineering, and heat balance, storage, handling, and economic merit. Prereq: 330. 1 hr and 1 lab. Sp, A

450 Electrical Distribution and Utility Design (2) Design of on-farm electrical systems, control, motors, stray voltage, special electrical loads, and safety. Prereq: Electrical Engineering 301. 1 hr and 1 lab. Sp, A

455 Waste Management System Design (2) Waste renovation principles and livestock waste handling techniques; problem definition, feasibility study, analysis, synthesis, and preparation of plans and specifications. Prereq: Engineering Science and Mechanics 341, Plant and Soil Science 210, Industrial Engineering 405, English 459. 1 hr and 1 lab. Sp, A

460 Design of Agricultural Structures (2) Design fundamentals for wood, steel and concrete components, compression and tension members; beam and column design; pile structure design; fasteners and joint design. Prereq: 320. 1 hr and 1 lab. Sp, A

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E

510 Similitude in Design and Research (3) Dimensional analysis; governing equations; theory of models; true, distorted, dissimilar models; prediction equations; interpretation of data; relations to machinery, and water structures, agricultural buildings, and other agricultural engineering related problems. Prereq: Engineering Science and Mechanics 321, 341. 2 hr and 1 lab. F, A

520 Agricultural Engineering Instrumentation (3) Modern instrumentation techniques. Static and dynamic response of instrumentation; signal conditioning; temperature, moisture, optical radiation, displacement, strain, pressure, velocity, acceleration, and flow measurements; digital data acquisition and control. Prereq: 410 or equivalent. 2 hrs and 1 lab. Sp, A

530 Research Problems in Agricultural Engineering (1-3) Theoretical and experimental studies relating to current problems in agricultural engineering. May be repeated. Maximum 6 hrs. E

600 Doctoral Research and Dissertation (3-15) P/NP only. E

610 Seminar (1) Current research and literature. May be repeated. Maximum 3 hrs. E

620 Computer Simulation of Agricultural Systems (3) Scientific approach to digital simulation; system definitions and boundaries, formulation of models,
552 Seminar (1) Current research and literature relat-
ed to agricultural production technology. May be repeated. Maximum 3 hrs. E

552 Selected Topics in Agricultural Engineering Tech-
nology (1-3) Current trends and problems in agricultural production technology. May be repeated. Maximum 6 hrs.

Agriculture

(College of Agriculture)

512 Teaching Internship in Agriculture (1) Super-
vised experience in teaching: test preparation and evaluation of agriculture students. May be repeated. Maximum 2 hrs for M.S. students; 4 hrs for Ph.D. students.

Animal Science

(College of Agriculture and College of Veterinary Medicine)

MAJOR DEGREES

Animal Science ........................................ M.S., Ph.D. Veterinary Medicine ........................................ D.V.M.

Don O. Richardson, Head

Professors:

K. M. Barth, Ph.D. Rutgers; M. C. Bell (Emeritus), Ph.D. Oklahoma State; J. K. Blatner (Emeritus), Ph.D. Ohio State; C. C. Chamberlain (Emeritus), Ph.D. Iowa State; B. H. Erickson, Ph.D. Kansas State; O. G. Hall (Dean), Ph.D. Iowa State; S. L. Harsand (Emeritus), Ph.D. Florida; E. R. Lidvall, M. S. Tennessee; T. P. McDonald, Ph.D. Tennessee; J. B. McLaren, Ph.D. Auburn; G. M. Merriman (Emeritus), D.V.M. Michigan State; J. K. Miller, Ph.D. Georgia; M. J. Montgomery, Ph.D. Wisconsin; R. L. Murphee (Emeritus), Ph.D. Wisconsin; D. O. Richardson, Ph.D. Ohio State; H. V. Shirley, Ph.D. Illinois; R. R. Shrode, Ph.D. Iowa State; R. L. Tugwell (Emeritus), Ph.D. Kansas State.

Associate Professors:


Assistant Professors:

G. A. Baumbach, Ph.D. Florida; B. R. Bell, Ph.D. North Carolina State; A. B. Chestnut, Ph.D. Illinois; W. C. Cullen, Ph.D. Minnesota; J. D. Godkin, Ph.D. Massachusetts; S. P. Oliver, Ph.D. Ohio State; S. E. Orosz, D.V.M., Ph.D. Ohio State; J. D. Smalling, Ph.D. Texas A & M.

Animal Science

The Department of Animal Science offers graduate programs leading to the Master of Science and Doctor of Philosophy in Animal Science. At the M.S. level, areas of concentration are nutrition, breeding, physiology (reproductive, mamma-
ry, and metabolic), and management with orientation towards beef cattle, dairy cattle, swine, and poultry. Since this department is also a part of the College of Veterinary Medicine, the areas of anatomy, systemic physiology (blood, cardiovascular, and neural), and histology are also available. The Ph.D. program offers concentrations in animal nutrition, animal breeding, animal physiology, animal anatomy, and animal management. For specific information, con-
tact the department head.

During the first term of matriculation in each degree program, all graduate students are required to enroll in 595. Students are also required to enroll in 596 each fall term, and in 597 each spring term.

THE MASTER'S PROGRAM

For admission to the M.S. program, a student must have obtained a 3.0 grade point average on a 4.0 scale during the junior and senior years in a com-
pleted undergraduate degree program in one of the animal sciences or in a related area. The student must submit evidence (letters of recommendation, personal interview, etc.) that indicates ability to complete require-
ments for the M.S. Prerequisite courses may be required if the student has insufficient undergraduate background. If the student has an unsatisfactory grade point average, acceptance may be on a probationary (non-
degree) basis and a minimum of 12 hours of graduate course work must be completed the first term with a minimum grade point average of 3.0 for admission to the M.S. pro-
gram.

The program requires the writing of a thesis based on original research; the com-
pletion of a minimum of 24 hours of graduate course work, of which at least 14 hours must be taken in courses numbered at or above the 500 level; and a minimum of 6 hours of thesis. Included in the course requirement are 4 hours of Agricultural 512, a minimum of 3 hours in statistics. These statistics courses must be chosen from the 400, 500, or 600 level of courses approved for use in the Intercollegiate Graduate Statistical Pro-
gram (ICGSP). The remainder of the course work will be selected jointly by the student and the major professor depending on the student's area of concentration and profes-
sional objectives.

The advisory committee will consist of the major professor, a faculty member of Animal Science, who will act as chairperson of the committee, and a minimum of two other fac-
ulty members, one of whom may be outside of the Animal Science Department. The advisory committee approves the student's course work and research problem and conducts the final oral examination which consists of a comprehensive oral examination and a defense of the thesis.

THE DOCTORAL PROGRAM

The doctoral program requires a minimum of 48 semester hours of course work beyond the B.S. and a minimum of 24 hours of doc-
toral research and dissertation. Students must present their M.S. thesis research, their dissertation proposal, and the completed dis-
sertation research in the departmental seminar. The 48 hours of course work must include:
1. A minimum of 16 hours in related fields outside Animal Science.
2. At least 24 hours credit at the 500 and 600 level, exclusive of doctoral research and dissertation, of which a minimum of 6 hours must be at the 600 level. Students in the nutrition, breeding, physiology, or anatomy concentration must complete at least 12 hours at the 500 and 600 level in the respective concentration or closely related area. Students in the management concentration must complete Animal Science 581 and 9 hours at the 500 or 600 level in two non-management concentrations for a total of 12 hours (including 581).
3. A minimum of 1 hour of Agriculture 512 in addition to that required at the M.S. level.
4. A minimum of 6 hours in 400-, 500-, or 600-level statistics courses approved for the ICSP.

A minimum of five faculty members will constitute the student's advisory committee, of which at least one must be outside Animal Science. The major professor will be the chairperson. The student and the major professor select a program of study depending on the student's area of concentration and professional goals. The advisory committee approves the course work and the dissertation research proposal and determines if there is to be a foreign language requirement. The advisory committee determines the comprehensive written and oral examination and the final dissertation defense examination.

**481 Beef Cattle Production and Management (3)** Integration of principles of nutrition, physiology, and breeding into complete beef cattle management programs. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives evaluated: production response and economic returns. Prereq: Animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab. Sp

**482 Dairy Cattle Production and Management (3)** Integration of principles of nutrition, physiology, and breeding into complete dairy cattle management programs. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives evaluated: production response and economic returns. Prereq: Animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab. Sp

**483 Pork Production and Management (3)** Integration of principles of selection, nutrition, breeding, physiology, and marketing into complete pork production and management program. Structure of industry, enterprise establishment, systems of production, production practices, and herd improvement program. Alternatives evaluated: production responses and economic returns. Prereq: Animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab. F

**484 Poultry Production and Management (3)** Structure of poultry enterprises: rearing, housing, feeding, processing, marketing. Prereq: Animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab. F

**486 Lamb and Wool Production and Management (3)** Integration of principles of selection, nutrition, breeding, physiology, and marketing into complete lamb and wool production and management programs. Structure of industry, enterprise establishment, systems of production, production practices and economics. Alternatives evaluated: production responses and economic returns. Prereq: Animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab. Sp

**500 Thesis (1-15)** P/NP only. E

**502 Registration for Use of Facilities (3-15)** Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

**511 Special Problems in Animal Science (1-4)** Prereq: Consent of instructor and department head. May be repeated. Maximum 9 hrs. E

**523 Advanced Mammalian Reproduction (3)** Current topics and new 'frontiers' in reproductive biology. Prereq: 322. Sp/A

**524 Advances in Mammary Physiology (3)** Development, anatomy, and function of mammary glands; endocrine interactions associated with mammary development and function; factors affecting yield and composition of mammary secretions. Prereq: 322 or consent of instructor. Sp/A

**531 Analytical Techniques in Animal Sciences (3)** Physical and chemical analyses of feeds, ingredients, tissues, and biological fluids associated with nutrition, physiology, and food products research. Prereq: Consent of instructor. 1 hr and 2 labs. F

**532 Experimental Techniques in Animal Nutrition (3)** Animal experimental techniques and concepts for growth, digestion, balance, tracer studies. Prereq: 531. 1 hr and 2 labs. Sp

**533 Nonruminant Animal Nutrition (3)** Physiological development in digestive system of nonruminant animal during the life cycle. Concepts and methodology concerning nutrient intake, relationship, availability and deficiencies of nutrients. Nonnutritive additives and environmental effects on nutrient utilization; nutrition of nonruminant products. Prereq: 322 or consent of instructor. F

**534 Ruminant Animal Nutrition (3)** Digestive physiology of ruminant stomach, rumen fermentation, determination of nutrient requirement and feed intake regulations of ruminant animals. Prereq: 332. F

**541 The Genetics of Populations (2)** Application and extension of principles and concepts learned in basic genetics, breeding and statistics to convey useable comprehension of the genetics of populations. Prereq: Basic courses in genetics, breeding and statistics. 1 hr and 1 lab. F/A

**542 Applied Animal Breeding (3)** Procedures for estimating population parameters, determination of response to various selection methods and breeding system, estimation of genetic and phenotypic interaction among metric traits, estimation of breeding values, optimum genetic improvement and strategies for simultaneous altering several genetic, industrial application of animal breeding methodology. Prereq: 541 or equivalent. Sp/A

**571 Design and Analysis of Biological Research (3)** Experimental design and procedures; selection of experimental units and methods of data collection and interpretation of data; statistical models and contrasts, analyses of variance: covariates, treatment arrangements, mean separation, and regression. Prereq: Plant and Soil Science 471 or equivalent; knowledge of software package on micro- or mainframe computer. (Same as Plant and Soil Science 571.) Sp

**572 Least-Squares Analysis (2)** Least-squares estimation and hypothesis testing procedures for linear models with possible singular covariance structures; analysis and interpretation of data; statistical models and contrasts, analyses of variance: covariates, treatment arrangements, mean separation, and regression. Prereq: 541 or equivalent. 2 hrs and 1 lab. F

**573 Intermediate Statistical Computing (2)** Application of statistical procedures to analysis and handling of data using computer, including sampling surveys and hardware, statistical analysis methods with high speed digital computers. Prereq: 521 or equivalent; knowledge of programming languages such as mainframe and software package. 2 hrs and 1 lab. F

**581 Advanced Livestock Management (3)** Objective functions to evaluate alternative livestock management policies. Systems approach to analysis and integration of reproductive management programs, genetic improvement policies, alternative feeding systems, programs, considerations of time, risk, and uncertainty in livestock production. Tools, linear programming, as aids in decision-making and resource allocation. Prereq: Management, economics, computer science, statistics. 2 hrs and 1 lab. F

**585 Colloquium in Animal Science (1)** Orientation; teaching, research and extension programs. Guidance in preparation of student's course of study and research plans. Required of beginning graduate students in animal science program. S/NC only. E

**590 Discipline Oriented Seminar (1)** Required of all animal science graduate students. Presentations: animal breeding, animal nutrition, animal physiology, animal management or animal anatomy. May be repeated. Maximum 5 hrs. S/NC only. F

**597 Commodity Oriented Seminar (1)** Required of all animal science graduate students. Presentations: beef and sheep, dairy, poultry, swine and veterinary sessions. May be repeated. Maximum 5 hrs. S/NC only. Sp

**600 Doctoral Research and Dissertation (3-15)** P/NC only. E

**621 Advanced Topics in Animal Physiology (1-4)** Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs. E

**631 Advanced Topics in Animal Nutrition (1-4)** Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs. E

**632 Advanced Energy-Protein Nutrition (4)** Chemical forms, digestion, absorption, intermediary metabolism, deficiencies, excesses and interaction of minerals and vitamins. Prereq: 533 or 534, and Biochemistry 410 or Nutrition 511 or consent of instructor. F/A

**633 Advanced Mineral-Vitamin Nutrition (4)** Chemical forms, digestion, absorption, intermediary metabolism, deficiencies, excesses and interaction of minerals and vitamins. Prereq: 533 or 534, and Biochemistry 410 or Nutrition 511 or consent of instructor. F/A

**641 Advanced Topics in Animal Breeding (1-4)** Advances and concepts, research techniques, current problems. Prereq: 542 or equivalent. May be repeated. Maximum 6 hrs. E

**642 Quantitative Breeding Research Methods and Interpretation (2)** Estimation of genetic parameters: phenotypic, genetic, and environmental correlations; repeatability; heritability; and selection indexes from simulated and actual data. Prereq: 542. 1 hr and 1 lab. Sp/A

**671 Advanced Research Planning (3)** (Same as Plant and Soil Science 671).*

**681 Advanced Topics in Animal Management (1-4)** Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs. E

**Animal Science-Veterinary Medicine**

See Veterinary Medicine for program description.

**PROFESSIONAL COURSES**

**821-22 Anatomy I/II (4,4)** Gross and applied anatomy: neural structures of common domestic animals: dog, cat, horse, cow. Dissection of embalmed specimens, prostections, slides, models, and living animals.

**823-24 Physiology I/II (4,4)** Introduction to concepts and problems in physiology which form basic for clinical observations and for formal training in pharmacology, medicine, pathology, and surgery. Cellular, neural, cardiovascular, renal, respiratory, digestive, endocrine, and reproductive physiology.

**Anthropology**

(College of Liberal Arts)

### MAJOR DEGREES

**Anthropology**  
M.A., Ph.D.

**William M. Bass, Head**

**Professors:**  
W. M. Bass, Ph.D. Pennsylvania;  

**Associate Professors:**  
J. E. Harrison, Ph.D. Syracuse; B. J. Howell, Ph.D. Kentucky; W. E. Klippel, Ph.D. Missouri; M. H. Logan, Ph.D. Pennsylvania State; G. F. Schroedi, Ph.D. Washington State.

**Instructor:**  
M. A. Bass (part-time), Ph.D. Kansas State.

**Research Associate Professor:**  

**Research Assistant Professors:**  
M. O. Smith, Ph.D. Tennessee; S. D. Tardif, Ph.D. Michigan State.

### 501 Special Topics in Anatomy and Physiology of Domestic and Laboratory Animals (1-4) May be repeated. Maximum 6 hrs. E

### 502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

### 521 Animal Physiology (4) Introduction to major body systems and interrelationships: nervous, muscle, blood, cardiovascular, kidney, respiratory, gastrointestinal, and endocrine. Concepts of metabolism, temperature regulation, and acid-base balance. Prereq: General undergraduate anatomy and physiology, and biochemistry, or consent of instructor. 3 hrs and 1 lab.

### 551 Mammalian Organology (3) Microscopic study of structure of organs and major organ systems. Prereq: Embryology, histology and/or consent of instructor. 2 hrs and 1 lab. Sp

### 552 Anatomy of Domestic Carnivores (4) Gross dissection by systems and regions of dog with comparison to cat. Prereq: Consent of Instructor. 1 hr and 3 labs. F

### 553 Anatomy of Farm Animals (3) Gross dissection by regions of horse, cow and pig with lecture/demonstration. Prereq: 552 and or consent of instructor. Sp

### 554 Comparative Hematology (3) Morphology, physiology and development of blood and blood forming organs; similarities and differences of major domestic and laboratory species. Prereq: Undergraduate physiology and/or consent of instructor. 2 hrs and 1 lab. Sp A

### 555 Anatomy of the Central Nervous System (1) Gross and microscopic anatomy of mammalian brain and spinal cord using sheep as model. Prereq: Consent of instructor. Sp A

### 651 Advanced Topics in Animal Anatomy (1-4) Current and future research methodology, laboratory situation, recent advances in quantitative techniques for gross and microscopic anatomy. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

### 652 Disorders of the Endocrine System (2) Pathological, physiological, and anatomical aspects of diseases; endocrine glands of various animal species. Prereq: 521 or consent of instructor. Sp

### 653 Advanced Mammalian Neurophysiology (3) Advanced physiological theories and principles related to function and dysfunctions of central and peripheral nervous systems. Special senses and current electrodagnostic procedures for evaluating neural systems. Prereq: Advanced course in animal physiology or equivalent and an advanced neuroanatomy course, or Psychology 526, and consent of instructor. Sp A

### 401 Principles of Cultural Anthropology (3) Exploration and illustration of major concepts, theories, and methods in cultural anthropology, with application to specific ethnographic situations. Prereq: 130.

### 411 Linguistic Anthropology (3) Basic linguistic concepts applied to research in cultural anthropology; investigation of relationships between language and culture. Prereq: 130 or Linguistics 200. (Same as Linguistics 411.)

### 412 Folklore in Anthropology (3) Introduction to anthropological study of folklore, using folklore and folkloric materials from various tribal, peasant, and complex societies. Prereq: 130 or consent of instructor.

### 413 Dynamics of Culture (3) Major forms of culture change, ranging from evolution and diffusion to religious revitalization and political revolt. Continuity and change in diverse cultural settings through use of archaeological, ethnographic, and contemporary cases. Prereq: 130.

### 440 Cultural Ecological (3) Concepts and methods in cultural anthropology, with application to specific ethnographic situations. Prereq: 130, 140, 410, or consent of instructor.

### 450 Current Trends in Anthropology (3) Analytical, integrative review of current directions of research and theory in anthropology.

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**Fields of Instruction/Anthropology**

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**Graduate Research Associate Professor:**  
M. C. Wheeler (part-time), Ph.D. Yale.

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**DEGREES**

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**MAJOR**

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**William M. Bass, Head**

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**Professors:**  

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**Associate Professors:**  
J. E. Harrison, Ph.D. Syracuse; B. J. Howell, Ph.D. Kentucky; W. E. Klippel, Ph.D. Missouri; M. H. Logan, Ph.D. Pennsylvania State; G. F. Schroedi, Ph.D. Washington State.

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**Instructor:**  
M. A. Bass (part-time), Ph.D. Kansas State.

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**Research Associate Professor:**  

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**Research Assistant Professors:**  
M. O. Smith, Ph.D. Tennessee; S. D. Tardif, Ph.D. Michigan State.

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**The Department of Anthropology offers both the M.A. and Ph.D. degrees with concentrations in biological anthropology, archaeology, cultural anthropology, and zoological anthropology.** Additional information on the Anthropology graduate program may be obtained from the departmental brochure or by contacting the Anthropology Department.

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**THE MASTER’S PROGRAM**

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**M.A. Requirements**

1. A minimum of 30 hours for graduate credit. A minimum of 24 of these hours must be in anthropology, including the following:
   a. 510 and 560
   b. one of the following courses: 512, 513, 514, 515
   c. one of the following courses: 520, 531, 561, 564
   d. two of the following courses: 580, 581, 582, 583.

   These requirements must be met prior to taking the Graduate Evaluation Examination.

2. Successful completion of the departmentally developed Graduate Evaluation Examination (GEE). It is expected that it will be taken at the end of the third semester in residence. The GEE is given each year in January.

3. An introductory statistics course (usually Statistics 531) if such a course has not been previously taken.

4. Successful completion of the thesis and final oral examination.

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**THE DOCTORAL PROGRAM**

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An incoming student should possess an M.A. in Anthropology. Students with an M.A. in another discipline may be admitted after completing specific requirements outlined in the departmental brochure. In addition to the requirements prescribed by The Graduate School for the Ph.D., the Anthropology Department requires the following:

1. Formation of an advisory committee and establishment of a program of study in consultation with the committee.

2. No minimum credit hour requirement. Specific courses to be taken are determined by students and their advisory committees. Students should plan to devote a minimum of 4 years beyond the B.A. to attain the Ph.D.

3. Demonstration of competence in statistics by completing Statistics 531 and 532 with a grade of B or better.

4. Demonstration of knowledge of one foreign language. This language should normally be French, German, Russian or Spanish, but another language may be substituted at the committee's discretion. This requirement may be met by:
   a. Successful performance on a language examination administered by the appropriate language department. Students electing this alternative should consult with their advisor.
   b. Completion of the intermediate (200-level) sequence of a language with a grade of B or better in the second semester.
   c. Completion of the second semester of specialized reading courses for graduate students with a grade of B or better.

5. Written and oral comprehensive examinations in three areas of specialization to be determined by the committee.


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**410 Principles of Cultural Anthropology (3) Exploration and illustration of major concepts, theories, and methods in cultural anthropology, with application to specific ethnographic situations. Prereq: 130.**

**411 Linguistic Anthropology (3) Basic linguistic concepts applied to research in cultural anthropology; investigation of relationships between language and culture. Prereq: 130 or Linguistics 200. (Same as Linguistics 411.)**

**412 Folklore in Anthropology (3) Introduction to anthropological study of folklore, using folklore and folkloric materials from various tribal, peasant, and complex societies. Prereq: 130 or consent of instructor.**

**413 Dynamics of Culture (3) Major forms of culture change, ranging from evolution and diffusion to religious revitalization and political revolt. Continuity and change in diverse cultural settings through use of archaeological, ethnographic, and contemporary cases. Prereq: 130.**

**440 Cultural Ecological (3) Concepts and methods in cultural anthropology, with application to specific ethnographic situations. Prereq: 120, 130, 410, or consent of instructor.**

**450 Current Trends in Anthropology (3) Analytical, integrative review of current directions of research and theory in anthropology.**

**460 Selected Topics in Archaeology (3) Regional or theoretical issues in archaeology for undergraduate students. Practical experience in laboratory study of archaeological materials. Prereq: 120 or consent of instructor. May be repeated. Maximum 6 hrs.**

**461 African Prehistory (3) African cultural history from earliest evidence of human activity to time of European contact. Stone age of African south of Sahara. Prereq: 120 or consent of instructor.**

**462 Early European Prehistory (3) Origins and evolution of human culture in Europe through beginnings of settled life. Paleolithic and Mesolithic chronology and lifeways. Prereq: 120 or consent of instructor.**

**463 Rise of Complex Civilizations (3) Development of complex societies in Old World from origins of agricultural economics to rise of States. Mesolithic, Neolithic, and Metal Age lifeways in Africa, Europe, and Asia. Prereq: 120 or consent of instructor.**
464 Principles of Zooarchaeology (3) Basic osteological study of human and nonhuman extinct and extant species of animals in subsistence and culture. Identification and interpretation of archaeologically derived molluscan and faunal remains; introduction to laboratory use of comparative collections. Prereq: 120 or consent of instructor.

480 Human Osteology (4) Intensive examination of human skeleton. Prereq: 110 and consent of instructor. 3 hrs and 1 lab.

481 Museology I: Museums, Purpose and Function (3) (Same as Art 481.)

482 Museology II: Exhibition Planning and Installation (3) (Same as Art 482.)

484 Museology III: Field Projects (1-12) (Same as Art 484.)


494 Primate Behavior (3) Social organization and behavior of selected primates: group composition, size, and structure; patterns of mating; other social interactions; communication; and cultural behavior. Application of primate studies to human ethology. Prereq: 110 or consent of instructor.

500 Thesis (1-15) P/NP only. E

501 Graduate Research (1-9) Independent investigation of special problems in anthropology. May be repeated. Maximum 18 hrs.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when students use University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Method and Theory in Cultural Anthropology (3) Development of primary theoretical orientations by cultural anthropologists; formulation of research problems and methods of collecting, organizing, and utilizing data. Prereq: Consent of instructor.

511 Special Topics in Cultural Anthropology (3) Seminar for advanced students on topics of special interest: ethnomedicine, psychological anthropology, comparative social organization, religion, and art. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

512 Urban Studies in Anthropology (3) Process of urbanization examined cross-culturally: theory and method in researching urban communities; urban problems and applied anthropology.

513 Rural Studies in Anthropology (3) Theory, method, and ethnographic research on selected problems and aspects of traditional agrarian groups in U.S. and peasant societies. Prereq: Cultural area course or consent of instructor.

521 Laboratory Studies in Zooarchaeology (4) Examination of skeletal materials of various prehistoric and recent species and character of species encountered in archaeological sites; use of comparative collections. May be repeated. Maximum 6 hrs.

522 Seminar in Archaeology (3) Theoretical and practical issues in contemporary archaeology: ethnoarchaeology, taphonomy, ceramic analysis, agricultural origins, and regional archaeological cultures. May be repeated. Maximum 9 hrs.

530 Fieldwork in Archaeology (3-5) Practicum in surveying, excavating, processing, and analysis of archaeological data. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

531 Quantitative Methods in Archaeology (3) Application of quantitative techniques to archaeological data critically examined through literature and problem solving. Basic and advanced statistical analyses and other mathematical methods. Prereq: Consent of instructor.

560 Theory in Archaeology (3) Detailed consideration of theory in contemporary archaeology: models of scientific explanation, research design, archaeological formation processes, and methods of analysis and interpretation.

561 Archaeological Resource Management (3) Federal legislation and regulations affecting identification, protection, and management of archaeological resources. Professional ethics and responsibilities and relationships of federal and state agencies, public interest groups, and professional archaeologists in conduct of federally sponsored archaeology. May be repeated. Maximum 6 hrs.

562 Problems in Old World Archaeology (3) (Same as Classics 562.)

563 Lithic Artifact Analysis (3) Methods for analyzing prehistoric stone tools in practical laboratory/lecture format. Stone tool production, use, stylistic variability, and discard processes.

564 Archaeology of Southeastern United States (3) Archaeological research and field schools in Southeastern United States; Tennessee prehistory.

580 Advanced Human Variation (3) Genetic and morphological variation among extant human groups; relations of variation to geography, ecology and subsistence.


583 Skeletal Biology (3) Practical and theoretical approaches to analysis of prehistoric human skeletal remains. Demography, vital statistics, pathology, nutrition, and measures of biological relationships as related to population as adaptive unit. Prereq: 480.

584 Quantitative Methods in Biological Anthropology (3) Application of statistical procedures to bioanthropological problems; interpretation of statistical results. Linear models. Prereq: Statistics 532 or equivalent.

585 Anthropometry (3) Techniques of measuring and describing skeletal material and human subjects: practical applications to growth, nutrition and human engineering. Prereq: Consent of instructor.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Advanced Graduate Research (1-6) Independent research and interpretation of anthropological data. Prereq: 480. May be repeated. Maximum 12 hrs. Only 3 hrs may count toward 600-level requirements.

610 Seminar in Cultural Anthropology (3) Selected topics primarily for doctoral students in cultural anthropology. May be repeated. Maximum 6 hrs.

611 Theory in Cultural Anthropology (3) Critical evaluation of current issues in theory and data interpretation, primarily for doctoral students in cultural anthropology.

620 Seminar in Nutritional Anthropology (3) Analytical review of major theoretical viewpoints in nutritional anthropology. Prereq: 516 and consent of instructor.

665 Advanced Seminar in Archaeology (3) Selected topics in prehistoric and historic archaeology. May be repeated. Maximum 6 hrs.

590 Selected Topics in Physical Anthropology (3) For doctoral students in biological anthropology. May be repeated. Maximum 6 hrs.

591 Selected Topics in Paleoanthropology (3) May be repeated. Maximum 6 hrs.

Architecture

(Office of the Provost)
Roy F. Knight, Dean
William J. Lauver, Associate Dean
Jon Coddington, Assistant to the Dean

Professors:

Associate Professors:
M. D. Herz, B. Arch. Columbia; S. A. Kinzy, M.Arch. Illinois; W. E. Martell, B.Arch. California (Berkeley); M. S. Moffett, Ph.D. Massachusetts Institute of Technology; V. Narancic, B. Arch. Belgrade; J. S. Rabun, M.A. Texas.

Assistant Professors:

The School of Architecture does not currently offer a graduate degree program; however, the courses listed below are available for graduate credit to students enrolled in other graduate programs.

Besides the undergraduate five-year Bachelor of Architecture degree program, the School of Architecture offers a three-year program leading to a Bachelor of Architecture to students who already hold a
Bachelor's degree or an advanced degree in another field.

This program begins with intensive initial studies in architecture and can be completed within three years. A minimum of 6 semesters' residency is required. The degree is the first professional degree recognized for purposes of eventual qualification for the license to practice architecture.

Applicants must provide a transcript of previous academic work and must have attained at least a 2.5 overall grade point average. Appropriate goals and abilities must be shown by the applicant as well.

Secondary degree students are required to submit a portfolio which demonstrates a proficiency in freehand and orthographic drawing skills prior to taking Basic Architecture. If an otherwise qualified student does not have these skills, he/she can come to the School of Architecture the summer before entering the second degree program and take an intensive drawing course which will fulfill the prerequisites.

Please consult The University of Tennessee Undergraduate Catalog for the minimum requirements of the Second Degree Program.

403 Introduction to Preservation (3) History, theory, and legal aspects of architectural preservation and restoration.

404 Preservation Technology (3) Techniques of preservation: methods of analysis, history of materials and technology used in old buildings.

405 Descriptive Analysis of Historic Buildings (3) Identification and analysis of characteristic elements of buildings from various architectural periods, American architecture. Survey techniques.

410 History and Theory of Urban Form (3) Patterns of community development. Selected historical and contemporary examples. Basic urban design issues and exemplary design approaches through lectures, readings, essays, and sketch studies. Historical change in urban form and design.

411 Architecture Since 1945 (3) Recent architectural developments and views of future.

412 Non-Western & Indigenous Architecture (3) Building responsive to climate, material availability, and economic level, as designed by anonymous builders. Prehistoric times to present throughout world. Fertile Crescent; Indus Valley; Hindu, Buddhist, and Mughal architecture of India, China, and Japan.

413 Tennessee Architecture (3) History of settlement patterns and building in Tennessee. Reading assignments, lectures, discussion, and field trips. Historical research using primary material.

414 History of Architectural Technology (3) Building materials and construction techniques from antiquity to present.

415 Medieval Architecture (3) History of architecture from decline of Rome to beginning of Renaissance.


420 American Architecture II (3) Stylistic periods from Gothic Revival through twentieth century.

421 History of Landscape Architecture (3) Intellectual, societal, and geographical influences that provide theoretical basis for design throughout history. Selected examples of landscape architecture analyzed in terms of design.

422 Modern East European Architecture (3) Twentieth-century architecture in Poland, Hungary, East Germany, Romania, Bulgaria, Yugoslavia.

426 Special Topics in History, Theory and Criticism (1-4) Special topics in history-related subjects. May be repeated. Maximum 6 hrs.


443 Building Energy Analysis (3) Balancing heat flow through external skin of residential and large and commercial buildings. Local climate evaluation. Site planning, building size and orientation, window area, wall treatment, infiltration control, and other design elements. Energy use quantification methods and economic analysis of energy efficient design features. Architectural program analysis of external and internal load dominated buildings. Prereq: 341.

444 Advanced Environmental Control Systems (3) In-depth analysis and innovative concepts in design of heating, ventilating, and air conditioning. Prereq: 341.

445 Advanced Lighting (3) In-depth analysis and innovative concepts in design of lighting. Prereq: 342.

473 Architectural Photography (3) Photography as design, research, and presentation medium. Application of photographic techniques, printing and processing. Color and black and white.

Art
(College of Liberal Arts)

MAJOR DEGREE
Art.........................M.F.A.

Don. F. Kurka, Head
William C. Kennedy, Associate Head

Professors:

Associate Professors:
P. M. Brakke, M.F.A. Yale; R. H. Daehnert, M.F.A. Wisconsin; J. F. Darrow, Ed.D. Illinois State; M. B. Goldenstein, M.F.A., Nebraska; B. Lee, M.F.A. Yale; R. LeFevre, M.F.A. Rochester Institute of Technology; F. Moffat, Ph.D. Chicago; T. J. Riesing, M.F.A.

Nebraska; S. Yates, M.F.A. North Carolina (Greensboro).

Assistant Professors:

Instructor:
D. Wilson, M.F.A. California (San Diego).

The Master of Fine Arts is the terminal degree in studio art. It is offered in the concentration areas of ceramics, graphic design/illustration, drawing, fiber-fabrics, printmaking, sculpture, and watercolor. Inter-area studies are available with consent of the faculty. In order to become a candidate, the applicant must be admitted by The Graduate School and approved by the Department of Art. In addition to the admission requirements of The Graduate School, the Department of Art specifically requires the following:

1. A detailed letter of intent.
2. Three letters of recommendation from former professors or professionals in the field.
3. An undergraduate major in art or evidence of equivalent proficiency.
4. A portfolio to be evaluated by the faculty. Application forms and further information are available by writing to the Department of Art.

M.F.A. REQUIREMENTS
A minimum of 60 hours is required:

1. Successful completion of 20 hours of study in a concentration area. An inter-area program must be approved by the graduate faculty only after the second semester in residence. Ten hours of concentration must be in second year courses (612, 514, etc.)
2. A minimum of 9 hours of art history for graduate credit.
3. Eleven hours of electives which may consist of any combination of courses offered by the University for graduate credit.

Art 599, Project in Lieu of Thesis (20 hours). A third year of semi-independent study. Student must have completed all other course work prior to registration.

4. A student with the permission of the area faculty can petition to take 3 hours of outside academies as a substitute for 3 hours of art history or 3 hours of concentration area. The petition is to be presented to the graduate committee for final approval and should directly address the need and relevance of this substitution to the student's concentration.

Four semesters beyond the Bachelor's degree are required in residence. Residence is defined by the Department of Art as (1) a minimum enrollment of 6 hours per semester and (2) use of Department of Art facilities so that students are available for discussion and criticism.

The candidate's committee will consist of a minimum of 3 members and a maximum of 6 members and will be appointed prior to registration for Art 599. Three members of the committee shall be as follows: one from the candidate's concentration area who shall be the major professor, one from art history, and one from a studio discipline outside the concentration area. Exhibition and oral examination: With the
completion of all requirements for the M.F.A., the student must produce an exhibition and, in the presence of work, must satisfactorily complete an oral examination.

ACADEMIC STANDARDS

1. First-year evaluation: At the end of the first 2 semesters in residence, the student must present a portfolio for evaluation by the faculty and receive permission to continue in the program.

2. Second-year evaluation: With completion of all course work, the student must present work for evaluation by the faculty and receive permission to register for Projects in Lieu of Thesis.

3. If, in a review by the student's major area faculty, the student's progress is deemed insufficient, the faculty may recommend a work period without advancement toward the degree, probation with specific goals set for a specific time, or dismissal.

GRADUATE MINOR IN THE HISTORY OF ART

A graduate minor in Art History may be arranged with consent of the student's committee, the instructors involved, and the Graduate School. Prerequisites are an undergraduate major in Art History or, in its equivalent, and reading knowledge of French, German, or Italian, unless waived by the Art History faculty.

401 Fiber: Advanced Projects (3-6) Prereq: 302 or consent of instructor. May be repeated. Maximum 12 hrs.

402 Fabric: Advanced Projects (3-6) Prereq: 301 or consent of instructor. May be repeated. Maximum 12 hrs.

405 Advanced Computer Enhanced Design (3) Prereq: 404 or consent of instructor. May be repeated. Maximum 6 hrs.

406 Goldsmithing (3-6) Metalsmithing techniques: granulation, electroforming, electroplating, electropolishing, anodization, and photo processes with individual studio problems to develop personal style of expression. Prereq: 6 hrs of metalsmithing or consent of instructor. May be repeated. Maximum 12 hrs.

409 Special Topics in Fiber/Fabric (3) Student- or instructor-initiated course at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

411 Drawing IV (6) Individualized pursuit of personal drawing techniques and concepts, supplemented by individual and group critiques: weekly life drawing sessions. Prereq: 311. May be repeated. Maximum 12 hrs.

413 Painting IV (6) Individual concepts and personal expression with varied media. Prereq: 313. May be repeated. Maximum 12 hrs.


419 Special Topics in Drawing and Painting (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.


424 Ceramics: Clay and Glazes (3) Clay chemistry, clay bodies, glaze theory, glaze calculation, intensive formulating, mixing, and testing of clay bodies and glaze formulas. Prereq: 321 and 322.

425 History of Ceramics Seminar (3) Ceramics from ancient through contemporary. Ceramics sculpture, and vessel aesthetic. Slide lectures and individual presentations. May not be used toward art history requirement. Prereq: 321 and 322.

426 Kilns: Design, Construction and Operation (3) Designing kilns, traditional and modern refractories, construction methods, and operation of wood, gas, and electric kilns. Prereq: 331 and 332.

429 Special Topics in Ceramics (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.


432 Special Topics in Photography (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

433 Advanced Sculpture (3-6) Individual development of sculptural problems and techniques. Prereq: 6 hrs of 300 level sculpture. May be repeated. Maximum 12 hrs.

439 Special Topics in Sculpture (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.


453 Advertising Illustration (3) Advertising illustration media and techniques as applied to product illustration. Prereq: 354.

454 Editorial Illustration (3) Editorial illustration media and techniques as applied to book, magazine, and newspaper illustration. Prereq: 453.

456 Graphic Design/Illustration Practicum (1-12) Practical experience in development of illustration field. Only by prearrangement with department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 12 hrs.

459 Special Topics in Graphic Design/ Illustration (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

462 Intaglio III (3-6) Individual projects through advanced color printing methods and combinations with other print media. Prereq: 362. May be repeated. Maximum 12 hrs.

463 Lithography III (3-6) Individual projects through advanced color etching methods from stones and aluminum plates. Prereq: 363. May be repeated. Maximum 12 hrs.


469 Special Topics in Printmaking (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

471 History of North American Art (3) Landmarks in painting, architecture, sculpture, and design from prehistory to 1900.

472 History of 20th-Century American Art (3) Development in architecture, painting, and design from 1900.

473 19th-Century American Painting (3) From West and Copley to emergence of 'The Eight.'

474 History of Modern Architecture in Europe and America (3) 19th-century styles, Sullivan and skyscraper. 20th century: Viennese leaders, the Bauhaus, Gropius, Van der Rohe, Le Corbusier, and Wright. Aalto to Kahn, Tange and Metabolism, Archigram, Soleri, and Venturi.

475 History of the 19th-Century Painting in Europe and America (3) France: Neoclassicism, Romanticism, Friedrich, Constable, Turner, Corot and Barbizon landscapists, Hudson River Group, Pre-Raphaelite Brotherhood, Manet, Courbet, Impressionism, Eakins, Homer, Seurat through Cezanne.

476 History of 20th-Century Painting in Europe and America (3) Fauvism, Die Brucke, Cubism, Der Blaue Reiter, Futurism, Dada and Surrealism, geometric abstraction, social commentary painting, Abstract Expressionism in U.S. and parallels in Europe: Pop, Op, Minimal and Concept art.

479 Special Topics in Art History (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

481 Museology I: Museums, Purpose and Function (3) Development of museums of art, history, natural and applied science. (Same as Anthropology 481.)

482 Museology II: Exhibition Planning and Installation (3) Exhibition concept development and implementation. Exhibition design and installation techniques. Publicity, production, matting and framing, shipping and storage. Prereq: 481 or consent of instructor. (Same as Anthropology 482.)

484 Museology III: Field Projects (1-12) Special field projects: restoration, preservation, registration, and other related research on or off campus. Prereq: 481 and 482. May be repeated. Maximum 12 hrs. (Same as Anthropology 484.)

485 History of Printmaking (2) Prints from 15th century to present. 20th century in Europe and U.S. Prereq: 172 and 173.

486 Art of Indian Asia (3) History of Indian art: Central Asia and Southeast Asia.

489 Studies in Art History (3) Concentration in individually selected area. Prereq: 12 hrs of art history and consent of instructor. May be repeated. Maximum 6 hrs.

494 Individual Problems (3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

495 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hrs.

499 Special Topics (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/ or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E

505 Graduate Fiber and Fabric (1-6) May be repeated. Maximum 10 hrs.

506 Graduate Fiber and Fabric II (2-6) May be repeated. Maximum 12 hrs.

511 Graduate Drawing I (2-6) May be repeated. Maximum 10 hrs.

512 Graduate Drawing II (2-6) May be repeated. Maximum 10 hrs.

513 Graduate Painting I (2-6) May be repeated. Maximum 10 hrs.
514 Graduate Painting II (2-6) May be repeated. Maximum 10 hrs.

515 Graduate Watercolor I (2-6) May be repeated. Maximum 10 hrs.

516 Graduate Watercolor II (2-6) May be repeated. Maximum 10 hrs.

521 Graduate Ceramics I (2-6) May be repeated. Maximum 10 hrs.

525 Graduate Ceramics II (2-6) May be repeated. Maximum 10 hrs.

541 Graduate Sculpture I (2-6) May be repeated. Maximum 10 hrs.

542 Graduate Sculpture II (2-6) May be repeated. Maximum 10 hrs.

551 Graduate Graphic Design/Illustration I (2-6) May be repeated. Maximum 10 hrs.

552 Graduate Graphic Design/Illustration II (2-6) May be repeated. Maximum 10 hrs.

561 Graduate Printmaking-Intaglio I (2-6) May be repeated. Maximum 10 hrs.

562 Graduate Printmaking-Intaglio II (2-6) May be repeated. Maximum 10 hrs.

563 Graduate Printmaking-Lithography I (2-6) May be repeated. Maximum 10 hrs.

564 Graduate Printmaking-Lithography II (2-6) May be repeated. Maximum 10 hrs.

565 Graduate Printmaking-Screen Printing I (2-6) May be repeated. Maximum 10 hrs.

566 Graduate Printmaking-Screen Printing II (2-6) May be repeated. Maximum 10 hrs.

571 Studies in Medieval Art (3) Art and architecture of Middle Ages: major monuments from Byzantine or western Europe. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

572 Studies in Italian Renaissance Art (3) Art and architecture of 14th, 15th, and/or 16th centuries in Italy. Early or High Renaissance or Mannerist periods. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

573 Studies in Baroque Art (3) 17th-century art and architecture: major artists and works from southern or northern Europe. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

574 Studies in Modern Western Art (3) Selected topics in 19th- and 20th-century western art. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

575 Studies in Modern American Art (3) Selected topics in 19th- and 20th-century American art. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

576 Studies in Asian Art (3) Selected topics in Japanese or Chinese art. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

579 Special Topics in Art History (3) Student- or instructor-initiated course offered at convenience of department. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 9 hrs.

580 Seminar in Art Criticism (3) Theory and practice. Prereq: M.F.A. candidate or consent of instructor.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

595 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hrs. S/NC only. E

Courses listed below offered periodically only at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated. Upon admission to the M.F.A. program at UT, a student may apply certain graduate courses taken at Arrowmont toward the degree, subject to the approval of the student's graduate committee.

400 Special Topics (2-4) Student- or instructor-initiated course offered at convenience of department. May be repeated.

410 Drawing (2-4) Intermediate to advanced. May be repeated.

425 Ceramics (2-4) Intermediate to advanced. May be repeated.

430 Photography (2-4) Intermediate to advanced. May be repeated.

440 Painting/Watercolor (2-4) Intermediate to advanced. May be repeated.

450 Metal Design (2-4) Intermediate to advanced. May be repeated.

450 Fiber (2-4) Intermediate to advanced. May be repeated.

470 Fabric (2-4) Intermediate to advanced. May be repeated.

480 Enameling (2-4) Intermediate to advanced. May be repeated.

490 Wood (2-4) Intermediate to advanced. May be repeated.

Art and Music Education

(College of Education)

MAJORS

Music Education

DEGREES

Music Education

M.S.

Music Education

M.S.

Charles H. Ball, Head

Professors:


Associate Professors:


Assistant Professor:

J. R. Sparks, M.S. Tennessee.

The Department of Art and Music Education offers graduate programs leading to the Master of Science with a major in Art Education and in Music Education. Although degree requirements are sufficiently flexible to allow programs to be tailored to the specific needs of the individual, all emphasize a balance between creative work in the arts discipline, advanced teaching tech-

niques, and a study of the philosophical and historical foundations of the field.

For additional information, contact the head of the Department of Art and Music Education, Room 211-A Music Building: (615) 974-3331.

Art Education

The Master of Science program requires Art Education 510, 520, and 593; 6 hours of 500-level courses in art history; 6 hours of 500-level courses in studio art; Curriculum and Instruction 580; 6 hours of 500-level elective courses in education; and 6 hours of Thesis 500.

The thesis may be of the conventional type or an exhibition of original works of art produced under the direction of Art and Art Education faculty and accompanied by a written analytical and critical essay. This essay must include a) a philosophical statement, b) an explanation of process and media for each work presented, and c) a compositional analysis of each work. A comprehensive written examination will be required during the final semester of work.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 History and Philosophy of Art Education (3) United States from 1860's to present. Prereq: Consent of instructor.

520 Program Development in Art Education (3) Current practices and procedures in art education: unit planning, sequential organization and teaching methods. Prereq: Consent of instructor.

590 Special Topics in Art Education (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

593 Independent Study in Art Education (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Music Education

The Master of Science requires Music Education 510 and 520; 9 hours of music education electives at the 500 level; 6 hours of Thesis 500; 6 hours of 500-level courses in music theory or history; 2 hours of applied music at either the 400 or 500 level; 2 hours of music ensemble at the 500 level; and 6 hours of music electives at the 500 level.

A three credit research problem and three extra hours course work in Music Education may be substituted for Thesis. If a larger thesis problem is desired, the thesis credit may be increased to 9 credit hours and 3 credit hours of Music Education electives may be dropped.

Diagnostic tests in theory, music history, music education, and applied music will be required. A final written and oral examination will be required.

500 Thesis (1-15) P/NP only. E
Audiology and Speech Pathology

(College of Liberal Arts)

**MAJORS**

A. Speech and Hearing Science...............................M.A.

B. Speech Pathology........................................M.A.

Professors:

S. Adler, Ph.D. Ohio State; C. W. Asp, Ph.D.

Ohio State; P. J. Carney, Ph.D. Iowa;

H. L. Luper, Ph.D. Ohio State; T. Naberok, Sc.

D. Prague, H. A. Peterson, Ph.D. Illinois;

B. Silverstein, Ph.D. Purdue.

Associate Professors:

S. B. Burchfield, Ph.D. Michigan State;

A. O. Diefendorf, Ph.D. Washington;

C. J. Ferrell, M.A. Tennessee; E. Hambly, Ph.D. Iowa.

Assistant Professor:

D. Arthur, M.A. Tennessee.

**THE MASTER'S PROGRAM**

A major is offered in Audiology or in Speech Pathology. A minor is offered in each of the two areas when approved by the department. The content 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.

Students majoring in either of the two areas are expected to complete the academic requirements for clinical certification from the American Speech-Language-Hearing Association, including the required number of clock hours of clinical practicum (minimum 150 hours as a graduate student; 300 total). An exception to this rule must be approved by the appropriate departmental committee.

Enrollment 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 may elect either the thesis or the non-thesis option. Students in both programs are required to take 511 and 517. The Master's program with the thesis will include a minimum of 30 semester hours of approved graduate credit, including 6 hours of 500 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least two-thirds of these total courses must be at the 500 or 600 level; no more than 6 hours of thesis courses and no more than 6 hours of practicum. Students in the non-thesis option program must present a total of 36 semester hours of approved graduate credit and pass a final written examination. A minimum of 24 hours must be at the 500 or 600 level, no more than 8 of which may be practicum. The dissertation as to choice of the thesis or non-thesis program is normally made following completion of 511 and a conference with the student's advisor.

**THE DOCTORAL PROGRAM**

The Ph.D. program in Speech and Hearing Science seeks to develop individuals for research or college teaching careers in the concentration areas of speech and language pathology, audiology, speech science, or 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 demonstrate their knowledge in the areas 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 three 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/her faculty committee. In addition to the general Graduate School requirements, specific requirements for the Doctor of Philosophy in Speech and Hearing Science will include:

1. Successful completion of course work in the study of one or more research tools or other specific scientific methodological vehicles pertinent to the research interests of the candidate. The choice of research tool(s) is subject to departmental approval.
2. A minimum of 9 semester 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 concentration to give a broad foundation and understanding.
4. A comprehensive examination to demonstrate scholarly knowledge of audiology, speech and language pathology, and speech and hearing science; and advanced knowledge of the specifics of the area of concentration.
5. Research and dissertation to give at least 24 hours of graduate credit (600 level).
6. A final oral examination.

**Astronomy**

See Physics and Astronomy

**502 Registration for Use of Facilities (3-15)** Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E.

**510 Foundations of Music Education (3)** History, philosophical and aesthetic bases. Prereq: Consent of instructor.

**520 Research in Music Education (3)** Definition of research problems, data collection and analysis, and research report writing. Application of knowledge of research techniques to analysis of existing research literature in music education. Prereq: Consent of instructor.

**530 Advanced Band Literature and Conducting (3)** Reading, conducting, and interpreting band scores suitable for school, college, and community bands; contemporary and standard band literature. Prereq: Consent of instructor.

**540 Advanced Choral Literature and Conducting (3)** Reading, conducting, and interpreting vocal scores suitable for school, college, church, and community groups. Prereq: Consent of instructor.

**550 Curriculum Development and Evaluation in Music Education (3)** Principles of curriculum development as applied to music education programs. Formulating objectives; construction of evaluation instruments; survey of appropriate literature. Prereq: Consent of instructor.

**555 Administration and Supervision of School Music (3)** Problems of supervision, research, and in-service education, teacher preparation, guidance. Prereq: Consent of instructor.

**560 Psychology of Music Teaching (3)** Research on musical perception and cognition and its application to teaching of music. Definition and measurement of musical ability. Prereq: Course in general psychology and 1 yr of music theory or consent of instructor.

**570 Studies in Elementary and Middle School Music (3)** Current trends and research in teaching of music in elementary and middle school. Prereq: Consent of instructor.

**580 Seminar in Music Education (3)** Class investigation and individual reporting of pertinent topics and issues in music education. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

**590 Special Topics in Music Education (3)** Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

**593 Special Problems in Education (3)** Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

**425 Introduction to the Psychology and Education of the Hearing Impaired (3)** (Same as Special Education 425.)

**431 Stuttering (3)** Nature, appraisal and treatment. Prereq: 304 or consent of instructor.

**433 Clinical Practice in Speech-Language Pathology I (1-4)** Prereq: 320 or consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval. (Same as Special Education 433.)

**434 Clinical Practice in Speech-Language Pathology II (1-4)** Prereq: 433 and consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval. (Same as Special Education 434.)

**440 Voice Disorders (3)** Etiology, diagnosis, and treatment of organic and functional voice disorders. Prereq: 304, 306, or consent of instructor. (Same as Special Education 440.)

**455 Problems in Speech Pathology (1-3)** Prereq: Consent of instructor.

**461 Introduction to Language Pathology in Children (3)** Nature, etiology and treatment of language retardation in children; observations of language therapy. Prereq: 320 or consent of instructor.

**463 Practical Applications of Language Habilitation Techniques (3)** Various methods and procedures in treating delayed/disordered preschoolers. Alternative/ supplemental systems. Prereq: 461 or consent of instructor.

**465 Speech and Language of the Culturally Different Child (3)** Speech and language differences of children of various minority groups, of different ethnic and class membership and from different geographic regions.
473 Audiology II (3) Basic principles of clinical audiology: pure tone, speech, masking and overview of special auditory tests. Prereq: 371. (Same as Special Education 473.)

494 Introduction to Aural Rehabilitation (3) Rehabilitation of acoustically impaired having communication difficulties, hearing and other sensory modalities. Prereq: 473.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or foreign language as a major degree is completed. May not be used toward degree requirements. May be repeated. 5/NC only. E

506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous system, role in speech and language. Prereq: 306.

507 Anatomy and Physiology of the Ear (3) Structure and function of human ear. Prereq: 371.

508 Electrophysiological Assessment of Auditory Function (3) Techniques for electrophysiological measurement of auditory sensitivity, sound transmission by ear, distortion in ear and ear as analytic mechanism. Prereq: Consent of instructor.

511 Introduction to Research in Speech and Hearing (2) Analysis of research techniques, application of statistics, and completion of pilot research project. Psychology 385 or equivalent or consent of instructor.

512 Clinical Practice in Audiology (1-4) Prereq: 473 and 494. May be repeated. Maximum 9 hrs.

513 Clinical Practice in Audiology: Off-Campus Sites. (1-4) Prereq: Consent of instructor.

514 Practicum in Verbo-Tonal Habilitation (1-4) Prereq: 494, 595, or consent of instructor. May be repeated. Maximum 8 hrs.

515 Practicum in Aural Rehabilitation (1-4) Prereq: 473 and 494. May be repeated. Maximum 8 hrs.

517 Instrumentation in Audiology and Speech Pathology (3) Principles of instrumentation in audiology and speech pathology; laboratory assignments for familiarization of students with instruments for measuring speech and hearing processes.

520 Aphasia (3) Historical review of aphasia literature, theories of brain functioning, aphasic classification and terminology, tests and rationale for testing, etiology, therapy considerations and prognosis for recovery. Prereq: 526 or equivalent or consent of instructor.

522 Seminar: Articulation and Voice Disorders (3) Current research in diagnosis and management of articulation and voice disorders. Undergraduate courses in articulation and voice disorders or consent of instructor.

531 Seminar on Stuttering (3) Current significant research in stuttering. Prereq: 431 or consent of instructor.

532-33-34 Advanced Clinical Practice in Speech-Language Pathology: On-Campus Sites (1-4, 1-4, 1-4) Prereq: 434 or equivalent and consent of instructor. 534 may be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.

535-36-37 Advanced Clinical Practice in Speech-Language Pathology: Off-Campus Sites (1-4, 1-4, 1-4) Prereq: 100 hrs clinical experience, consent of instructor. May be repeated. Maximum 8 hrs each. Enrollment for less than 2 semester hrs must have prior departmental approval.

538 Advanced Clinical Practice in Speech-Language Pathology: Public Schools (1-4) May be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.

539 Motor Speech Disorders (3) Neuromotor organization for speech production; types of motor speech disorders and associated neuromuscular symptomatology; diagnosis management of motor speech disorders. Prereq: 506.


545 Sound Measurement Techniques and Hearing Conservation (3) Techniques of measurement and analysis of sound; hearing conservation in schools and industry. Prereq: Consent of instructor.

546 Advanced Audiology (3) Theory and practice of advanced pure tone audiometry; instrumentation and interpretation of audiometric findings with diagnostic diagnosis. Prereq: 473.

547 Special Problems in Audiology (1-3) Prereq: 473 or equivalent and consent of instructor. May be repeated. Maximum 6 hrs.

548 Special Study in Audiology (1-3) Special reading, consultation, and research activities in field of audiology. May be repeated. Maximum 6 hrs.

550 Seminar in Audiology (1-3) Significant research in various areas of audiology. Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.

551 Special Auditory Tests (3) Theoretical and practical consideration of auditory procedures used for differentiating among conductive, cochlear, retrocochlear, central and nonorganic hearing loss. Prereq: 473,507, and 546.

552 Seminar in Speech Pathology (2-3) Current significant research in speech pathology. Topics vary. Prereq: 9 hrs in speech pathology. Prereq: May be repeated with consent of department. Maximum 9 hrs.


555 Special Problems in Speech-Language Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

556 Independent Study in Speech-Language Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

557 Management and Supervision for Speech-Language-Hearing Professionals (3) Management systems, accountability, performance appraisal and clinical supervision for audiologists and speech language pathologists interested in private practice, supervisory or administrative positions.

561 Tutorial in Child Language Pathology (2) Interactions with various staff members of Pediatric Language Programs: selected topics.

563 Hearing Disorders (3) Auditory disorders commonly encountered in medical environment. Etiology, pathology and evaluative procedures to differentiate lesions of auditory mechanism. Field trips may be required. Prereq: 473 or equivalent and 527.

567 Pediatric Audiology (3) Theoretical and practical considerations in evaluation and treatment of hearing loss in infants and children. Audioligical intervention in case management of hearing impaired child: amplification, educational alternatives, and state and federal guidelines.

569 Foreign Study (1-15) See page 31.

572 Off-Campus Study (1-15) See page 31.

573 Research (1-18) See page 31.

579 Psycholinguistic Concepts in Speech Pathology (3) Psycholinguistic concepts and information theory in studying the normal acquisition of language and certain disorders of language. Prereq: Consent of instructor.

581 Foreign Study (1-15) See page 31.

592 Advanced Aural Rehabilitation (3) Procedures; assessment and counseling for communicative function of hearing impaired. Prereq: 494.


600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Experimental Phonetics (3) Acoustical and perceptual analyses of speech production and overall oral communication. Prereq: 517 or consent of instructor.


603 Language Science (3) Seminar of theories and paradigms of research on acquisition and use of language: phonology, syntax, semantics and pragmatics. Prereq: Graduate standing and consent of instructor.


608 Advanced Clinical Concepts and Models in Hearing Science (3) Theoretical concepts of clinical manifestations in the physical and functional model of normal and abnormal auditory mechanism function. Prereq: Consent of instructor.

609 Seminar in Speech Science (2) Experimental areas: speech physiology, acoustic analysis, recognition, perception and intelligibility of speech, communication theory, and psycholinguistic measurement of speech and language. Topics vary. Prereq: 601 or consent of instructor. May be repeated. Maximum 8 hrs.

610 Seminar in Hearing Science (2) Advanced study of perception of nonspeech acoustic signal, detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 602 or consent of instructor. May be repeated. Maximum 6 hrs.

611 Experimental Design in Speech and Hearing (2) Analysis of experimental design in thesis and related journals. Generation of experimental designs. Prereq: Consent of instructor.

619 Advanced Technology in Speech and Hearing (2) Applications of recent technological advances, computers, to speech and hearing research. Prereq: Consent of instructor.

620 Advanced Seminar in Audiology (2) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

622 Advanced Seminar in Speech and Language (2) Topics vary: aberrations of voice, articulation, speaking time and rhythm, language development or use, and language symbolization. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

625 Directed Research (1-4) Participation in ongoing or non-dissertational research. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

627 Directed Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

628 Directed Study in Audiology (1-3) Prereq: Consent of instructor. May be repeated. Max. 6 hrs.

629 Directed Study in Speech Science (1-3) Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

630 Directed Study in Hearing Science (1-3) Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

631 Directed Study in Speech Science (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
Aviation Systems
(College of Engineering)

MAJOR DEGREE Avigation Systems.................M.S.

Lead Professor:  R. D. Kimberlin, M.S. Tennessee.

Professors:  F. G. Collins, Ph.D. California (Berkeley);  W. Frost, Ph.D. Washington;  A. A. Mason, Ph.D. California Institute of Technology;  J. M. Wu, Ph.D. California Institute of Technology;  R. L. Young, Ph.D. Northwestern.

The University of Tennessee Space Institute offers a program leading to the Master of Science with a major in Aviation Systems. The Aviation Systems program is designed for those who possess a Bachelor's degree in engineering or science and who wish to study under a "systems philosophy" toward careers in research and development or administration in areas pertinent to aviation. To qualify for admission to this program, the applicant must possess a Bachelor's degree in engineering or science from an accredited institution, show evidence of ability to pursue and benefit from the program, and fulfill The University of Tennessee Graduate School admission procedures and grade point standards. Prerequisites to the program include a basic knowledge of computer utilization and statistics; an understanding of aerodynamic fundamentals, aircraft propulsion, and performance; and some understanding of economics and accounting.

Both thesis and non-thesis programs are available. The thesis program involves satisfactory completion of the following requirements:

1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering or economics for the research and development area.
3. Three hours in industrial engineering or economics for the administration area.
4. Three to 6 hours of electives selected from the major field, engineering, and/or the areas of item three (3) above.
5. Six hours of Aviation Systems 500 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 requirements:

1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering for the research and development area.
3. Nine hours in industrial engineering, economics, or finance for the administration area.
4. Nine to 12 hours of electives in the major field, engineering, and/or the areas of item three (3) above.
5. Satisfactory completion of an assigned project under Aviation Systems 510.
6. Satisfactory completion of a comprehensive final written examination on all course work submitted for the degree and defense of the project course paper.

The thesis program involves a minimum of 30 semester hours credit while the non-thesis program involves a minimum of 33 semester hours credit.

500 Thesis (1-15) P/N only. E


502 Registration for Use of Facilities (0-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E.

503 Air Vehicles (3) Current capabilities and future requirements for civilian and military air vehicles. Parameters significant for air vehicle type selection. Integration of air vehicle into aviation systems. Prereq: 501.


505 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure, administrative and enforcement procedures. Prereq: 501.

510 Special Topics in Aviation Systems (3) Current problems. Prereq: Consent of instructor. May be repeated with consent.

521-22 Experimental Flight Mechanics (3,3) Experimental techniques for flight mechanics. Specialized program for graduate students in aeronautical engineering. Prereq: Consent of instructor. 521-22 may be repeated.


Biochemistry
(College of Liberal Arts)

MAJOR DEGREES Biochemistry.........................M.S., Ph.D.

Wesley D. Wicks, Head

Professors:  J. E. Churchich, Ph.D. Sheffield (England);  L. Huang, Ph.D. Michigan State;  P. D. Joshi, Ph.D. Poona (India);  K. J. Monty, Ph.D. Rochester;  T. P. Salo (Emeritus), Ph.D. Michigan;  W. D. Wicks, Ph.D. Harvard.

Assistant Professors:

R. H. Feinberg (Emeritus), Ph.D. California (Berkeley);  J. W. Koontz, Ph.D. Kentucky.

Adjunct Faculty:

E. Fairfield, Ph.D. Stony Brook;  W. Farkas, Ph.D. Duke;  S. Kennel, Ph.D. California (San Diego);  D. Roberts, Ph.D. California (Davis).

MASTER'S PROGRAM

1. At least one year each of Introductory Organic Chemistry with laboratory* and approved physical chemistry.

2. A minimum of 8 semester hours of approved biology or physical science beyond the introductory level and including the subject areas of genetics and physiology.

3. Biochemistry 511-12 and 515-16.

4. At least 6 hours of advanced seminar courses, and 6 hours of 500-level courses from the following: 601, 603, 604, 605, 606.

5. At least 6 hours of Master's research and a thesis.

6. A final examination that covers both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

1. Introductory Organic Chemistry*, Introductory Physics*, Differential and Integral Calculus*, approved physical chemistry, and at least 12 hours of biology beyond the introductory level and including the subjects of genetics and physiology.

2. Biochemistry 511-12 and 515-16.

3. At least 3 hours of approved graduate courses in chemistry, physics, or other physical science; for example, Chemistry 550, 551, 552, Physics 521, 522, 551. No survey courses will be accepted.

4. At least 6 hours of topics offered in 621 and 622.

5. Participation in 601 and 603 during the entire period of residence.

6. Comprehensive examination, taken before the end of the third year of study.

7. A dissertation reporting the results of original and significant research conducted during the term of candidacy.

8. A final oral examination which will be concerned primarily with the student's dissertation.

Petitioning for Master's Degree

Students who have passed the comprehensive examination in the Ph.D. program and have completed at least 30 hours of approved course work for graduate credit, at least two-thirds of which must be at or above the 500 level, may petition the department for award of a Master's degree. The additional requirements for such a degree are:

1. The preparation of a research manuscript suitable for submission for publication in a major scientific journal and 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; or

2. Publication of at least one full-length paper in a major biochemical journal as senior author.

*Though completion of these courses or their equivalent is required, they may not be taken for graduate credit.
Biomedical Sciences

(Office of the Provost)

MAJOR DEGREES

Biomedical Sciences ..................... M.S., Ph.D.

Raymond A. Popp, Acting Director

Professors:
D. Billen, Ph.D. Tennessee; D. E. Olins, Ph.D. Rockefeller.

Assistant Professor:
C. Soumoff, Ph.D. California (Los Angeles).

Research Professor:

Research Associate Professor:
E. C. Uberbacher, Ph.D. Pennsylvania.

Shared Faculty:
Not all faculty listed are necessarily available in teaching and/or research roles in every academic year.

W. E. Barnett, Ph.D. Florida State; H. I. Adler, Ph.D. Cornell; D. P. Allison, M.S. Tennessee; G. Bunick, Ph.D. Pennsylvania; W. L. Carrier, M.S. Tennessee; J. S. Cook, Ph.D. Princeton; J. N. Dumont, Ph.D. Massachusetts; J. L. Epler, Ph.D. Florida State; R. J. Fry, M.D. Dublin (Ireland); R. K. Fujimura, Ph.D. Wisconsin; C. W. Gehrs, Ph.D. Oklahoma; F. L. Snyder, Ph.D. North Dakota; A. Solomon, M.D. Duke; A. L. Stevens, Ph.D. Western Reserve; P. A. Swenson, Ph.D. Stanford; R. L. Tyrrell, Ph.D. Pennsylvania State; H. L. Ulrich, Ph.D. Rochester; V. R. Uppuluri, Ph.D. Indiana; L. C. Waters, Ph.D. Georgia; C. H. Wei, Ph.D. Wisconsin; H. Witschi, M.D. Berne (Switzerland); K. K. Yang, M.D. Taiwan, Ph.D. Tulane.

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 the Doctor of Philosophy. The National Laboratory is a well-known center of basic research. The school utilizes the facilities and staff 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.

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 concentration areas available for Master's thesis and Ph.D. dissertation work are biochemistry, biophysics, carcinogenesis, genetics, cellular, developmental and mammalian biology, and radiation biology. Included are such subjects as anatomy, physiology, biochemistry, transcription, translation, and control mechanisms. Prior knowledge of fundamentals of gene expression expected. Prerequisites: 511 or Life Sciences 511. (Same as Life Sciences 512.) S.

515 Experimental Techniques I (3) Modern experimental techniques and instrumentation in lab. Primarily for departmental graduate students. Prerequisite: Consent of instructor.

516 Experimental Techniques II (3) Laboratory rotations. Students work in laboratory of facility member on clearly defined project. Written proposal and oral report. Primarily for departmental graduate students. Prerequisite: 515. S.

521 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated. Maximum 9 hrs.

525 Graduate Research Participation (3-12) Tutorial laboratory experience. May be repeated. Maximum 12 hrs. E.

561 Environmental Toxicology (3) Basic concepts in toxicology; molecular toxicology and detoxification; receptor—ligand interaction; mutagenesis, teratogenesis, carcinogenesis; pathologic changes and environmental impact. Prerequisite: 410, Chemistry 350-60-69 or consent of instructor. (Same as Ecology 561.) E.

562 Techniques in Environmental Toxicology (1) Experimental techniques for the assessment of polysubstance and toxics, and impacts of pollutants in global ecosystems. Laboratory exercises on analytical, biochemical, and bioassay methods in toxicological studies. Prerequisites: 410 or quantitative methods, 561 and Chemistry 350-60-69. (Same as Ecology 562.) E.

800 Doctoral Research and Dissertation (3-15) P/NP only. E.

601 Advanced Biochemistry Seminar (1) Invited speakers. Topics posted in advance. Required every semester in residence. S/NC only. F.

603 Current Topics in Biochemistry (1) Seminars and lectures dealing with current advances in field of chemical biology. Required every semester in residence. S/NC only. F.

604 Current Topics in Environmental Toxicology (1) Critical reviews of research problems and methods in environmental toxicology, behavioral toxicology, biochemical and ecological effects, bioassays and epidemiology. Presentations by students, faculty and guest lecturers from academia and industry. May be repeated with consent of department. Maximum 6 hrs. (Same as Ecology 604.) S/N only. F.

605 Current Topics in Regulation of Protein Function (1) Covalent modifications of proteins by phosphorylation-dephosphorylation allosteric interactions. Prerequisites: 410 or equivalent. May be repeated. Maximum 6 hrs. S/N only. F.

606 Current Topics in Biological Membrane Research (1) Prerequisite: 410 or equivalent. May be repeated. Maximum 6 hrs. (Same as Microbiology 606.) S/N only. F.

621 Advanced Topics I (3-13) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry. Prerequisites: 511-12 or consent of instructor. May be repeated. Maximum 9 hrs.

Biomedical Sciences

(Office of the Provost)

MAJOR DEGREES

Biomedical Sciences ..................... M.S., Ph.D.

Raymond A. Popp, Acting Director

Professors:
D. Billen, Ph.D. Tennessee; D. E. Olins, Ph.D. Rockefeller.

Assistant Professor:
C. Soumoff, Ph.D. California (Los Angeles).

Research Professor:

Research Associate Professor:
E. C. Uberbacher, Ph.D. Pennsylvania.

Shared Faculty:
Not all faculty listed are necessarily available in teaching and/or research roles in every academic year.

W. E. Barnett, Ph.D. Florida State; H. I. Adler, Ph.D. Cornell; D. P. Allison, M.S. Tennessee; G. Bunick, Ph.D. Pennsylvania; W. L. Carrier, M.S. Tennessee; J. S. Cook, Ph.D. Princeton; J. N. Dumont, Ph.D. Massachusetts; J. L. Epler, Ph.D. Florida State; R. J. Fry, M.D. Dublin (Ireland); R. K. Fujimura, Ph.D. Wisconsin; C. W. Gehrs, Ph.D. Oklahoma; F. L. Snyder, Ph.D. North Dakota; A. Solomon, M.D. Duke; A. L. Stevens, Ph.D. Western Reserve; P. A. Swenson, Ph.D. Stanford; R. L. Tyrrell, Ph.D. Pennsylvania State; H. L. Ulrich, Ph.D. Rochester; V. R. Uppuluri, Ph.D. Indiana; L. C. Waters, Ph.D. Georgia; C. H. Wei, Ph.D. Wisconsin; H. Witschi, M.D. Berne (Switzerland); K. K. Yang, M.D. Taiwan, Ph.D. Tulane.

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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, 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.

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 concentration areas available for Master's thesis and Ph.D. dissertation work are biochemistry, biophysics, carcinogenesis, genetics, cellular, developmental and mammalian biology, and radiation biology. Included are such subjects as anatomy, physiology, biochemistry, transcription, translation, and control mechanisms. Prior knowledge of fundamentals of gene expression expected. Prerequisites: 511 or Life Sciences 511. (Same as Life Sciences 512.) S.

515 Experimental Techniques I (3) Modern experimental techniques and instrumentation in lab. Primarily for departmental graduate students. Prerequisite: Consent of instructor.

516 Experimental Techniques II (3) Laboratory rotations. Students work in laboratory of facility member on clearly defined project. Written proposal and oral report. Primarily for departmental graduate students. Prerequisite: 515. S.

521 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated. Maximum 9 hrs.

525 Graduate Research Participation (3-12) Tutorial laboratory experience. May be repeated. Maximum 12 hrs. E.

561 Environmental Toxicology (3) Basic concepts in toxicology; molecular toxicology and detoxification; receptor—ligand interaction; mutagenesis, teratogenesis, carcinogenesis; pathologic changes and environmental impact. Prerequisite: 410, Chemistry 350-60-69 or consent of instructor. (Same as Ecology 561.) F.

562 Techniques in Environmental Toxicology (1) Experimental techniques for the assessment of presence, toxicity, and impacts of pollutants in global ecosystems. Laboratory exercises on analytical, biochemical, and bioassay methods in toxicological studies. Prerequisites: 410 or quantitative methods, 561 and Chemistry 350-60-69. (Same as Ecology 562.) S.

800 Doctoral Research and Dissertation (3-15) P/NP only. E.

601 Advanced Biochemistry Seminar (1) Invited speakers. Topics posted in advance. Required every semester in residence. S/NC only. F.

603 Current Topics in Biochemistry (1) Seminars and lectures dealing with current advances in field of chemical biology. Required every semester in residence. S/NC only. F.

604 Current Topics in Environmental Toxicology (1) Critical reviews of research problems and methods in environmental toxicology, behavioral toxicology, biochemical and ecological effects, bioassays and epidemiology. Presentations by students, faculty and guest lecturers from academia and industry. May be repeated with consent of department. Maximum 6 hrs. (Same as Ecology 604.) S/N only. F.

605 Current Topics in Regulation of Protein Function (1) Covalent modifications of proteins by phosphorylation-dephosphorylation allosteric interactions. Prerequisites: 410 or equivalent. May be repeated. Maximum 6 hrs. S/N only. F.

606 Current Topics in Biological Membrane Research (1) Prerequisite: 410 or equivalent. May be repeated. Maximum 6 hrs. (Same as Microbiology 606.) S/N only. F.

621 Advanced Topics I (3-13) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry. Prerequisites: 511-12 or consent of instructor. May be repeated. Maximum 9 hrs.
degree before degree is completed. May not be filed at least one full semester prior to candidacy. 

5. Passing both written and oral comprehensive examinations. 

6. A dissertation reporting the results of original and significant scientific research. A minimum of 24 semester hours of course work is required. 

7. A final oral examination on the dissertation. 

8. 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 to prepare students for research careers in the biomedical sciences. Students spend a semester in each of the three laboratories. Approaches and technologies in various areas of modern biology are emphasized. The program includes a seminar in which students submit current research on mechanisms of gene regulation; protein synthesis, protein chemistry and enzyme mechanisms; and transport phenomena. 

674 Computing for the Life Sciences (3) Interactive computing. Mini- and micro-computer environments. Basic, Fortran, and/or Pascal languages; application of statistics, graphics, text manipulation, and computer communications. 


518 Cell Biology I (3) Structure and composition of major nuclear and cytoplasmic organelles of eukaryotic cells. Pertinent instruments and techniques; meiosis and mitosis; cell cycle; chromosome structure; nucleic acid metabolism; nucleoli and ribosome biogenesis; survey of specialized cells. Structure of genetic transmission in bacteria. Coreq: 511. 

519 Cell Biology II (3) Comparative biochemical approach to cell structure and function. Membrane systems and metabolism; development and function of mitochondria, chloroplasts, peroxisomes and other organelles as related to metabolism and regulation; transport phenomena; cell cycle, cell products; interaction of cells; functions of tissues and organs. Coreq: 514, 518. 

525 Computing for the Life Sciences (3) Interactive computing. Mini- and micro-computer environments. Basic, Fortran, and/or Pascal languages; application of statistics, graphics, text manipulation, and computer communications. 

531-32-33 Biomedical Sciences Laboratory (3,3,3) Approaches and technologies in various areas of modern biology. Students spend a semester in each of three laboratories conducting research in different areas of biomedical science. Required of all first-year students. 

543-46-49 Graduate Research Participation (3,6,9) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated. 

551-52-53 Special Topics in Biomedical Sciences (3,3,3) Either tutorials or formal lectures. Potential topics: X-ray diffraction and crystallography; excised-state biophysics; physical chemistry or macromolecules; mammalian genetics coverage. 


574 Statistics for Biologists (2) Application and interpretation of statistical methods in data analysis. Random variation; normal, binomial, and Poisson distribution; statistical presentation of data; estimating means and variance; confidence intervals; tests of significance for comparing the respective means of two continuous variables; Chi-square tests; correlation and association; linear regression. Coreq: Statistics 201 or consent of instructor. 

600 Doctoral Research and Dissertation (3-15) P/NP only. 

622 Enzyme Regulation and Kinetics (3) Kinetics of catalysis; inhibition by product, substance and dead end; substrate inhibition; independent analysis of allosteric enzymes, types of feedback regulation; role of substrates in enzyme regulation; multifunctional enzymes. Prereq: 511, 514. 

624 Chemistry and Metabolism of Lipids (2) Nomenclature, chromatoographic isolation, chemistry, physical properties, and enzymology of lipids. Hormonal action of prostaglandins and role of lipids in membranes, enzymatic expression of genes, nervous tissue, lipid chemistry of mammals. Comparative aspects, lipid pathways in bacteria and yeast. Prereq: 511, 514. 


628 Molecular Genetics of Carcinogenesis (2) DNA and RNA tumor viruses, oncogenes, growth factors, and their potential role in induction of cancers. 


641 Techniques in Cell Biology (3) Basic concepts of cell biology techniques, their application to specific research problems, kind of data yield, and cautions in data interpretation. Laboratory demonstrations may be arranged where appropriate. Prereq: 511, 514, 518, 519. 

551-52-53 Advanced Topics in Biomedical Sciences (3,3,3) Current and future research developments: protein synthesis, protein chemistry and enzyme mechanisms; cytology, and special topics. Either as tutorial or literature survey requiring substantial student preparation. May be repeated. 

650 Mammalian Genetics (3) Known genetic variants affecting each organ system of experimental mammals, especially laboratory mice. Inheritance of phenotypical and biochemical traits in rodents and other laboratory rodents. Prereq: 515. 


666 Cyto genetics (3) Chromosome structure, chromosomal alterations (mitosis and meiosis), mechanisms of induction of chromosomal alterations by radiation and chemicals, aneuploidy, chromosome configuration in situ hybridization. Chromosome changes and cancer, human cytogenetics, sister chromatid exchanges, human genetics as a tool in human genetics, assignment, molecular techniques for analyzing chromosome changes. Prereq: 515. 

Botany (College of Liberal Arts) 

DEGREES 

Major Botany勃----..M.S., Ph.D. 

Raymond W. Holton, Head 

Professors: 

J. D. Caponetti, Ph.D. Harvard; E. E. C. Clebsch, Ph.D. Duke; H. R. DeSelm, Ph.D. Ohio State; A. M. Evans, Ph.D. Michigan; W. R. Herndon (Alumni Distinguished Service Professor), Ph.D. Vanderbilt; L. G. Hickok, Ph.D. Massachusetts; R. W. Holton, Ph.D. Michigan; K. W. Hughes, Ph.D. Utah; L. W. Jones, Ph.D. Texas; J. F. McCormick, Ph.D. Emory; F. H. Norris (Emeritus), Ph.D. 

500 Thesis (1-15) P/NP only. E 

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E 

507 Physical Chemistry (3) Thermo-dynamics; phase equilibria; chemical equilibria; electromotive force; surface chemistry; electrolyte solutions; kinetics; conductance; viscosity; diffusion. 

511 Biochemistry (3) Chemistry of carbohydrates, lipids, proteins, and coenzymes; enzyme kinetics intermediates; metabolism and photosynthesis; biosynthesis of amino acids, lipids, and macromolecules. Coreq: 507. 

514 Biophysical Biochemistry (3) Chemistry metabolism and biosynthesis of purines, pyrimidines and nucleic acids; biosynthesis of RNA, DNA, and proteins. Energy levels and excited states of large molecules; optical instrumentation; adaptations to system perturbations; properties of macromolecules in solutions; molecular solution; molecular conformations; internal and intramolecular forces; principles of microscopy. Prereq: 511. 

515 Genetics (3) Mendelian genetics, mitosis and meiosis; transmission genetics; mapping and linkage; genetics of phage, bacteria and eucaryotes; mapping, linkage, mutation, cytoplasmic inheritance. Mechanisms of recombination, chromosome structure and replication. 

517 Molecular Genetics (2) Molecular biology of genetic processes. Nucleic acids, chromosome structure; present current research on mechanisms of gene regulation; protein synthesis; suppression of nonsense and sense mutations; gene families and hereditary diseases. Prereq: 511, 514, and 515. 

518 Cell Biology I (3) Structure and composition of major nuclear and cytoplasmic organelles of eukaryotic cells. Pertinent instruments and techniques; meiosis and mitosis; cell cycle; chromosome structure; nuclear and RNA metabolism; nucleoli and ribosome biogenesis; survey of specialized cells. Structure of genetic transmission in bacteria. Coreq: 511. 

519 Cell Biology II (3) Comparative biochemical approach to cell structure and function. Membrane systems and metabolism; development and function of mitochondria, chloroplasts, peroxisomes and other organelles as related to metabolism and regulation; transport phenomena; cell cycle; cell products; interaction of cells; functions of tissues and organs. Prereq: 514, 518. 

525 Computing for the Life Sciences (3) Interactive computing. Mini- and micro-computer environments. Basic, Fortran, and/or Pascal languages; application of statistics, graphics, text manipulation, and computer communications. 

531-32-33 Biomedical Sciences Laboratory (3,3,3) Approaches and technologies in various areas of modern biology. Students spend a semester in each of three laboratories conducting research in different areas of biomedical science. Required of all first-year students. 

543-46-49 Graduate Research Participation (3,6,9) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated. 

551-52-53 Special Topics in Biomedical Sciences (3,3,3) Either tutorials or formal lectures. Potential topics: X-ray diffraction and crystallography; excised-state biophysics; physical chemistry or macromolecules; pathology; mammalian genetics coverage. 


574 Statistics for Biologists (2) Application and interpretation of statistical methods in data analysis. Random variation; normal, binomial, and Poisson distribution; statistical presentation of data; estimating means and variance; confidence intervals; tests of significance for comparing the respective means of two continuous variables; Chi-square tests; correlation and association; linear regression. Coreq: Statistics 201 or consent of instructor.
Ohio State; R. H. Petersen (Alumni Distinguished Service Professor), Ph.D. Columbia; A. J. Sharp (Emeritus) (Alumni Distinguished Service Professor), Ph.D. Ohio State; H. H. Shugart, Ph.D. Georgia; P. L. Walne, Ph.D. Texas.

Associate Professors:

Assistant Professor:
B. E. Wofford (Curator), Ph.D. Tennessee.

The Department of Botany offers the Master of Science in Botany. A PhD. degree is offered in the field of Botany.

ADMISSION REQUIREMENTS
The Botany Department requires scores from the general and subject biology portions of the Graduate Record Examination, at least three letters of recommendation or standard recommendation forms from academic or professional persons, a short statement describing reasons for interest in graduate education in Botany, and the following academic requirements:

1. Bachelor's degree: a B.A. or B.S. from an accredited college or university with a cumulative grade point average of 2.5 or better, with evidence of ability to do work of graduate quality.
2. General Botany or general biology: 8 semester hours.
3. Advanced Botany or closely allied biological sciences: 12 semester hours.
4. Physical sciences: general inorganic chemistry: 8 semester hours; organic chemistry: Physics highly recommended.
5. College mathematics: 6 semester hours including 1 term of calculus.
6. Evidence of a broad undergraduate background, an ability to do work of graduate quality, and an interest in the study of plant science are considered to be much more important than the particular courses taken as an undergraduate. Accordingly, students lacking specific prerequisite courses but otherwise qualified may be admitted to graduate studies in Botany. In such cases, the deficiencies should be removed as soon as possible, typically during the first year of the student's graduate program. The determination of deficiencies and the manner in which they will be removed will be decided upon by the student's pro-tem committee during the first meeting with the student.

The MASTER'S PROGRAM
The program for the Master of Science is patterned to fit the needs of students who desire a less extensive course of study than the PhD. program. However, the applicant must be equally well prepared and display an aptitude and ability for advanced study. The M.S. includes thesis and non-thesis options.

Thesis Option
The thesis program is the normal route taken by botany students for the M.S. In accordance with the emphasis of the University and the department on research, it involves writing and defending a thesis to describe the results of a completed research project of original work. It is important that the entering student promptly identify a major professor and a suitable research project. (It may be either a terminal degree or a preliminary step to studying for a Ph.D. 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. This must be completed before enrollment in Botany 500.
2. Successful completion of 30 hours of graduate credit, at least two-thirds of which must be at the 500 level or higher.
3. Demonstrated reading proficiency in one modern foreign language or in the use of computer for data analysis. Proficiency in a foreign language may be demonstrated by satisfactory performance on an examination in one modern foreign language (see Graduate Coordinator) or an A or B in French 302 or German 332 (can also be applied to the doctoral program). Proficiency in computer use may be demonstrated by satisfactory completion with a grade of A or B of the following computer science courses or their equivalent: C.S. 101 or 102, 112, and 403 or Stat. 261.
4. Satisfactory completion of two hours at the 600 level.
6. Presentation of a 30 minute departmental seminar.
7. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.

Non-Thesis Option
1. Satisfactory completion of 34 semester hours of approved graduate courses of which 30 semester hours must be in Botany 500. At least two-thirds of the hours must be at the 500 level or higher.
2. Satisfactory completion of two hours at the 600 level.
3. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.
4. Satisfactory performance on a final written examination on all work offered for the degree. The student's committee will require that an oral examination follow the written examination.

THE DOCTORAL PROGRAM
The Doctor of Philosophy program is patterned to provide training that involves extensive independent research within the student's area of concentration. Although there is no formal program of course work, the student's committee may require specific courses for the completion of the degree. Most students spend from three to five years working on their Ph.D.

Requirements for successful completion of the Ph.D. are as follows:
1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehensive preliminary examination.
3. Presentation of one or more cognate areas outside of the department totaling 6 hours of graduate credit with at least a B average.
4. Satisfactory performance on an examination in one modern foreign language (see Graduate Coordinator) or an A or B in French 302 or German 332.
5. Satisfactory completion of 6 hours at the 600 level (excluding dissertation).
7. Presentation of a departmental seminar near the end of the doctoral program.

Note: The listed requirements for the M.S. and Ph.D. degrees should be interpreted as minimal requirements. Specific stipulations or requirements such as additional foreign languages or an additional oral preliminary examination may be required by the student's faculty committee.

401-02 Field Studies in Botany (3,3) Field experience and taxonomy of special plant groups. Topics vary: botany, lichenology, morphology, mycology, photobiology, physiology, phycology, pteridology, and taxonomy.


412 Plant Anatomy (3) Cells, tissues and organs; development in vegetative and reproductive structures of vascular plants—seed plants. Prereq: 110-20 or Biology 110-20.

426 Paleobotany and Palynology (3) Same as Geology 426.

431 Plant Ecology (3) Interactions between individuals, species, communities and their environments. Circulation of energy and matter in ecosystems. Weekly field trips or laboratory periods, and at least two weekend field trips. Prereq: 330 or equivalent. Su.

451 Plant Tissue Culture (3) Methods for culture of cells, tissues, and organs: media preparation and maintenance of cultures. Prereq: 110-20 or Biology 110-20 or equivalent and Chemistry 120-30 or equivalent. Recommended prereq: 310-20, 321, 412; Microbiology 310 or 319; Ornamental and Landscape Design 330; and Plant and Soil Science 331.

500 Thesis (1-15) P/NP only. E.

501 Mycology (4) Intensive survey of fungi, all major classes, lecture laboratory and field information. Occasional field trips. Prereq: 310, 3 hrs and 1 lab. Su.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student is enrolled in Botany and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E.

503 Non-Thesis Research (2) Library, field, or laboratory research under supervision of staff member. Not for thesis candidates. May be repeated. Maximum 4 hrs. E.
Business Administration/Fields of Instruction

506 Phycology (4) Comparative study of major algal phyla, both freshwater and marine: morphological, developmental, ecological, taxonomic and phylogenetic aspects. Field and laboratory studies, identification, classification. Prereq: 310 or consent of instructor. 3 hrs and 1 lab. F, A

507 Biological Illustration (3) Principles and applications of photography (B/W and Color) photomacro- and photomicrography, drawing, graphics and video for recording and presentation for research and publication of data in pictorial and graphic form.

509 Morphology and Evolution of Basidiomycetes (4) Structure and function of somatic and sexual life cycles as applied to evolution in group. Cultures and specimens in laboratory. Prereq: 310 or equivalent.

512 Taxonomy of Grasses and Grass-like Plants (3) Collection, identification, classification of grasses, sedges and rushes, phylogeny of the grass subfamilies and tribes. Prereq: 330 or consent of instructor. F, A

516 Biosystematics (3) Major experimental methods in systematics and application to specific types of systematic problems. Cytotaxonomy, numerical taxonomy, chemotaxonomy and cladistics.


530 Advanced Taxonomy of Flowering Plants (3) Evolution and classification of families of angiosperms, local flora. Prereq: 330 or equivalent. 2 hrs and 1 lab. F, A

531-32 Special Problems in Botany (1-4, 1-4) May be repeated. Maximum 12 hrs.

535 Plant Communities and Plant Geography (4) Plants in communities and their classification and ordination; geographic distribution of communities—ther climatic and soils relationships. Prereq: 431.

537 Natural Resource Management and Environmental Assessment in Developing Nations (3) (Same as Ecology 537 and Planning 553.)

544 Seminar in Botany (1) Readings and discussions of current literature and/or selected topics in botanical research. May be repeated. Maximum 8 hrs. S/NC only.


555 Seminar in Quaternary Studies (3) (Same as Geology 555 and Zoology 555.)

565 Phytoplankton Ecology (3) Interaction between environment and phytoplankton. Nutrient uptake, primary production, competition, ecological theory applied to phytoplankton communities, and physiological adaptations by populations to environment. Prereq: 310 or consent of instructor.

573 Population Biology (3) (Same as Zoology and Ecology 573.)

578 Plant Cell Biology (4) Plant cellular organization, structure and function. Protection of cellular components and correlation of their structures and functions. Principles and application of analytical and experimental laboratory procedures in cell biology research. Prereq: Biology 220 or equivalent. Recommended prereq: Biochemistry 410-19. 3 hrs and 1 lab. F, A

580 Bryophytes and Pteridophytes (4) Taxonomy, phylogeny, ecology and developmental morphology; field studies and current research. Prereq: 310-20 or consent of instructor. 2 hrs and 2 labs. F, A

581 Cytogenetics (3) Chromosome structure and behavior during mitotic and meiotic divisions in relation to structural changes, genetic control, hybridization, specialization, and polypility. Laboratory emphasis on normal and aberrant meiotic systems and somatic chromosomes from plants and animals. Prereq: 310 and at least 6 additional hrs in biological sciences. (Same as Forestry 581.) Sp, A

582 Methods and Instrumentation in Laboratory Investigation (1) Project experience and theoretical background in various research methods, ion exchange resins, adsorption spectrometry, disc electrophorsis, polargraphy, zonal and ultra centrifugation, gas chromatography, automatic analyzers, microscopy, culture methods, use and detection of radioisotopes. Prereq: Chemistry 350, 360; Physics 121, 122. May be repeated. Maximum 5 hrs. S/NC only.

583 The Field Research Problem (3) Conceptualization, planning, and implementing field research. Criteria for choosing instruments, sampling methods, and location for study of populations, communities, and ecosystem. Field practice. Development and critique of formal research proposal like those required by granting and contracting agencies. Prereq: 431, or 555 or 573.

585 Methods and Instrumentation in Field Investigation (1) Appropriate methods and instrumentation. Topics vary. May be repeated with consent of instructor. Maximum 5 hrs. S/NC only.

590 Developmental Plant Morphology (3) Developmental morphology of plants from vegetative and reproductive organography, and pollination determination and differentiation. Prereq: 310, 320 or 412 and 321 or 521 or consent of instructor. 2 hrs and 1 lab. F, A

600 Doctoral Research and Dissertation (3-15) P/NP only. E

606-07 Advanced Topics in Botanical Sciences (1-3, 1-3) Experimental botanical science: nomenclature, morphology and systematic of vascular plants, cryptogramic botany, cytology and cell biology, genetics, plant physiology, palynology and ecology. May be repeated. Maximum 12 hrs.

632 Ecosystems of the World (2) Characterization of world and regional ecosystems, special characteristics of ecosystem function. F, A

637 Applied Ecology (3) (Same as Ecology 637.)

662 Seminar in the History of Botany (2) History of botanical exploration and advances from early civilized to modern periods. May be repeated. Maximum 4 hrs.

Broadcasting
(For College of Communications)

MAJOR

COMMUNICATIONS

Degree M.S.

Norman R. Swan, Head

Professors:
D. W. Holt, Ph.D. Northwestern;
H. H. Howard, Ph.D. Ohio; N. R. Swan, Ph.D. Missouri.

Associate Professor:
B. A. Moore, Ph.D. Ohio.

Assistant Professors:
G. C. Johnson, Ph.D. Southern Illinois;
D. Ziegler, Ph.D. Southern Illinois.

Adjunct Professor:
Lindsey Nelson, B.A. Tennessee.

The Department of Broadcasting offers a concentration area for the Master's with a major in Communications. See Communications for additional information.

410 Television News (3) Writing, reporting, producing, and producing news for television. Experience as reporter/producer for television news program. Electronic news gathering equipment and techniques, video editing. Prereq: 310. 1 hrs and 4 labs. E

420 Radio-TV Sales and Promotion (3) Problems and practices of television, radio, and cable sales and promotion. Case studies in sales, sales management, pricing, rate cards, use of rating, and sales presentation. Effective station promotion techniques. Prereq: 320. F

430 Producing for Television (3) Principles of television studio and field production, both technical and creative. Writing, producing, shooting, and editing video stories and programs, 3/4 cameras, recorders, and editing system. Prereq: 330. E


490 Radio & Television Management (3) Business policies and practices of broadcast operations, departmental function, cost and income analysis, leadership styles and techniques, mid-level management. Capstone course to be taken in student's last semester. Prereq: 275, 310, 330, E

500 Radio & Television Law and Regulations (3) Legal problems faced by broadcast managers. Philosophy of regulatory policy formation. Efforts at self-regulation. Sociopolitical restraints, effects of laws and regulations, and public pressure on stations, networks, cable and new technologies. Unique situation of broadcasting among media in terms of regulations. Prereq: Consent of instructor or admission to program. F

570 Radio & Television Research (3) Various techniques used by stations and consultants in broadcast research. Applied audience research, deciding which method to use, interpreting results, and applying research to management decision making. Prereq: Communications 512 or 612, or consent of instructor. Sp

580 Seminar in Radio & Television (3) Salient issues in broadcast, broadcasting. Prereq: 612 or consent of instructor. Pr

590 Advanced Radio & Television Management (3) Financial management of broadcast operations: budgeting, financial planning, accounting, and related techniques. Theoretical perspectives in broadcast management, organization and management of commercial and non-commercial operations from perspective of general manager. Prereq: 490. Sp

597 Independent Study (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

598 Internship (3) Full-time (30-40 hrs per week) work experience in news, production, or sales and management with non-university professional organization. Educational experience beyond that available at university. Final term paper. No retroactive credit for previous work experience. Prereq: Senior or gradu- ate standing, completion of at least 15 hrs of broadcasting courses, GPA 3.0 or better, and consent of department head.

Business Administration
(For College of Business Administration)

MAJOR

DEGREES

Business Administration M.B.A., Ph.D.
THE MBA PROGRAM

The MBA program is designed for students with undergraduate degrees in the social and natural sciences, the humanities, and professional fields such as engineering, business, agriculture, and architecture. For full-time students, the MBA program is a two-year, lock-step program with students beginning in the fall of each year and graduating in the spring, two years hence. During the summer between the first and second year, students must complete an internship with a company using those skills acquired during the first year of the MBA program.

The complete MBA program with a concentration in management or new venture analysis and entrepreneurship is offered for part-time evening students. The part-time program has the same admissions requirements, curriculum (except for the summer internship, which is not required of part-time students), and faculty as the full-time program. Part-time students enter in the fall semester and take approximately 4 years to complete the program. Part-time students are required to successfully complete six hours of graduate credit per semester.

The program consists of 15 MBA core courses and 5 concentration/elective courses. Each course is 3 semester hours of graduate credit with the exceptions of Business Administration 501 and 503, which are one semester hour of graduate credit each.

Application and Admission

Applications are accepted for fall semester only. The application deadlines for fall semester are March 1 for international students and June 1 for others. Applications by U.S. citizens and permanent residents received after June 1 will be considered as space allows.

To obtain application materials, write or call:

Associate Dean for Graduate Business Programs
Suite 527, Stokely Management Center
College of Business Administration
The University of Tennessee
Knoxville, TN 37996-0550
Telephone: (615) 974-5033

To be considered for admission, the applicant's file must be complete. A completed file includes the Graduate School Application, transcripts of prior college work, the MBA program application, two completed recommendation forms, and the Graduate Management Admission Test (GMAT) score report. The first items should reach the Graduate School ten days before the MBA application deadline to allow for processing. Additional information is required by The Graduate School for international students (see page 14).

For admission to the MBA program, consideration is given to (1) the applicant's academic record with particular attention to the last two years of undergraduate work and previous graduate studies, (2) scores on the GMAT and the Test of English as a Foreign Language (TOEFL) for those whose native language is not English, (3) work experience and other activities that demonstrate potential for leadership, and (4) recommendations from professors and work supervisors. The admission decision is based on all factors which make up the total application; therefore, there is no automatic cut-off for either grade point averages or GMAT scores.

Prerequisites

Upon matriculation, the student must have received a Bachelor's degree from a regionally accredited institution. College-level mathematics through at least one course in calculus is one of two prerequisite requirements for entry into the program. Students whose undergraduate training does not include calculus should arrange to take it at UT or at another accredited institution prior to the fall semester of entry into the program. The other prerequisite is that the student possess basic operating skills on a microcomputer. An intensive one-week summer workshop is offered for candidates not having the required computer skills. Those electing the management science or statistics concentration must have completed two years of college-level calculus.

MBA Core

The following courses are required in each student's program. For full-time students, the sequence of core courses is:

Third semester: Economics 503, Business Administration 506.

The same courses, but in a different sequence, comprise the core for part-time students.

Concentration and Electives

A concentration area may be indicated on the MBA Program Application or this declaration may be deferred until after matriculation. In any event, selection must be made no later than completion of 18 hours of MBA program coursework. In some cases, a selection of an area early in the program is encouraged to facilitate proper course sequencing. Requests for changes in concentration area must be submitted for approval to the Office of Graduate Business Programs.

Among the 5 courses in the concentration/electives block, at least 3 but not more than 4 must be in one of the following concentration areas. For specific courses required in concentration areas, see the appropriate field of instruction.

Controllership

Economics
Finance
Forest Industries Management
Management Science
Marketing
New Venture Analysis and Entrepreneurship
Statistics
Transportation and Logistics*

*Available to residents of West Virginia under terms of the Academic Common Market. (See College of Business Administration.)

The remaining elective courses (1 to 2) must be in fields outside the concentration area, normally selected from MBA courses offered in other departments of the college. Courses outside the College of Business Administration as well as courses listed in the Graduate Catalog numbered below 500 may be included in this block only with written permission via formal petition to the Office of Graduate Business Programs.

Transfer Credits

Graduate level courses taken at other institutions accredited by the American Assembly of Collegiate Schools of Business that otherwise conform to University policy may be credited toward MBA degree requirements within the following limits:

MBA Core: 6 hours
Concentration Area: 3 hours (provided at least 6 hours of work at this institution are included in the concentration area).
Elective Area: 3 hours.

The maximum number of hours that may be transferred is 9 semester hours. Transfer credit will be considered upon formal petition to the Associate Dean for Graduate Business Programs.

Other Requirements

The Application for Admission to Candidacy must be approved by two faculty members and the department head in the student's area of concentration and the Associate Dean for Graduate Programs in the College of Business Administration. It should be submitted to the Graduate Office at least one full semester prior to the date the degree is conferred. (Admission to candidacy in the fall semester permits graduation in the following spring semester.)

To qualify for the degree, the student must achieve a B average (3.0) or above in MBA core courses required in his/her program, a B average or higher in courses comprising the concentration area, and a B average or higher in the overall program. The student must demonstrate competency in these areas in a comprehensive exam administered in the capstone course, Business Administration 509.

BUSINESS ADMINISTRATION CONCENTRATION

For complete listing of MBA program requirements, see above.

MBA Concentration

New Venture Analysis and Entrepreneurship:

This MBA concentration has been designated a Center of Excellence by the Tennessee Higher Education Commission. The concentration is comprised of three specifically designated courses which are interdisciplinary in nature. This concentration strives to build a strong academic foundation for both entrepreneurial and intrapreneurial activities. The new venture analysis and entrepreneurship concentration is offered to both the full- and part-time student in recognition of the growing trend in American business today towards new product/venture development. The new venture analysis/entrepreneurship concentration courses may be combined with two elective courses in another area (finance, management, etc.) to achieve a dual concentration.

Minimum Course Requirements for MBA
Concentration: Finance 551, Management 551, and Marketing 550. These course descriptions are listed for reference under their fields of instruction.

DUAL J.D.-MBA PROGRAM

The College of Business Administration and the College of Law offer a coordinated dual program leading to the conferral of both the Doctor of Jurisprudence and the Master of Business Administration. The dual program saves the student one year over the time that would be required to earn both degrees independently.

The establishment of the dual program recognizes the increasingly complex body of knowledge to the creative conduct of business and business-related law practice, the complementary nature of many aspects of the graduate programs of the College of Law and the College of Business Administration, and the intellectual benefits inherent in the concurrent study of both business and business-oriented law. The program is designed to accommodate the interests of students who (a) contemplate a career in public service and want to acquire the skills and perspective of the lawyer and the business-oriented manager; (b) contemplate a career in business management and want to acquire the skills and perspective of a lawyer; or (c) contemplate a career as a lawyer specializing in business-related law and want to acquire the skills and perspective of the business-oriented manager.

Admissions

Applicants for the J.D.-MBA program must make separate application to, and be competitively and independently accepted by, the College of Law for the J.D., The Graduate School and College of Business Administration for the MBA degree, and by the Dual Program Committee.

Students who have been accepted by both colleges may apply for approval to pursue the dual program anytime prior to, or after, matriculation in either or both colleges. Such approval is subject to the conditions that dual program studies be started prior to entry into the last 28 semester hours of J.D. course work and prior to entry into the second year of the MBA program. Students interested in entering the dual degree program should submit a letter of application to the Dual Program Committee.

The College of Business Administration offers financial aid and graduate assistantships for full-time students. The college requires the Graduate School Application, scores from the GMAT, and four written recommendations. All materials should be received by the College of Business Administration not later than March 1. Late applications are considered only if space is available.

Under exceptional circumstances, a student may be considered for acceptance into the Ph.D. program without having a Master's degree. An applicant in this situation should have an outstanding undergraduate background and should represent a deep and sincere commitment to the pursuit of a career in research and instruction. If you are interested in applying to the Ph.D. program under these circumstances, contact the Associate Dean for Graduate Business Programs for consideration of the application.

The J.D. normally requires at least three years of intensive study and research beyond the Master's degree. Typically, the first two years of a student's program consist of course work, writing, and research.

The third year usually focuses on completion of the dissertation research and writing. It is emphasized that the Ph.D. program of study is structured for full-time students only. Upon acceptance of a student by a particular departmental faculty, the student is expected to remain in residence until the dissertation has been completed and all requirements are met for completion of the Ph.D. Since the program focuses on the development of competent scholars, heavy emphasis is placed on both teaching and research skills. As part of the doctoral program, each student is required to serve as a teaching assistant to an undergraduate business class or as a research assistant to a senior faculty member. Typically, the College of Business Administration offers financial support for doctoral students during their tenure in the program.

The Ph.D. program is highly flexible, offering a wide array of concentrations and cognates. Moreover, heavy emphasis is placed on individualized instruction and close student-faculty interaction. Instruction takes the form of regular classes, doctoral seminars, and independent study and research. Students are also encouraged to attend lectures and discussions by visiting scholars throughout the year.

There are five concentrations offered in the Ph.D. program:

- Accounting
- Finance
- Management (Operations Management and Strategic Management)
- Marketing
- Transportation and Logistics

More detailed information concerning these specific areas is available by writing directly to each department chairperson and by referring to the appropriate fields of instruction.
Degree Requirements

Doctoral students must file a program of study that has been approved by their temporary doctoral advisory committee and the Associate Dean for Graduate Business Programs by the end of the first semester of course work after entry into the program. This committee is nominated by the department chairperson in a student's intended area of concentration, subject to the Graduate Council's policies and procedures.

Following are specific degree requirements:
1. Students must complete at least three years of full-time course work beyond the baccalaureate degree, with two years of residence on the Knoxville campus.
2. Students must complete appropriate courses at the graduate level, or other approved concentrations of course work, in the following areas:
   - Accounting
   - Behavioral Science
   - Business Policy
   - Calculus
   - Computer Science
   - Economics
   - Finance
   - Legal Environment
   - Management
   - Marketing
   - Statistics

All work in the above areas is subject to approval by the temporary doctoral advisory committee and the Associate Dean for Graduate Business Programs. Specific majors may have prerequisites not listed above.

3. Basic Core: Economics 510 (or approved substitute) is required, except that Management 567 (or equivalent) may be substituted with prior approval.
4. Research Tools: A minimum of 9 semester hours of graduate research methods courses at the graduate level, including at least 6 semester hours in statistics courses beyond Statistics 531, are required. The remaining 3 semester hours may be completed in additional statistics courses (not to include Statistics 531) or in other areas such as research methodology, management science, computer science, econometrics, and psychometrics.

5. Concentrations: The concentration is the focal point of the Ph.D. program. Students are expected to complete the literature and research techniques in the concentration area and to do quality research as evidenced by the preparation of an acceptable dissertation. A minimum of 12 semester hours of course work is required. At least 6 semester hours in statistics courses beyond Statistics 531 are required. The remaining 3 semester hours may be completed in additional statistics courses (not to include Statistics 531) or in other areas such as research methodology, management science, computer science, econometrics, and psychometrics.

6. Concentrations: The concentration is the focal point of the Ph.D. program. Students are expected to complete the literature and research techniques in the concentration area and to do quality research as evidenced by the preparation of an acceptable dissertation. A minimum of 12 semester hours of course work is required. At least 6 semester hours in statistics courses beyond Statistics 531 are required. The remaining 3 semester hours may be completed in additional statistics courses (not to include Statistics 531) or in other areas such as research methodology, management science, computer science, econometrics, and psychometrics.

Doctoral Committee

A doctoral student is advised by a temporary doctoral advisory committee, consisting of at least four faculty members, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. When the doctoral committee has been formed, the temporary doctoral advisory committee ceases to exist.

Admission to Candidacy

Students may apply for admission to candidacy for the Ph.D. after maintaining at least a "B" average in course work, successful completion of comprehensive examinations, and acceptance of a research proposal for the dissertation by the student’s doctoral committee.

Admission to candidacy must be approved at least one full semester prior to the date the degree is conferred. (Admission in the fall permits graduation in the following spring semester.)

Application for admission to candidacy must include a listing of all courses taken in each of the fields required for the degree (business functional areas, basic disciplines, concentration and cognate area). Graduate courses accepted from other institutions must be included. Under “Other Requirements,” the date of acceptance of the research proposal by the doctoral committee should be indicated. The application must be approved by the student’s doctoral committee and the Associate Dean for Graduate Business Programs before submission to the Graduate School.

Dissertation

Minimum of 24 semester hours: The student must complete a dissertation embodying the results of original research demonstrating the ability to do scholarly writing. The dissertation is supervised by the candidate’s doctoral committee, which must certify its completion and acceptability after oral defense of the candidate’s research effort.

The dissertation normally must be completed within three years of the student’s advancement to candidacy.

Chemical Engineering

(College of Engineering)

MAJOR

Chemical Engineering

DEGREES

M.S., Ph.D.

Associate Professor: J. W. Prados (Vice President for Academic Affairs), Ph.D. Tennessee; C. D. Scott (Adjunct), Ph.D. Pennsylvania; A. C. Sheth (UTSI), Ph.D. Northwestern.

Assistant Professor: F. E. Weber, Ph.D. Minnesota; T. W. Wang, Ph.D. M.I.T.

Lecturer: D. W. Lane (Adjunct), Ph.D. Tennessee.

Graduate programs lead to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering with concentrations in chemical engineering, polymer science and engineering, advanced control systems, and polymer science and engineering.

THE MASTER'S PROGRAM

The standard Master’s program includes a thesis and leads to the Master of Science. Minimum department requirements are as follows:
1. A total of at least 21 hours in graduate courses in chemical engineering and related areas is required to complete the thesis. The minimum requirements are 15 hours in chemical engineering; 3 hours in other engineering, scientific, or business areas (as approved by the departmental faculty); and 3 optional hours from either one of these two categories.


3. Active participation in graduate seminars in the department. Resident students must register for CHE 501 every semester it is offered.

4. A final oral examination covering the thesis, related fields, and graduate course work.

Under certain conditions, a candidate may apply for a non-thesis program. To be eligible, a candidate must show evidence of significant professional experience after the baccalaureate degree; at least five years of industrial experience; and must register with the departmental faculty. The faculty will then consider each application individually. Upon acceptance, the requirements for completion of the non-thesis option are as follows:

1. A total of at least 33 hours in graduate courses in chemical engineering and related areas. The minimum requirements are 18 hours in chemical engineering; 6 hours in other engineering, scientific, or business areas (as approved by the departmental faculty); and 9 optional hours from either one of these two categories.

2. Completion of a critical review of the literature and other sources in an area related to chemical engineering (CHE 580).

3. A written comprehensive examination covering the major field and the oral examination covering the review paper and related areas.

THE DOCTORAL PROGRAM

Students applying for entrance into the doctoral program must submit evidence of ability to perform research, and eligibility for the program.

Department requirements consist of the satisfactory completion of:

1. Graduate courses in chemical engineering, amounting to approximately 24 semester hours, at least 9 of which must be in 500 series courses.

2. Supporting courses in related scientific and engineering fields amounting to approximately 24 semester hours, subject to approval by the student’s faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.

3. The comprehensive examination, usually given in two parts, and covering such topics as chemical engineering operations and processes, thermodynamics, technology, and other related fields.

4. Active participation in graduate seminars conducted by the department. Resident students must register for CHE 501 every semester offered.

5. Reading ability, by means of a written examination, in one foreign language of technical or commercial significance. Language must be selected from the following list, which is not intended to be comprehen-

sive and may be amended from time to time by vote of the departmental faculty. Chinese, French, German, Japanese, Korean, Russian, and Spanish. Foreign students whose native language is one of those on the approved list will not be required to take an examination.

401 Chemical Engineering Data Analysis (3) Experimental data; data evaluation; statistical properties of samples; empirical modeling of processes; statistical process control; optimization techniques.
403 Introduction to Optimization (3) Principles and applications of optimization techniques to chemical process design; unconstrained and equality constrained optimizations, linear programming, dynamic programming, and geometric programming. Prereq: Mathematics 241.
410 Chemical Engineering Laboratory II (3) Laboratory investigations of mass transfer and chemical reaction phenomena in chemical engineering. Prereq: 440, 450.
450 Chemical Reactor Fundamentals (3) Brief review of homogeneous and heterogeneous reaction kinetics; idealized homogeneous reactor models, both for closed and flow systems; corrections for non-ideal residence time distribution; identification of scaling parameters; catalyst effectiveness factors and conversion in fixed bed catalytic reactors. Prereq: 340, Chemistry 350.
475 Fundamentals of Bioreactor Design (3) Reactor modeling; biochemical reaction kinetics and design for microbial fermentations and cell culture, batch, fed batch and continuous operation; suspension cultures and immobilized systems; factors affecting productivity and control.
476 Principles of Biochemical Separations (3) Selection and design of separation and purification processes; analysis of separation processes; chromatography, electrophoresis, centrifugation, membrane processes, and conventional and supercritical fluid extraction.
485 Hydrocarbon Processing (3) Chemical and physical properties of selected petroleum and those processes utilized in conversion of raw material into various fuels and selected chemical feedstocks. Prereq: 340.
486 Coal Processing to Liquid Fuels (3) Characterization of various coals with respect to current gasification and liquefaction technologies; modeling of conversion processes and estimation of product yields and associated water, oxygen, and energy requirements; catalytic hydroprocessing, blast furnace coke consideration; economic assessments. Prereq: 485.
500 Thesis (1-15) P/NP only. E
501 Graduate Seminar (1) Prereq: Admission to graduate program. May be repeated. S/NC only.
502 Registration for Use of Facilities (3-15) Prereq: Admission to graduate program. May be repeated. S/NC only.
505 Engineering Analysis (3) Formulation and solution of problems in chemical engineering and materials areas, ordinary and partial differential equations; types of ODE's, PDE's and related numerical methods; conformal mapping; variational methods; introduction to numerical methods. (Same as Materials Science Engineering 505.)
506 Approximate Methods in Chemical Engineering (3) Chemical engineering problems requiring approximate solution; introduction to some approximate methods. Prereq: 505.
531 Advanced Chemical Engineering Thermodynamics (3) Phase equilibrium in ideal and nonideal solutions; composition relationship between phases, solution behavior and applications of activity coefficients; introduction to microscopic approach to thermodynamics.
541 Fluid Mechanics and Polymer Processing (3) (Same as Polymer Engineering 541.)
542 Diffusive and Stagewise Mass Transfer Operations (3) Analysis of mass transfer phenomena, coupled mass transfer and reaction, mass transfer operations in packed towers and agitated vessels, membrane separations. Equilibrium stage concepts applied to mass transfer operation, emphasizing nonisothermal and multicomponent systems.
551 Chemical Reactor Analysis (3) Rate models for heterogeneous reactions, properties of porous catalysts, catalyst deactivation, fluid-fluid and fluid-solid reactors.
561 Process Modeling and Simulation (3) Theories and structures of models; art of simulation; Model development from basic principles. Model development from plant test. Use of models in operation, optimization and control. Prereq: Consent of Instructor.
588 Measurement Science I (3) (Same as Nuclear Engineering 588, Computer Engineering 588, Electrical and Computer Engineering 588, Engineering Science and Mechanics 588, Mechanical Engineering 588, and Aerospace Engineering 588.)
589 Measurement Science II (3) (Same as Nuclear Engineering 589, Computer Engineering 589, Electrical and Computer Engineering 589, Engineering Science and Mechanics 589, Mechanical Engineering 589, and Aerospace Engineering 589.)
590 Special Topics in Chemical Engineering (3) May be repeated. Maximum 6 hrs.
600 Doctoral Research and Dissertation (3-15) P/NP only. E
625 Venture Analysis (3) One or more chemical engineering processes as basis for proposed new venture business. Case study with attention to markets, manufacturing needs, cost estimation, and management and financial planning. To support decisions by management or by potential investors. Prereq: 525 or equivalent.
631 Advanced Topics in Statistical Thermodynamics and Molecular Dynamics (3) Statistical thermodynamics and molecular dynamics. University facilities simulations, Monte Carlo and molecular dynamic calculations; applications to supercritical fluids, macromolecules and biological systems. Prereq: 531.


661 Advanced Topics of Process Dynamics and Control (3) May be repeated. Maximum 6 hrs.

691 Advanced Topics of Chemical Engineering (3) May be repeated. Maximum 6 hrs.

Chemistry

(College of Liberal Arts)

MAJOR

DEGREES

Chemistry

M.S., Ph.D.

Gleb Mamantov, Head

Professors:

J. E. Bloor, Ph.D. Manchester; N. S. Bowman (Emeritus), Ph.D. Princeton; C. A. Buehler (Emeritus) (Alumni Distinguished Service Professor), Ph.D. Ohio State; W. E. Bull, Ph.D. Illinois; J. Q. Chambers, Ph.D. Kansas; T. F. Williams, Ph.D. London; J. H. Shibata, Ph.D. Berkeley; C. E. Barnes, Ph.D. Stanford; G. K. Schweitzer, Ph.D. Illinois; D. A. Shirley (Emeritus), Ph.D. Iowa State; W. A. Van Hook, Ph.D. Johns Hopkins; E. L. Wehry, Ph.D. Purdue; T. F. Williams, Ph.D. London; J. H. Wood (Emeritus), Ph.D. North Carolina.

Associate Professors:

J. L. Adcock, Ph.D. Texas; J. E. Bartness, Ph.D. Northwestern; K. D. Cook, Ph.D. Wisconsin; F. A. Grimm, Ph.D. Cornell; J. L. Kovacs-Young, Ph.D. Yale; G. A. Lane, Ph.D. California (Berkeley); L. J. Magid, Ph.D. Pennsylvania; F. M. Schell, Ph.D. Indiana; M. J. Sapanik, Ph.D. Iowa State; C. Woods, Ph.D. North Carolina State.

Assistant Professors:

S. D. Alexandratos, Ph.D. California (Berkeley); C. E. Barnes, Ph.D. Stanford; C. S. Feigerle, Ph. D. Colorado; J. H. Shibata, Ph.D. Washington.

Students majoring in Chemistry for the Master's or doctoral degree are required to present as a prerequisite two years of chemistry including quantitative analysis.

THE MASTER'S PROGRAM

The department offers concentrations in six areas for the M.S.: analytical chemistry, environmental chemistry, inorganic chemistry, organic chemistry, polymer chemistry, and physical chemistry.

The requirements for the M.S. in Chemistry consist of the satisfactory completion of:

1. Research and a thesis to give a minimum of 6 hours of graduate credit in Chemistry 500.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)
3. Prescribed remedial courses based on performance on entrance examinations.
4. Sufficient graduate coursework in chemistry (at the 400 level or above) and/or a related field to make an overall total of 30 hours, including one of the following sequences: 510-11-12, 530-31-32, 550-51-52, 570-71-72-73, 590-94-95. At least 14 hours of this graduate coursework must be at the 500 level or above.
5. A final oral examination.

THE DOCTORAL PROGRAM

The department offers concentrations in eight areas for the Ph.D.: analytical chemistry, chemical physics in cooperation with the Department of Physics), environmental chemistry, inorganic chemistry, organic chemistry, physical chemistry, polymer, and theoretical chemistry.

The requirements for the Ph.D. in Chemistry (except for the chemical physics concentration) consist of the satisfactory completion of:

1. Research and a dissertation to give at least 24 hours of graduate credit in Chemistry 600. Registration must be continuous from the beginning of research.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar.
3. Prescribed remedial courses based on performance on entrance examinations.
4. Completion of the comprehensive oral examination and defense of an original research proposal to give 2 hours of credit in Chemistry 601.
5. Demonstration of a reading knowledge of French, German, Russian, or an alternative approved by the Chemistry faculty.
6. Eighteen additional hours in courses at the 500 level or above including at least one course above 601 and one of the following sequences: 510-11-12, 530-31-32, 550-51-52-53-54, 570-71-72-73, and 590-94-95.
7. A final oral examination.

The Ph.D. program with concentration in chemical physics is conducted jointly with the Department of Physics. Requirements depend on the choice of the major department. Chemistry departmental requirements include passing the above degree requirements in chemical physics with a concentration in chemical physics plus 6 additional hours in physics at the 500 level or above. Three of the additional physics hours can be used to satisfy the 18 hours requirement in item 6.

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, bonding theories, descriptive chemistry of elements, kinetic and mechanistic inorganic reactions, applications of modern techniques for characterization, coordination and organometallic chemistry. Prereq: 230. Prereq or coreq: 360 or 381. Sp

431 Radioactivity and Its Application (2) Radioactive measurements and therapeutic applications. Radioactive decay, detection apparatus and techniques, tracer procedures, safety precautions in agriculture, biology, medicine, nutrition. Not for credit by chemistry or physics majors or minors. Prereq: Mathematics 122 or equivalent and 1 yr of general chemistry. Sp


470 Advanced Physical Chemistry (3) Chemical dynamical, statistical thermodinamics, quantum mechanics of atomic and molecular systems, crystal structure and solid state. Prereq: 380 or 381. Sp

500 Thesis (1-15) P/NP only. E

501 Chemistry Seminar (1) Lectures and discussion on current research. May be repeated. Continuous registration required for resident graduate students. S/NC only. F,Sp

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student is using Department of Physics facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

505 Special Problems (3) Specially assigned theoretical or experimental work on problems not covered in other courses. Prereq: Consent of Department. May be repeated. Maximum 6 hrs. S/NC only.

510 Analytical Spectrometry (3) Principles and practice of optical and mass spectrometric techniques in quantitative chemical analysis. Prereq: 1 yr of physical chemistry. F

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena. Prereq: 1 yr of physical chemistry. Sp

512 Electroanalytical Chemistry (3) Fundamentals of electrode processes; principles and practice of electroanalytical techniques in quantitative chemical analysis and applied to study of chemical systems. Prereq: 1 yr of physical chemistry. F

520 Chemical Instrumentation (3) Principles of analog and digital systems in chemical instrumentation; practice in design and construction of chemical instruments. Prereq: Consent of instructor.

530 Chemical Bonding (3) Wave mechanical atom, group theory, quantum approach to molecular orbital theory, covalent, ionic, and metallic bonding, ligand field theories, solid state. Prereq: 1 yr of physical chemistry. F

531 Characteristics of Inorganic Compounds (3) Descriptive chemistry of elements, structure, reactions, kinetics, mechanisms, equilibria, and spectra of coordination, organometallic, biomimetic compounds. Prereq: 530. Sp

532 Experimental Methods of Inorganic Chemistry (3) Electronic, infrared, Raman, microwave, NMR, ESR, nuclear quadrupole, Mossbauer, mass, and photoelectron spectroscopies to characterization of inorganic compounds. Prereq: 530. F

540 Nuclear and Radiochemistry (3) Nuclear properties, radioactivity, radioactive decay processes, nuclear structure and models, nuclear reactions, radiation and matter, radiation detection. Prereq: 1 yr of physical chemistry. F

550 Structure and Reactivity in Organic Chemistry (3) Structure and bonding in organic compounds; molecular orbital theory, stereochemistry, conformational analysis, and molecular mechanisms; substitution effects on acidity and reactivity. Introduction to reaction mechanisms. Prereq: 360. F

551 Organic Reactions (3) Organic transformations
of use in synthesis; carbonyl chemistry and carbon-carbon bond formation; stereochemistry and regiochemistry of synthetic processes. Prereq: 550. Sp

552 Organic Reaction Mechanisms (3) Techniques and principles in study of organic reaction mechanisms; applications and interpretations in polar, radical, and pericyclic reactions; reactive intermediates. Prereq: 550. F

553 Spectroscopic Characterization of Organic Compounds (2) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, infrared, ultraviolet and mass spectrometry. Prereq: 360 or equivalent. Sp

554 Advanced Organic Chemistry Laboratory (1) Synthesis of organic compounds illustrating modern techniques. Prereq: 360 or equivalent. Sp

570 Quantum Chemistry and Spectroscopy (3) Basic principles of quantum mechanics and their applications to molecular orbital theory, molecular structure, and spectroscopy; introduction to group theory. Prereq: 1 yr of physical chemistry. F

571 Advanced Quantum Chemistry and Spectroscopy (3) Prereq: 570 or consent of instructor. Sp

572 Thermodynamics and Statistical Mechanics (3) Macroscopic and microscopic description of equilibrium systems. Basic principles of thermodynamics and statistical mechanics, and application to selected chemical systems. Prereq: 1 yr of physical chemistry. F

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory. Prereq: 1 yr of physical chemistry.

580 Fundamental Topics in Physical Chemistry (3) Quantum chemistry, spectroscopy, chemical kinetics, transport properties, thermodynamics, and statistical thermodynamics. Prereq: 1 yr of physical chemistry. F

590 Polymer Chemistry (3) Fundamentals of polymer synthesis and characterization through application of organic and physical chemical principles. Prereq: 1 yr each of organic and physical chemistry.


595 Physical Chemistry of Polymers (3) Conformation of macromolecules, solution and bulk properties, rubber elasticity, kinetics of polymerization, polymer thermodynamics. Prereq: 590 or equivalent. Sp

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Chemistry Research Proposal (2) Preparation and oral defense of original written research proposal based on thorough survey of chemical literature. Prereq: Consent of department head. S/NC only. E

610 Selected Topics in Analytical Chemistry (3) Topics of current significance. Prereq: 510-11-12 or consent of instructor. May be repeated. Maximum 12 hrs.

630 Selected Topics in Inorganic Chemistry (3) Topics of current significance. Prereq: 530-31-32 or consent of instructor. May be repeated. Maximum 12 hrs.

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 550-51-52 or consent of instructor. May be repeated. Maximum 12 hrs.


670 Selected Topics in Physical Chemistry (3) Topics of current significance. Prereq: 570-72-73 or consent of instructor. May be repeated. Maximum 12 hrs.

690 Selected Topics in Polymer Chemistry (3) Topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

**Child and Family Studies**

(College of Human Ecology)

<table>
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<th>MAJORS</th>
<th>DEGREES</th>
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<tr>
<td>Child and Family Studies</td>
<td>M.S. Human Ecology</td>
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Greer L. Fox, Head

Professors:
- J. L. Cunningham, Ph.D. Michigan State

Associate Professors:
- J. H. McInnis, Ph.D. Florida State
- G. Peterson, Ph.D. Brigham Young
- S. Twardosz, Ph.D. Kansas.

Assistant Professors:
- J. Allen, Ph.D. Purdue; B. Barber, Ph.D. Brigham Young; L. Blinn, Ph.D. Ohio State.
- C. Buehler, Ph.D. Minnesota; C. Catron, Ed.D. Vanderbilt; R. Haistocks, Ph.D. Ohio State; G. Pettit, Ph.D. Indiana University.
- D. Tegano, Ph.D. Virginia Tech; K. Weddle, Ph.D. Tennessee.

The Department of Child and Family Studies encompasses two primary concentrations: child development and family studies. Integration of these areas creates a unique perspective for the study of individuals and families. Each graduate student's program of study is carefully planned in conjunction with a faculty committee to establish a program consistent with individual goals.

All programs are characterized by a broad array of course work, varied research experiences, and opportunities for experiences in applied settings.

Because the doctoral degree is a research degree, students at this level receive substantial preparation in statistics and research methodology. Interested students should contact the department head.

**ADMISSION REQUIREMENTS**

Admission to the program is contingent upon faculty evaluation of GRE scores, undergraduate/graduate GPA, written comprehensive examination, and work experience. Prerequisites for admission to the Master's or doctoral program are 9 semester hours of either upper division undergraduate or graduate social science. A minimum of 18 credits in child and family studies required for foundation courses: 510, 511, 550, 551, 570, 571.

**THE MASTER'S PROGRAM**

An individual program of study may be designed by the student in consultation with his or her major professor and committee. The program provides for a concentration in either child development or family studies. Specializations in the child development concentration consist of early childhood education, early childhood special education, early childhood administration, and child development. Specializations in the family studies concentration consist of family life intervention and family science. Thesis and non-thesis options are available in both concentrations.

All students in the child development concentration must enroll in CFS 510, 511, 533, and 571. At least 6 hours in a cognate area outside the department must be completed. Thesis students are required to take the following: 3 hours of 500-level research methods, 3 hours of 500-level statistics, 6 hours of CFS courses in the area of specialization, 6 hours of thesis credit and an oral comprehensive examination. Non-thesis students are required to take the following: 3 hours of 500-level research methods, 3 hours of 500-level statistics, 6 hours of CFS courses in an area of specialization, 6 hours of thesis credit and an oral comprehensive examination.

Students seeking the M.S. in Child and Family Studies are required to file a plan of study with the department head after 15 hours of graduate credit have been completed.

**THE Ph.D. CONCENTRATION**

The doctoral program in Human Ecology prepares scholars in the concentration areas of child development and in family studies. The strength of the doctoral program is based on three major components: the integration of child development and family studies within the context of human ecology and related areas of concentration in child development or family studies, and an emphasis on becoming proficient producers and consumers of research. A doctoral program that is concurrently specialized and integrative in nature reflects the complexity of the disciplinary subject matter, provides a broader context to formulate theoretical questions, and broadens the empirical literature for addressing those questions.

Requirements include:
2. Minimum 12 credits in 500- and 600-level courses in child development or family studies, with at least 3 credits in 600-level courses (in addition to the required courses described in #1);
3. Minimum 6 credits in a cognate area;
4. Minimum 9 credits in graduate-level statistics; with at least 3 of these credits in a more specialized area than a sequence of survey courses.
5. Minimum 3 credits of specialized research methods.
6. Pre-doctoral research project approved by student's committee;
7. College Professional Seminar, Human Ecology 610;

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
510 Survey of Research in Human Development (3) Current literature and issues in human development. Prereq: 9 hrs of either upper division undergraduate or graduate social science or consent of instructor. F
511 Theories of Human Development (3) Perspectives for studying development through life span. Use of theoretical frameworks, development of theoretical models, and application to intervention programs for problem behavior. Per. age groups. Prereq: 510 or equivalent or consent of instructor. Sp
512 Survey of Research in Early Childhood Education (3) Current literature and issues in early childhood education. Prereq: 510 or equivalent or consent of instructor. Sp
521 Organizational Management in Early Childhood Education (3) Designing, implementing, and evaluating physical and human resources in educational environments. Development of skills in environmental organization, interpersonal leadership, and supervision of staff. Prereq: 512. F
522 Naturalistic Interventions for Parents and Teachers of Young Children (3) Common problems faced by parents and teachers; methods available to modify problem behavior. Per. age groups. Prereq: 510 or equivalent or consent of instructor. F,A
533 Socialization (3) Process of socialization throughout life span. Family as primary socializing agent. Prereq: 510 or equivalent or consent of instructor. F
540 Parent-Child Relations (3) Influence of parents on children, influence of children on parents, reciprocal patterns of interchange. Description of systems models, child abuse, and impact of divorce on children. Prereq: 550 or equivalent or consent of instructor. F,A
550 Survey of Research in Family Studies (3) Research literature and issues in family science. Prereq: 9 hrs of either upper division undergraduate or graduate social science or consent of instructor. F
551 Conceptual Frameworks and Theory in Family Studies (3) Conceptual frameworks for studying family. Use of family conceptual frameworks, development of theoretical models, and application to research and family intervention programs. Prereq: 550 or equivalent or consent of instructor. Sp
556 Family Life Education Programs (3) Planning, implementing and evaluating programs in marital, parent-child, and family relationships, and parenthood education. Prereq: Consent of instructor. (Same as Home Economics Education 563.) F,A
564 Practicum in Human Development or Family Studies II (3) School and community programs concerned with education for human development and family living. Committee approved and supervised written project. Prereq: 564 and consent of instructor. E
565 Practicum in Human Development or Family Studies II (3) School and community programs concerned with education for human development and family living. Committee approved and supervised written project. Prereq: Consent of instructor. S/NC only. E
566 Approaches to Family Intervention and Counseling (3) Various theoretical approaches for family intervention and counseling. Structural, strategic, experiential and social learning schools of practice. Effects of intervention from perspective of their impact on family functioning and communication. Prereq: 562. (Same as Educational and Counseling Psychology 566.) Sp,A
571 Research Seminar (1) Presentation and critique of research projects. Prereq: Departmental major or consent of instructor. May be repeated. S/NC only. E
580 Special Topics in Human Development or Family Studies (1-3) Research, theory and current issues in child development or family studies: divorce, handicapped children, public interaction, work and family. Piaget, mainstreaming children, theory and research in human sexuality, cognition. Prereq: 6 graduate hrs in major, or consent of instructor. May be repeated with different topics. Maximum 9 hrs. E
581 Directed Study in Human Development or Family Studies (3) Individual learning experiences in specific topics in child development or early childhood education. Prereq: 6 graduate hrs or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E
590 Assessment of Development and Learning in Young Children (3) Theory, empirical research and practices related to measurement of development and learning in young children. F,A
591 Assessment of Family Behavior (3) Analysis of methods and measures used in family science research. Prereq: 551 or equivalent or consent of instructor. F,A
600 Doctoral Research and Dissertation (3-15) P/NP only. E
610 Advanced Special Topics in Human Development or Family Studies (1-3) Study of research and theory related to current issues. Prereq: 12 graduate hrs in major or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E
630 Advanced Study in Infant and Early Childhood Development (3) Normative and nonnormative development during infant and preschool years of life; cognitive, emotional, social, and physical aspects. Prereq: 510 or equivalent or consent of instructor. F,A
631 Adolescent Development in Families (3) Normative and nonnormative adolescent development; physical, cognitive, moral, social, familial, peer and personal. Prereq: 510 or equivalent or consent of instructor. F,A
632 Family Communication and Conflict Management (3) Human communication and conflict management within family context. Theoretical perspectives for familial processes, adjustment, decision making, and coping. Prereq: 550 or equivalent or consent of instructor. Sp,A
650 Marriage and the Family (3) Process of marriage, family development, and family life. Prereq: 550 or equivalent or consent of instructor. F,A

Civil Engineering
(Majors in Science)

MAJORS

Civil Engineering

DEGREES

Civil Engineering

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

Environmental Engineering

M.S.

Gregory D. Reed, Acting Head

Professors:


K. W. Heathington, Ph.D. Northwestern, P.E.;

J. B. Humphreys, Ph.D. Texas A & M, P.E.;

H. L. Johnson, M.S. Tennessee, P.E.;

W. A. Miller, Ph.D. Georgia Institute of Technology, P.E.; G. D. Reed, Ph.D. Arkansas, P.E.; B. A. Tshantz (Condra Professor), Sc.D. New Mexico State, P.E.; G. R. Walker (Emeritus), M.S. Massachusetts Institute of Technology, P.E.; D. W. Weeter, Ph.D. Purdue, P.E.; F. J. Wegman (IBM Professor), Ph.D. Northwestern.

Associate Professors:

B. J. Frederick, BCE Clarkson, P.E.;

J. H. Hansen, Ph.D. Missouri; G. D. Kressin, J.D. Tennessee; A. B. Moore, M.S. Tennessee; R. B. Robinson, Ph.D. Iowa State, P.E.; R. F. Tiry (Emeritus), B.S. Marquette, P.E.

Assistant Professors:

R. M. Bennett, Ph.D. Illinois; E. C. Drumm, Ph.D. Arizona, P.E.; W. F. Kane, Ph.D. Virginia Polytechnic Institute.

Lecturers:


The Department of Civil Engineering offers degrees leading to the Master of Science, Master of Engineering, and Doctor of Philosophy with a major in Civil Engineering concentrating in environmental engineering, structural engineering, materials engineering, and transportation engineering; to the Master of Science in Environmental Engineering with concentrations in water quality, water resources, air quality, and solid waste.

MASTER OF SCIENCE PROGRAM

The Master of Science programs in Civil Engineering and Environmental Engineering are offered to graduate programs in recognized undergraduate curricula.

Departmental requirements provide that 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 a major in Civil Engineering.
Civil Engineering/Fields of Instruction

454 Urban Drainage Engineering

(3) Design and management of stormwater conveyance and control structures. Application of hydrologic and hydraulic principles to design of drainage systems for urban, storm, and highway development; development of method for design of storm sewers, culverts, and detention systems. Evaluation of commonly used computer runoff models; floodplain evaluation. Prereq: 390, 395.

495 Water Resources Development and Management

(3) Principles of water resources project development and management. Institutional framework: water law, water management, water conservation; design of water resources development projects that include systems for surface and ground water; environmental assessment of water resources projects and management. Prereq: 390, 395.

502 Registration for Use of Facilities

(3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/J/N only. E

508 Seminar

(1) Reports on current research in civil engineering at UTK. Prereq: Graduate standing.

510 Urban Systems: Engineering and Management

(3) Various urban systems usually under responsibility of city manager and/or city engineer: streets, lighting, water, sewage, refuse, traffic, recreation, personnel management, finance, planning and public relations. Prereq: Graduate standing.

521 Pavement Design


526 Screening and Environmental Design

(3) Strength of fine-grained soil from perspective of idealized simple, clay. Drained and undrained strength and stress-strain behavior of real soils. Laboratory testing. Stability of natural and cut slopes and embankments. Prereq: 335.

532 Principles of Rock Mechanics

(3) Properties of rock materials and analyses. Analysis of stress and strain; friction; time-dependent effects. Applications in stress analysis of rock structures. Prereq: 330 or consent of instructor.

535 Advanced Foundations and Retaining Structures

(3) Planning, design, and construction of retaining structures. Analysis of shallow foundations for structures and_INSTANCE; deep foundations, drilled piers; foundation design with pressure-meter, lateral earth pressures and design of retaining structures and sheetpiles. Prereq: 335.

536 Numerical Methods in Geotechnical Engineering


540 Construction Management I


541 Construction Management II


543 Construction Estimating

(3) Project costs, estimating and takeoff techniques, market cost conditions, and feasibility of design to cost. Prereq: 340 or consent of instructor.

545 Rock Excavation


551 Traffic Engineering/Characteristics

(3) Driver-vehicle-roadway systems; traffic flow modeling, elements of traffic management, highway safety. Prereq: Graduate standing.
552 Traffic Engineering-Operations (3) Signs, signals, and signal operations; control; signal timing/phasing; one-way reversible flow; system operations; identification and correction of high-accident locations and system deficiencies. Prereq: 551 or 452.

553 Geometric Design and Layout of Roadways and Community Facilities (3) Functional and geometric design and rural and urban roads of all classes; subdivision layout; configuration of urban roads of all classes; techniques for access control; freeway interchange changes and street intersections; and parking. Prereq: 452 or consent of instructor.

554 Urban Transportation Planning (3) Transportation problems in urban area; systematic planning for pedestrian locations and system deficiencies. Prereq: 551 or 452.

555 Public Transit Planning (3) Characteristics of transit modes, conventional and para-transit; operational design of transit services: route planning and scheduling; cost analysis; mode choice models; performance evaluation; transit surveys; organization and financing. Prereq: 554 or graduate standing.

556 Traffic Accident Reconstruction (3) Data collection and analysis as basis for accident prevention on control programs; roadside hardware design and crash testing. Prereq: 452 or graduate standing.

557 Transportation Planning and Operations with Micro-Computer Applications (3) Transportation system management techniques and application of microcomputers to analysis of transportation actions. Prereq: 551, 554.

558 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development plans. Analysis of relationship between various transportation modes and between transportation and other community features. Use of planning process to establish existing travel patterns, modeling of demand, proposing alternatives and evaluation. Prereq: Graduating standing. Same as Planning 558.

561 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, solution techniques; direct stiffness analysis of plate trusses, general members; trusses, beams, and structures composed of general members. Prereq: 361.

562 Analysis and Design of Plate Structures (3) Plate bending and buckling theory; analysis and design of bridge and building floors and structural plate components. Prereq: 361.

563 Statically Indeterminate Structures (3) Reflections of the behavior of structural systems; solution methods; moment distribution and other displacement methods; secondary stresses. Prereq: 361.

564 Finite Element Structural Analysis (3) Application of finite element method to structural analysis; plane stress, plane strain, axisymmetric, and three-dimensional elements; use of typical computer programs. Prereq: 561.

565 Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; elastostatic behavior considered for structural systems; earthquake design and response of structures. Prereq: 561.

566 Structural Reliability (3) Application of probability and statistics to evaluating reliability of structures; development of safety factors and probability based design codes.

571 Behavior of Steel Structures (3) Behavior of structural steel members due to static and fatigue loads; interaction of plastic and elastic design results and current specialization for design. Prereq: 471.

572 Connections for Structural Steel Frames (3) Design, analysis and behavior of connections for structural steel frames; bolts, welds, and semi-rigid connections; column bases and column splices. Prereq: 472.

573 Prestressed Concrete (3) Properties of prestressing materials; methods of post-tensioning and post-tensioning; analysis and design of simple and continuous beams and slabs. Prereq: 471.

574 Behavior of Reinforced Concrete Members (3) Moment-curvature relations for reinforced concrete beams; combined bending and axial load; shear and torsion; relation between research results and specifications for design. Prereq: 472.

575 Repair and Retrofitting of Structures (3) Techniques, methods, and materials for repair and retrofitting of deteriorated or overstressed structures, foundation underpinning, retrofitting of steel fatigue failures. Prereq: 472.

588 Measurement Science I (3) (Same as Nuclear Engineering 588, Chemical Engineering 588, Engineering Science and Mechanics 588, Electrical and Computer Engineering 588, Mechanical Engineering 588, and Aerospace Engineering 588.)

589 Measurement Science II (3) (Same as Nuclear Engineering 589, Chemical Engineering 589, Engineering Science and Mechanics 589, Electrical and Computer Engineering 589, Mechanical Engineering 589, and Aerospace Engineering 589.)

590 Special Problems in Civil Engineering (1-6) Enrollment limited to civil engineering students in nonthesis programs. May be repeated. Maximum 6 hrs. S/NC only.

595 Special Topics (1-4) Problems and topics related to current developments in field. May be repeated. Prereq: Consent of instructor.

596 Special Readings (1-4) Readings related to current development in field. May be repeated.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

637 Numerical Models for Geologic Materials (3) Numerical models to represent the stress; strain/ volume relationships for soils, rock, and concrete; nonlinear elastic models; classical plasticity models; critical state and capped plasticity models; multiple surface models; determination of parameters from laboratory tests; numerical implementation. Prereq: 500 and Engineering Science and Mechanics 539.

639 Soil Dynamics (3) Behavior of soils and soil-structure systems under time dependent loading; wave propagation in elastic media; principles of seismic refraction techniques; effects of earthquakes and vibrating machines on soils and foundations; dynamic and cyclic soil testing and determination of soil parameters. Prereq: 335 and 565 or Engineering Science and Mechanics 431.

651 Analysis Techniques for Transportation Systems I (3) Analysis of trip generation, trip distribution, modal split and traffic assignment, employing mathematical, statistical, and computer science techniques. State of the art and new modeling techniques. Prereq: 554 or 558.

652 Analysis Techniques for Transportation Systems II (3) Advanced topics of application of mathematical, statistical and computer science techniques in modeling and analysis of transportation systems. Prereq: 651.

666 Advanced Structural Reliability (3) Monte Carlo methods: structural system reliability; random processes; dynamic loads on structures. Prereq: 566.

671 Behavior of Steel Bridges and Buildings (3) Behavior, analysis and design of plate girders, columns, and composite members subjected to static and dynamic loading. Prereq: 571.

674 Behavior of Reinforced Concrete Beams and Slabs (3) Theoretical and numerical analysis of statically determinate reinforced concrete beams and frames; limit analysis; behavior, analysis, and design of reinforced concrete slabs; yield-line theory, finite element solutions, and ACI Code Method. Prereq: 574.

682 Fields of Instruction/Civil Engineering

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or housing rooms before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

508 Seminar (1) Reports on current research in environmental engineering at UTK. Prereq: Graduate standing.

510 Environmental Protection (3) Managing of water resources, wastewaters, air quality, solid wastes, and hazardous materials to promote efficiency and comfort to and safeguard balances in natural ecosystems. Prereq: Consent of instructor.

520 Open Channel Hydraulics (3) Open channel flow principles, properties, and classifications; uniform and gradually varied flow theory and applications; open channel design; unsteady flow theory and analysis; dynamic routing; spatially varied flow; non-linear alignment; microcomputer applications, featuring HEC-2 model. Prereq: Civil Engineering 390.

522 Floodplain and Urban Flood Management (3) Review of national, regional, and local flood problems; state of the art flood damage reduction alternatives: structural and non-structural; institutional responses: policies, programs, organizations, regulations, and legal aspects; floodplain hydrology and hydraulics; HEC-1, HEC-2: floodway encroachment, flood hazard zones, and flood potential determinations; case studies. Prereq: Civil Engineering 390 or consent of instructor for non-majors.

524 Sediment Transport (3) Sediment properties and measurements; principles of dynamics of suspended and bed sediment in erodible channels; erosion, transportation, and deposition of sediment by flowing water; erodible channel design; channel regime theory; common computer models. Prereq: Civil Engineering 390.


530 Stormwater Modeling (3) Systems approach to stormwater modeling. Hydrologic components, linear and nonlinear systems integrated into mathematical models of watershed response. Review and application of computer models used in hydrologic computer models. Prereq: Civil Engineering 395.

535 Ground Water Hydrology (3) Dynamics of flow in porous media, physical processes important in sub-surface hydrology, hydrodynamics, dispersion, anisotropy, layered soils and unsaturated flow phenomena. Analytical and numerical solution of flow equations; Elements of groundwater contamination and groundwater law. Prereq: Civil Engineering 390 or Engineering Science and Mechanics 341.

440 Remote Sensing for Transportation and Facilities Siting (3) Principles of remote sensing; sources of data and data acquisition systems; photo interpretation, analog and digital techniques for analysis of aerial and terrestrial photos, radar and thermal imaging with application to transportation and facilities planning, construction and operations. Prereq: Consent of instructor.

441 Remote Sensing Data Acquisition and Analysis (3) Active and passive sensors; automated analog and digital analysis and interpretation of remotely sensed image enhancement and classification techniques for color aerial photo and thermal imagery applications to environmental pollution and stress assessment. Prereq: Consent of instructor.

551 Physicochemical Unit Processes (3) Theory and design application in water and wastewater treatment. Prereq: Civil Engineering 380, and Civil Engineering 390.
552 Biological Treatment Theory (3) Theory and design applications of biological processes to treatment of wastewater and solid wastes. Prereq: Civil Engineering 380. 2 hrs and 1 lab.

553 Environmental Engineering Chemistry (3) Theoretical, applied, and analytical chemistry related to generation, measurement, and treatment of environmental contaminants. Prereq: Chemistry 130. 2 hrs and 1 lab.

555 Solid Waste Management (3) Magnitude and characteristics of solid waste problems; collection systems; design of disposal systems; landfill, incineration, and composting, design of resource recovery systems; current and future regulations. Prereq: Senior standing.

556 Hazardous Waste Management (3) Analysis and design of operations and processes for hazardous waste disposal and processing; regulations analysis; industrial applications. Prereq: Graduate standing or consent of instructor.

570 Air Quality Management/Pollution Control (3) Introductory course on concepts of air pollution, analysis of relationships among sources, meteorology, effects; stack sampling; emission control systems. Prereq: Consent of instructor.

571 Design of Air Pollution Control Systems (3) Design and evaluation of systems used to control emission of gaseous and particle air pollutants: Comprehensive design of specific devices and systems. Prereq: 570.

572 Air Quality Dispersion Modeling (3) Diffusion in atmosphere; application of atmospheric dispersion models and evaluation of meteorological and air quality data. Prereq: Consent of instructor.

573 Sampling of Air Pollutants (3) Standard sampling methods for particulate and gaseous air pollutant emissions from industrial processes; ambient air monitoring instrumentation/techniques. Prereq: Consent of instructor.

590 Special Problems in Environmental Engineering (1-6) Enrollment limited to environmental engineering students in non-thesis program. Prereq: Graduate standing. May be repeated. Maximum 6 hrs. S/NC only.

595 Special Topics (1-4) Problems and topics related to current developments in field. May be repeated.

596 Special Readings (1-4) Readings related to current developments in field. May be repeated.

620 Advanced Surface Water Hydraulics (3) Advanced topics in surface water hydraulics; solutions in St. Venant's equations of unsteady flow for complex channel situations; dam breach modeling. Prereq: 520.

630 Advanced Stormwater Modeling (3) Advanced topics in stormwater modeling; stormwater quality modeling; advanced applications of available stormwater computer models. Prereq: 530.

651 Industrial Waste Unit Operations and Processes (3) Theoretical design and laboratory modeling of industrial waste treatment processes and operations. Prereq: 551, 552. 2 hrs and 1 lab.


653 Pollutant Fate Modeling and Risk Assessment (3) Application of scientific principles concerning movement and fate of chemicals at interfaces of air, water, and earthen solids in environment. Methods of assessing risk posed by presence of those chemicals. Prereq: 551.

691 Special Topics in Environmental Engineering (3) Application of scientific principles concerning wastewater treatment. Prereq: Consent of instructor. May be repeated.

692 Special Topics in Environmental Engineering (3) Advanced problems of current interest. Prereq: Consent of instructor. May be repeated.

695 Special Topics in Environmental Engineering (3) Selected advanced problems of current interest. Prereq: Consent of instructor. May be repeated.

697 Special Topics in Environmental Engineering (3) Advanced study of specific problems of current interest. Prereq: Consent of instructor. May be repeated.

561 Special Topics in Classical Civilization (3) Advanced tutorial work in Greek and Roman authors in English translation; problems in cultures of Greece and Rome. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

562 Problems in Old World Archaeology (3) Selected topics and research problems in European, Asian, and African prehistory. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. (Same as Anthropology 562.)

Classics
(College of Liberal Arts)

H. C. Rutledge, Head

Professors:

G. C. Gesell, Ph.D. North Carolina; H. C. Rutledge, Ph.D. Ohio State.

Associate Professors:

C. P. Craig, Ph.D. North Carolina; J. E. Shelton, Ph.D. Vanderbilt; D. W. Tandy, Ph.D. Yale.

Assistant Professor:

S. D. Martin, Ph.D. Michigan.

The graduate courses in the Classics include the wider reading of Greek and 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 lit and life.

401 Greek Poetry (3) Epic, lyric, drama, Authors vary. Prereq: 261.


405-06 Selected Readings from Greek Literature (3,3) For advanced students in Greek, plays, historical writings, poetry of ancient Greece in original Greek. Prereq: 401-402 or consent of instructor. May be repeated. Maximum 9 hrs. Sp

414 Cicero and Techniques of Latin Prose Composition (3) For advanced students in Latin, practice in prose composition, writings of Cicero the model. Prereq: 351-52 or consent of instructor. Sp

422 Seminar in Classical Studies (3) Field of classical studies today; recent achievements in areas of both philology and archaeology; impact of decipherment of Linear B; new understandings of culture and politics of 'golden age' of Pericles and Augustus; classical studies and academic profession on both high school and college levels. May be repeated. Maximum 6 hrs.

431-32 Selected Readings from Latin Literature (3,3) For advanced students in Latin oratory, historical writings, poetry of ancient Rome in original Latin. Prereq: 351-352 or consent of instructor. May be repeated. Maximum 9 hrs.

435 Medieval Latin (3) Selected readings from Latin prose and poetry of medieval Europe. Prereq: Consent of instructor.

441 Special Topics in Classical Civilization (1-3) Art, literature, religion, and society of Greece and Rome. May be repeated with consent of department. Maximum 9 hrs.

461 Studies in Classical Archaeology (3) Variable content course offering subject matter not taught in an existing course, or concentrating on one aspect of existing course. Prereq: According to topic. May be repeated. Maximum 9 hrs.

462 Roman Law (3) Development of Roman law through examination of cases from writing of Roman jurists, world's first legal professionals. Understanding legal institutions in relationship to Roman society; Roman property and contract law.

501 Special Topics in Greek Literature (3) Advanced study of classical Greek literature, authors selected by students and instructor. May be repeated. Maximum 9 hrs.

531 Special Topics in Latin Literature (3) Advanced study of classical or medieval Latin literature, authors selected by students and instructor. May be repeated. Maximum 9 hrs.

541-42 The Latin Epic: Lucretius, Vergil (3,3) Advanced study of epic masterpieces of Lucretius and Vergil; both Georgics and Aeneid of Vergil.

561 Special Topics in Classical Civilization (3) Advanced tutorial work in Greek and Roman authors in English translation; problems in cultures of Greece and Rome. May be repeated. Maximum 9 hrs.

562 Problems in Old World Archaeology (3) Selected topics and research problems in European, Asian, and African prehistory. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. (Same as Anthropology 562.)

Communications
(College of Communications)

MAJOR

DEGREES

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

Professors:

P. G. Ashdown, Ph.D. Bowling Green; J. A. Crook, Ph.D. Iowa State; G. A. Everett, Ph.D. Iowa; D. W. Smith, Ph.D. Northwestern; H. H. Howard, Ph.D. Ohio; B. K. Leller, Ph.D. Southern Illinois; M. S. Singletary, Ph.D. Southern Illinois; N. R. Swan, Ph.D. Missouri.

Associate Professors:

J. N. Adamson, M.S. Tennessee; M. M. Miller, Ph.D. Michigan State; B. A. Moore, Ph.D. Ohio; R. E. Taylor, Ph.D. Illinois.

Assistant Professors:

C. E. Caudill, Ph.D. North Carolina; G. G. Johnson, Ph.D. Southern Illinois; M. J. Stankey, Ph.D. Illinois; D. Ziegler, Ph.D. Southern Illinois.

MAYOR SCIENCE PROGRAM

The Master of Science with a major in Communications is intended for students who desire a career in the mass media with an emphasis on communications management and a development of understanding of the communication processes and social role of the mass media. The program follows a broad-based multi-media approach while allowing the student to concentrate in one of four fields: advertising, broadcasting, journalism or public relations.

The prospective student who is interested only in acquiring basic skills in one of the areas listed above is advised to enroll for a second baccalaureate rather than an advanced degree.

Degree Requirements

The M.S. program emphasizes communications management in the areas of advertising, broadcasting, journalism (publications), and public relations. A minimum of 31 hours of approved graduate work is required:

1. Ten hours of core courses—Communications 510, 512, 540, and 550, the first three of which must be taken during the first two semesters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College.

2. Twelve hours within one department of the college, at least 6 hours at the 500 level.
reasons for pursuing the doctorate. Personal and quantitative aptitude on the Graduate work if applicant holds a Master's degree; Those holding Master's degrees should time study beyond the Bachelor's degree. general, however, the program may be com-

requirements for admission to full potential begins only in the fall semester. The Master's degree 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 pro-

interviews with members of the Ph.D. Admissions Committee are recommended and may be required. Professional experi-

DOCTOR OF PHILOSOPHY PROGRAM

The Ph.D. with a major in Communications is intended to prepare scholars for teaching, research, and communications law.
The student also must pass a written exami-
nation after completion of the core courses and communications.

Communications majors in the M.S. pro-
must demonstrate ability to use a typewriter proficiently within their first semester in residence.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required 

510 Orientation to Master's Studies (1) Degree and these requirements. Committee formation and pro-

512 Fundamentals of Media Research (3) Applications of communications research techniques for management. Gathering and analysis of data for assessing media audiences and message impacts. Prereq: Consent of instructor or admission to program. Sp

521 Tutorial in Communications Teaching (1) Experience as teacher under guidance of faculty member. Prereq: Consent of instructor. S/NC only. E

540 Theory for Media Management (3) Selected research hypotheses and theories in literature of mass communications, managerial decision-making. Prereq: Consent of instructor or admission to program. F

550 Seminar in Media Economics and New Technology (3) Electronic and print media ownership, finance and corporate structure. Roles of new technologies and marketing techniques in changing media content and function in future. Prereq: Consent of instructor or admission to program. Sp

593 Seminar in Mass Communications Issues (3) Contemporary mass communication issues. Consent of instructor. Minimum 6 hrs. E

DEGREES

Comparative and Experimental Medicine (Office of the Provost)

MAJOR

Comparative and Experimental Medicine

Ph.D.

Hyram Kitchen, Chair
Joint Graduate Coordinating Committee:
J. E. Fuhr; R. A. Griesemer; H. Kitchen; J. E. Lawler; R. L. Michel.

The Comparative and Experimental Medicine degree program (M.S. and Ph.D.) is a jointly-administered graduate program intended to prepare students for teaching and/or research careers in the health sciences. This program emphasizes the comparative approach to the study of pathology, immunopathology, aberrant metabolism, oncology, and genetic disorders. The Ph.D. program is open to approved graduate students seeking training in this area and is especially useful for individuals with professional degrees. For the student with an undergraduate biology science background, the Comparative and Experimental Medicine program provides an unusual opportunity to study disease processes common in humans and animals from a multidisciplinary perspective. The scope of this intercollegiate program, which pools faculty resources from both veterinary and human medicine, is broadened by faculty members representing animal science and numerous areas of the life sciences. The interdisciplin ary training environment includes such diverse support as facilities and personnel at the Veterinary Teaching Hospital, the Oak Ridge National Laboratory, Knoxville Zoological Park, Hemophilia Clinic, Birth Defect Center, Aberrant Metabolism Laboratory, and Hematology and Oncology services. For specific course listings, see Veterinary Medicine and Medical Biology under Fields of Instruction.

ADMISSION REQUIREMENTS

General Requirements
Admission to The Graduate School of UTK will apply. In addition, all applicants will be required to furnish three letters of recommendation from individuals who are familiar with their scholastic or professional records.

Requirements for Admission to the Master of Science Degree Program
Applicants will be required to have a professional degree in one of the medical sciences (M.D., D.D.S., D.V.M.) or a baccalaureate degree with course work including chemistry through organic; mathematics through calculus; one year of physics; and one year of basic biology plus an additional half-year of more advanced study in the field of biology including courses such as biochemistry, mammalian anatomy, histology, cell biology, or others that are appropriate for individuals aspiring to research careers in biomedical science.

Applicants for admission to the Master of Science program whose backgrounds include no formal training in the biomedical field beyond the baccalaureate degree will be required to present evidence of satisfactory performance on the Graduate Record Examination. The graduate minor consists of 511 or its equivalent plus an additional 6 hours of computer science graduate level courses at or above the 400 level.

THE DOCTORAL PROGRAM

Admission Requirements
A student seeking admission to the Ph.D. program is expected to meet the following requirements:
1. The student should have three letters of recommendation sent directly to the department head from individuals capable of assessing the student's potential for advanced work in computer science (for example, college teachers or employers for whom the student has worked after earning a Bachelor's degree). The department reserves the right to contact these individuals or other knowledgeable people if additional information is deemed necessary or desirable.
2. The student is expected to have taken the GRE verbal and quantitative general test within the past three years and to have these scores sent to The Graduate School.
3. The student should satisfy the background requirements for graduate work. See the departmental brochure for details.

Preliminary Courses Work
The departmental preliminary course requirements include a set of 400-level core courses and a distribution among 500-level and 600-level courses as determined by the departmental graduate committee. Information about specific requirements is available from the department.

Admission to Candidacy
Admission to the Ph.D. program does not guarantee admission to candidacy for the degree. Official admission to candidacy is based on the following procedures:
1. The student completes the course work requirements as defined above.
2. The student passes the comprehensive examinations covering three areas determined individually in advance. Each exam is graded as high pass, pass, low pass, or fail. The student must make a high pass in at least one of the areas and no less than low pass in all other exams. These exams may be taken a maximum of two times, separated by no more than one calendar year. In a second attempt, a student does not have to test in the area(s) in which a high pass was earned on the first attempt. The Computer Science Graduate Committee administers these exams, which must be passed prior to admission to candidacy and at least two semesters in advance of conferral of the degree. Comprehensive examinations must be taken within five years, and all requirements must be completed within eight years of the time of a student’s first enrollment in the doctoral program.
3. The student requests a member of the Computer Science Department’s faculty to become the major professor, dissertation director, and chair of the student’s commit-
The committee must have at least four members, with at least three from the Computer Science Department and at least one holding an appointment in another department. At least three members, including the chair, must be approved by the Graduate Council to direct doctoral research.

4. The student's dissertation committee evaluates the student's background and performance and outlines a coherent program of study, which may include additional courses and outside readings in the technical literature. This program is subject to periodic revision within reasonable limits and will be reviewed by the committee no less frequently than once a year. Completion of the entire program is not required before admission to candidacy.

5. In a public meeting, the student presents to the committee a survey of current literature in the area of proposed Ph.D. research.

The student completes Graduate School requirements for formal admission to candidacy.

Postcandidacy Work

1. The student completes courses and other aspects of the program noted above.

2. The student complies for fewer than 400-level courses (at least 9 credits earned, exclusive of 600 Dissertation).

Dissertation Proposal

After consultation with the committee and initial investigation of a topic, the student submits a written proposal to the committee and makes an oral presentation of this proposal in a meeting which other faculty may attend. The written version must be typed, conform to high standards of scholarly writing, and contain an overview of previous research in the area of interest. Based on the written and oral presentations, the committee must accept, reject, or modify the topic to make it suitable for doctoral research.

Dissertation and Residency Requirements

The student continuously registers in CS 600 (minimum of three hours each semester) from the time the topic proposal is approved, admission to candidacy occurs, or registration for course 600 is begun, whichever comes first. The semester in which the dissertation is accepted is The Graduate School and the summer semesters are included in this continuing registration. The minimum residency for a doctoral degree is one academic year or two consecutive semesters of full-time study (minimum of nine hours each semester) in the graduate program subsequent to admission to candidacy. Part-time enrollment does not count toward this requirement.

Dissertation Defense

The student defends the dissertation in a public meeting. The committee determines pass or fail.

401 Applications of Computer Graphics (3) Service course in computer graphics. Commercial software, techniques, hardware. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

402 Applications of Artificial Intelligence (3) Service course in artificial intelligence. Commercial software, techniques, hardware. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

403 Applications of Microcomputers (3) Service course in microcomputers, DOS, commercial software and hardware. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

404 Applications of Database Systems (3) Service course in database systems. Commercial software, systems, techniques. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

405 Introduction to Artificial Intelligence (3) Basic techniques such as expert system research, gaming, and theorem proving. Prereq: 320. 3 hr lab required.

421 Expert Systems (3) Production rule model and its extension into many-valued and fuzzy logics. Deriving explanations, examples of expert system tools and building expert systems. Other methodologies—frames, scripts, decision expressions. Prereq: 421. 3 hr lab required.

423 Natural Language Processing (3) Phrase-structured and slot grammars, error-correcting interfaces and semantics. Applications in database and expert systems. Prereq: 381 and 421.

424 Robotics Software (3) Software for robotic control. Prereq: 331 and Mathematics 142. 3 hr lab required.

425 Functional Languages (3) Functional, applicative approach, object-oriented languages. LISP and SMALLTALK, used for research applications. Prereq: 111, 112 and Mathematics 222. 3 hr lab required.

432 Computer Graphics (3) Interactive computer graphics. Transformations, perspectives, shading, vector generation. Color, image and texture, hardware, tablets and chips, with goal of understanding techniques for designing computer systems for graphics capability. Prereq: 331. 3 hr lab required.

433 Computer Systems Architecture (3) Parallel processing, memory, I/O, pipelines, specialized architectures. Prereq: 331 and 360.

434 Networks and Communications (3) ISO open system interconnection model, protocols, study of several existing wide area networks, local area networks. Prereq: 331 and 360.

453 Computer Systems (3) Disk operating systems, peripherals, local area networks and communication protocols. Introduction to multiprocessor microcomputer systems. Prereq: 331 and 360. 3 hr lab required.

463 Computer Systems Hardware Design (3) Computer system hardware: bus structures, I/O devices, interrupt support, timing, direct memory access, logic, timing budgets, and system consideration. Lab: construction, testing and debugging of either or both processor or peripheral boards. Prereq: 360. 3 hr lab required.

471 Programming Languages (3) Study and comparison of programming languages and their environments. Human Interfaces, formalisms, domain of applicability, object manipulation, syntax. Prereq: 111 and 112.


482 Graph Theory and Applications (3) Planarity, network flow, critical paths. Prereq: 111, 112 and 311.


494 Special Topics in Computer Science (1-3) May be repeated. Maximum 9 hrs.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

511 Immigration to Computer Science (5) Advanced programming techniques in high-level language; control of input/output devices; file systems; machine organization and assembly language programming, data structures and analysis of algorithms. Computing laboratory. Prereq: Course in programming.

512 Boolean Algebra and Logic Design (3) Relations, functions, proofs in discrete math; Boolean algebras.
620 Advanced Topics in Intelligent Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.
630 Advanced Topics in Computer Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.
640 Advanced Topics in Databases/Information Retrieval (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.
650 Advanced Topics in Pattern/Image Analysis (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.
660 Advanced Topics in Software Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.
670 Advanced Topics in Numerical Mathematics (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.
680 Advanced Topics in Theory and Foundations (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.
690 Advanced Topics in Computer Science (1-6) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

Cultural Studies

(Contents of each program offered by the College of Liberal Arts.)

Mary P. Richards, Director

The College of Liberal Arts offers a series of interdisciplinary undergraduate majors and minors through its Cultural Studies programs. These programs include Afro-American Studies, American Studies, Ancient Mediterranean Civilizations, Asian Studies, Cinema Studies, Comparative Literature, Latin American Studies, Linguistics, Urban Studies, and Women's Studies. Certain courses within these programs are available for graduate credit as listed below. See the Undergraduate Catalog for program descriptions and directors.

Afro-American Studies

450 Issues and Topics in Afro-American Studies (3) Problems, topics, issues, and individuals. May be repeated. Maximum 6 hrs.
452 Black African Politics (3) (Same as Political Science 452.)
461 African Prehistory (3) (Same as Anthropology 461.)
483 Afro-American Women in American Society (3) Historical and contemporary socio-eco-political factors in American society as related to Black women. (Same as Women's Studies 483.)

Asian Studies

421 Readings in Islamic Literature (3) Prereq: Mastery of intermediate-level Arabic or consent of instructor. May be repeated. Maximum 9 hrs.
431 Readings in Chinese Literature (3) Prereq: Mastery of intermediate-level Chinese or consent of instructor. May be repeated. Maximum 9 hrs.
451 Readings in Japanese Literature (3) Prereq: Mastery of intermediate-level Japanese or consent of instructor. May be repeated. Maximum 9 hrs.

Comparative Literature

401-02 Special Topics in Comparative Literature (1,3) Content varies. May be repeated. Maximum 9 hrs.

Latin American Studies

401 Cultural Plurality and Institutional Changes in Latin America (3) Value systems, behavioral patterns, political parties, role of military, church, educational institutions, dictatorship and nationalism.

601 Latin American Studies Seminar (3) Selected topics. May be repeated. Maximum 6 hrs.

Linguistics

460 Topics in Linguistics (3) Content varies. May be repeated. Maximum 6 hrs.
411 Linguistic Anthropology (3) (Same as Anthropology 411.)
420 The Development of Historical Linguistics as a Science (3) Scientific understanding of language change. Emergence of Neogrammarians from 19th-century intellectual trends. Impact of synchronic, descriptive, structural and transformational generative linguistics on contemporary diachronic theory. Prereq: 6 hrs of courses required for linguistics concentration or consent of instructor.
425 Introduction to Descriptive Linguistics (3) (Same as French 425, German 425, Russian 425, and Spanish 425.)
426 Methods of Historical Linguistics (3) (Same as German 426, French 426, Russian 426, and Spanish 426.)
429 Romance Linguistics (3) (Same as French 429 and Spanish 429.)
435 Structure of the German Language (3) (Same as German 435.)
436 History of the German Language (3) (Same as German 436.)
471 Sociolinguistics (3) (Same as English 471 and Sociology 471.)
472 American English (3) (Same as English 472.)
474 Teaching English as a Second or Foreign Language I (3) (Same as English 474.)
475 Teaching English as a Second or Foreign Language II (3) (Same as English 475.)
485 Special Topics in Language (3) (Same as English 485.)
498 Problems in Linguistics: Romance Languages (3) (Same as French 598 and Spanish 598.)
Urban Studies
401 The City in the U.S. (3) (Same as Planning 401.)
441 Urban Geography (3) ( Same as Geography 441.)
464 Urban Ecology (3) (Same as Sociology 484.)

Women's Studies
400 Topics in Women's Studies (3) Content varies. May be repeated.
422 Women Writers in England (3) (Same as English 422.)
425 Women's Health (3) (Same as Health 425.)
434 Psychology of Gender (3) ( Same as Psychology 434.)
458 Rhetoric of the Women's Rights Movement (3) (Same as Speech 458.)
483 Afro-American Women in American Society (3) (Same as Afro-American Studies 482.)

Curriculum and Instruction
(College of Education)

MAJOR DEGREES
Curriculum and Instruction M.S., Ed.S., Ed.D.
Education Ph.D.

Theodore W. Hipple, Head

Professors:
J. E. Alexander, Ed.D. Kentucky

Associate Professors:

Assistant Professors:
R. A. Austin, Ph.D. Florida State; D. A. Hendricks, Ph.D. Alabama; A. M. Rutherford, M.A. Virginia.

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

THE MASTER'S PROGRAM
For the Master of Science, thesis and non-thesis options are available in the Curriculum and Instruction major with concentration in the following areas: curriculum, elementary education, English education, foreign language education, instructional media and technology, mathematics education, reading education, science education, and social science education. The non-thesis option requires the completion of 33 semester hours of course work. The thesis option requires the completion of 30 semester hours including six hours of Thesis 500.

THE SPECIALIST PROGRAM
The Educational Specialist degree program with a major in Curriculum and Instruction encompasses concentrations in the following areas: curriculum, elementary education, English education, foreign language education, instructional media and technology, mathematics education, science education, social science education. The Doctor of Philosophy with a major in Education includes concentrations and specializations as listed under Education.

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

404 Problems in Improvement of Instruction (1-3) Special conferences, workshops, or in-service programs. May be repeated. Maximum 6 hrs. S/NC only.


451 Education in Cultural Perspective (3) Contribution of anthropological concepts (primarily concepts of culture) to understanding of education processes, problems, and thought in our society and others.

460 Teaching Reading and Literature in the Secondary School (3) Teaching basic reading skills and ways of teaching literature.

461 Developing Reading Skills in Content Fields (3) Techniques for teaching reading and study skills in content areas of school program. Extensive assessment of textbooks. Middle school and high school.

475 Utilization of Instructional Media (3) Basic concepts of communication and instructional development for improving instruction through use of media. (Same as Library and Information Science 475.)

488 Introduction to Instructional Computing (3) Room computers of use, applications for teachers, overview of computer operation and software for teachers of all grades.

496 Teaching Science Grades 7-12 (3) Methods, materials, recent trends in science and environmental education programs for secondary schools. Prereq: Admission to teacher education.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when 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.

503 Problems in Lieu of Thesis (3-3) May be repeated. Maximum 9 hrs. S/NC only.

504 Studies and Theory in Language Development (3) Studies and theory of language development in children. Prereq: 1 elementary school language arts course or consent of instructor.

507 Teaching Poetry Grades 7-12 (3) Research and theory in application to teaching of poetry. Design of strategies and materials for teaching and writing and reading of poetry. Review of texts and materials.

568 Teaching Composition in the Secondary School (3) Teaching narration, description, exposition, and argumentation; writing process and marking of student papers.

569 Teaching Fiction in the Secondary School (3) Teaching of novels and short stories.


515 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students' programs. May be repeated. Maximum 6 hrs. S/NC only.

516 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students' programs. May be repeated. Maximum 6 hrs. S/NC only.

517 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students' programs. May be repeated. Maximum 6 hrs. S/NC or letter grade.

518 Educational Specialist Research and Thesis (2) May be repeated. Maximum 4 hrs. P/NP only.

519 Educational Specialist Research and Thesis (2) P/NP only.

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

521 Teaching Social Studies in Elementary and Middle Schools (3) Planning and techniques. Trends in curriculum, development of concepts and generalizations, integration of social sciences. Prereq: Course in teaching of social studies or consent of instructor.

522 Teaching Mathematics in Elementary and Middle Schools (3) Instructional strategies for teaching elementary and middle school children. Learning environment. Prereq: 443 or equivalent or consent of instructor.

523 Diagnosis and Correction of Children's Difficulties in Learning Mathematics. Old Children's difficulties in learning mathematics and procedures for helping classroom teacher correct difficulties. Prereq: 522 or equivalent or consent of instructor.


525 Strategies, Programs and Materials for Teaching Elementary Social Studies (3) Analysis of new and innovative social studies program materials and techniques. Exploration of current trends in social...
526 Philosophy of Education (3) Truth, knowledge, and valuation in relation to work in schools. Prereq: Consent of instructor. F,Su

527 Elementary School Curriculum (3) Examination, evaluation, and application of curriculum designs in elementary school. Trends and issues which affect elementary education. Prereq: Consent of instructor. F,Su

528 Teaching Language Arts Elementary and Middle School (3) Recent trends and current materials and methods in teaching elementary language arts (except reading). Prereq: Course in language arts or consent of instructor. Sp,Su

529 Practicum in Diagnosis and Remediation of Difficulties in Learning Mathematics (2) Assessment and application of diagnostic procedures for teaching reading at elementary school level. Prereq: Course in teaching of reading or consent of instructor. F,Su

530 Teaching Reading in Elementary and Middle Schools (3) Trends in methods, materials, basic approaches, skill development and assessment procedures for teaching reading at elementary school level. Prereq: Course in teaching of reading or consent of instructor. F,Su

531 Teaching Science in Elementary and Middle Schools (3) Recent trends in methods, materials, and content in elementary science. Prereq: Course in teaching elementary school science or consent of instructor. F

532 Instructional Research; Analysis and Application (3) Analysis of research on instruction. Translation and application of research findings into instructional performance. Prereq: Consent of instructor. F,Su

533 Reading in Middle and Secondary Schools: Research and Theory (3) Analysis of components of effective middle and secondary school reading programs. Research and theoretical bases. Prereq: Course in reading education or consent of instructor. Su

534 Seminar in Reading Education (1-6) May be repeated. Maximum 6 hrs. E

535 Curriculum Evaluation and Program Improvement (3) Historical background and importance of educational evaluation in relation to curriculum development. Understanding systematic curriculum evaluation approach and applying it to improve program development and implementation. Prereq: Consent of instructor. E

536 Psychology of Reading (3) Reading act, relationship between learning theory and reading, role or reading in special educational and cultural factors. Prereq: 500-level course in reading education or consent of instructor. F

537 Diagnosis and Correction of Classroom Reading Problems (3) Procedures, methodologies and materials for diagnosing and correcting classroom reading problems. Prereq: Course in reading education, or equivalent teacher experience, or consent of instructor. Sp,Su

538 Practicum in Diagnosis of Reading Problems (2) Theoretical and practical applications of specific reading diagnostic instruments; testing of elementary and/or secondary school students, preparing case study reports, and conducting parent conferences. Prereq: Course in diagnosis and correction of classroom reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp

539 Practicum in Remediation of Reading Problems (2) Application and analysis of teaching methodology in working with elementary and/or secondary school students on one-to-one or small group basis. Prereq: Consent of instructor. Maximum 4 hrs. Sp

540 Topics in improvement of instruction (1-3) Special conferences, workshops, and in-service programs. May be repeated. Maximum 6 hrs. S/NC only. E

541 The High School Curriculum (3) Identification of problems associated with the high school curriculum framework, assessment of trends in programs of local, regional, and national significance. E

542 Development of Educational Thought (3) Histo- ry and philosophy of education and its influence on influential educators. Plato, Quintillian, Comenius, Rousseau, Pestalozzi, Froebel, Dewey. Prereq: Graduate status and consent of instructor. F

543 Foundations of Educational Policy (3) Relationship between theory, policy, and practice; educational policies that arise from philosophical and practical considerations; how to determine and research on educational issues and principles for conducting educational enter- prise. F,Su

544 Survey in Contemporary Philosophies of Education (3) Existentialism, phenomenology, philosophical anal- ysis, Marxism, structuralism, hermeneutics and other philosophies. E

545 Educational Sociology (3) Sociological analysis of American education system. Controversial social issues that affect educational system and potential solutions offered by various programs. Open to Jun- iors, seniors, and graduate students. F

546 Topics in History of Education (3) May be repeated. E

547 Topics in Philosophy of Education (3) May be repeated. F,Su

549 Topics in International Education (3) Historical, philosophical, and sociological foundations; selected nations and their cultures. May be repeated. E

550 Assessment and Correction of Language Arts Difficulties (3) Procedures and materials for diagnos- ing and correcting language arts difficulties; analysis of children's work. Prereq: At least one language arts course or consent of instructor. Su

552 Developmental Reading Practicum (2) Diagnosis and teaching children having developmental and corrective reading needs. Prereq: Course in diagnos- is and correction of reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Su

557 The Junior High and Middle School Curriculum (3) Curriculum and instructional design for junior high and middle school. Characteristics of students, cur- riculum design, instructional patterns, and organization and structure of junior high and middle schools. Prereq: 558 Curriculum Planning and Development (3) Foundations and principles of curriculum planning and development. Historical analysis of curriculum theory, principles of planning and development, and classroom applications for improved learning. E

561 Educational Statistics (3) Applications of descriptive and inferential statistics to educational and instruc- tional problems. Use of electronic calculators in educational research. Prereq: One year college course in mathematics, an elementary course in statistics, or consent of instructor. F,Su

562 Direction and Supervision of Student Teaching (3) Roles and responsibilities of cooperating teachers and student teacher; objectives and policies of stu- dent teaching program; elements of clinical supervision; overview of research. F,Su

564 Curriculum for Early Childhood Education (K-3) (3) Theoretical foundations and current research on content and skill areas of curriculum for kindergarten and first grade; application to local school setting. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. Sp,Su

565 Programs, Materials and Strategies in Teaching Elementary Science (3) Analysis of new and innova- tive science teaching materials, instructional strategies and current curriculum issues in use of mate- rials. Prereq: Graduate course in elementary science, at least one year teaching experience, or consent of instructor. Sp

566 Administering Instructional Media Programs (3) Leadership roles and responsibilities of professional media administrator in variety of organizational set- tings. F

567 Application of Theory in Early Childhood Education (K-3) (3) Principles and practices from selected theor- etical orientations. Pertains to early childhood education or consent of instructor. May be repeated. Maximum 6 hrs. F,Su

568 Teacher-Parent-Community Relations (3) Tech- niques for effective relations between parents and teachers; examination of roles and responsibilities of paren- tal involvement; volunteer programs; influence of community on educational process. Prereq: Consent of instructor. Sp,Su

569 Advanced Production of Audiovisual Software (3) Hand and mechanical lettering, flat picture mount- ing-laminating, overhead projection, audio production, TV studio orientation, computer-assisted produc- tions, and printing techniques. (Same as Library and Information Science 569.) Sp,Su

573 Utilization of Educational Television and Radio (3) Television and radio as instructional and training media. Selecting, making and evaluating instruction- al/training video and audio tapes. F

577 Introduction To Data Processing in Curriculum and Instruction (3) Analysis of current activities in educational computing and data processing. Curriculum, instructional, research, and classroom management applications from microcomputers to super computers. Prereq: Consent of instructor. F,Su

578 Teaching English as a Second Language (3) Instructional methods and utilization of assessment pro- cedures to diagnose English linguistic proficiency; materials for non-native speaker in K-12 classroom. Prereq: Required for Tennessee ESL (K-12) certification. Sp,Su

579 Career Development: Workshop (1-6) E

580 Techniques for Research in Curriculum and Instruct- ion (3) Fundamentals of research methodology applicable to curriculum, instruction, and other areas of educational inquiry. Critical reading of research and development of skills needed for proposal develop- ment. E

581 Seminar in Mathematics Education (3) Current issues influencing instruction in mathematics in schools, elementary through college. Related teaching meth- odologies. Opportunities for work on special problems. Prereq: Undergraduate course in teaching of mathematics. Su

582 Teaching Enrichment Mathematics in Middle and Junior High Schools (3) Topics to enrich middle and/or junior high mathematics. Geometric, labora- tory, and problem solving activities. Special attention to computer system. Opportunities for individual projects. Prereq: F,Su

583 Teaching Mathematics in Senior High Schools and Community Colleges (3) Topics appropriate for high school and community/junior college mathematics curriculum. Special problems related to enrichment, problem solving, and use of microcomputers. Opportu- nities for special projects. Prereq: F,Su


585 Teaching Secondary School Social Studies (3) Strategies, project, materials, and programs in social studies. Prereq: Undergraduate course in teaching of social studies. F,Su

586 Teaching Probability & Statistics (3) Teaching of probability and statistics in schools, elementary through college. Probabilities and statistical experiments, dem- onstrations, and applications. Prereq: F,Su

584 Field Experience (1-3) Application of curricular and instructional principles, methods, and materials in schools. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

590 Seminar in Teaching English in Secondary Schools (3) Content varies. Theoretical and practical approaches to teaching English in secondary school. May be repeated. Su

592 Linguistics and the Teaching of English (3) Grammar, usage, semantics, dialectology, history of language, and lexicography. Su

593 Independent Study (1-3) May be repeated. S/NC or letter grade. E

594 Supervised Readings (1-3) May be repeated. S/NC or letter grade. E

595 Special Topics (1-3) May be repeated. S/NC or letter grade. E

596 Teaching of Natural Science and Environmental Education (3) Strategies, laboratory techniques, assessment, current programs and professional guidelines for middle, junior and senior high schools, and community colleges. Prereq: Consent of instructor. F

597 Teaching Drama Grades 7-13 (3) Strategies and materials for teaching creative dramatics, enacting and writing of plays, reading of scripts. Sp

598 Developing Speaking and Listening Skills, Grades 7-12 (3) Teaching approaches to nonverbal communication, interpersonal and group communication, public address and listening. Review of tests and materials. Sp

599 Seminar in Social Studies Education (3) Research, trends, and issues in secondary social studies. Su

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Studies in English Education (3) Issues and research in teaching of English. Su

602 Seminar in Reading Education (1-8) May be repeated. Maximum 8 hrs. E

603 Advanced Studies and Theoretical Models of Reading (3) Research on reading processes. Current theoretical models related to how learners process print. Prereq: 500-level courses in reading education or consent of instructor. Sp

604 Seminar in Curriculum and Instruction (1) Required 2 courses in research or related courses. S/NC only. E

605 Organizing and Administering Reading Programs (3) Analyzing and synthesizing instructional, learning, and materials components into classroom, school and system programs. Prereq: 500-level courses in reading education or consent of instructor. Su

606 Research in Elementary Education (3) Analysis of research in elementary education with application to classroom teaching. Prereq: research course. Su

608 Seminar in Philosophy of Education (3) Selected philosophical issues in education. Prereq: 2 courses in history or philosophy of education. May be repeated with consent of instructor. E

621 Seminar in Social Studies Research and Theory (2) Status of research and theory. Needed research, related research from other fields, and application of research. Prereq: Recent course in teaching of social studies or consent of instructor. May be repeated. Maximum 4 hrs. E

623 Programs for Curriculum Improvement (3) Research methodology; application to descriptive/ethnographic curricular materials. Critical reading of research, methodology development in descriptive and ethnographic areas. Sp

625 Seminar in History of Education (3) Selected historical issues in education. Prereq: 2 courses in history or philosophy of education. May be repeated with consent of instructor. Sp

628 Advanced Studies in Elementary School Science (2) Current research in elementary school science as applied to classroom practice. Prereq: Graduate course in science education or equivalent or consent of instructor. May be repeated. Maximum 4 hrs. E

635 Teacher Education in America (3) For students preparing to enter teacher education. Brief historical development, program analysis and evaluation, current issues, and future directions. F

640 The Dynamics of Educational Change (3) Interdisciplinary approaches to change process in education. Prereq: Consent of instructor. Sp

648 Topics in Sociology of Education (3) May be repeated. Sp

650 Advanced Studies in Early Childhood Education (3) Prereq: 2 graduate courses in early childhood education and consent of instructor. May be repeated. Maximum 6 hrs. S/NC only. E

651 Advanced Studies in Elementary School Language Arts (3) Selected issues in elementary school language arts. Prereq: Graduate course in elementary school language arts or consent of instructor. Sp

652 Advanced Studies in Educational Anthropology and/or Sociology (3) Ethnographic methods applied to formal and non-formal educational settings. Analysis of selected research in field. Prereq: 467, 2 courses in cultural anthropology, or consent of instructor. Sp

669 Instructional Media Research (3) Identification, location, and collection of developmental and experimental research on instructional media. Application of research. Sp

671 Advanced Educational Statistics (3) Applications of parametric and non-parametric statistical inference to educational and instructional problems. Use of microcomputers in educational research. Prereq: 561. Sp, Su

672 Interpretation and Application Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction, newer methodologies and strategies. Utilization of research to improve curriculum and instruction practice, application of research principles in context of specific professional assignments. Prereq: Consent of instructor. Sp

675 Curriculum Evaluation: Theory and Application (3) Evaluation trends and issues. Theoretical framework to design evaluation studies for various educational programs. Sp

676 Curriculum Theory (3) Influential curriculum theories and approaches, implications for structure and design of educational programs. Nature and function of theory, theory building activities. Prereq: Consent of instructor. E

683 Advanced Studies in Elementary School Mathematics (3) Research in elementary school mathematics. Prereq: Graduate course in mathematics education or consent of instructor. Sp

685 Educational Leadership: Theory and Practice (3) Theories of leadership applied to variety of educational settings. Prereq: Consent of instructor. F, Su

689 Internship (1-3) Experiences in application of principles and practices of curriculum development and instructional improvement. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

693 Independent Study (1-3) May be repeated. S/NC or letter grade. E

694 Supervised Readings (1-3) May be repeated. S/NC or letter grade. E

695 Special Topics (1-3) May be repeated. S/NC or letter grade. E

696 Advanced Studies in Secondary Science and Environmental Education (3) Trends in science and environmental education, materials methods and research for middle, junior and senior high schools, and community colleges. Prereq: 586 or equivalent and consent of instructor. Sp

Ecology

(Majors of Liberal Arts)

DEGREES

Ecology

M.S., Ph.D.

Dewey L. Bunting, Director
B. L. Dearden, Associate Director
Paul A. Delcourt, Associate Director

Shared Faculty:
C. G. Amundsen, Ph.D. Botany
S. I. Auerbach, Ph.D. O.R.N.L.
G. M. Burghardt, Ph.D. Psychology
J. R. Carter, Ph.D. Geography
E. C. Clebsch, Ph.D. Botany
C. C. Coutant, Ph.D. O.R.N.L.
D. L. DeAngelis, Ph.D. O.R.N.L.
B. L. Dearden, Ph.D. Forestry; H. R. Delcourt, Ph.D. Botany; P. A. Delcourt, Ph.D. Geology
P. W. Parmalee, Ph.D. Anthropology; M. R. Patton, Ph.D. Fisheries & Wildlife

The Graduate Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary ecology.
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, the national Park Service, 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 that is truly unique. In addition, faculty research programs provide opportunities for student research elsewhere on this continent and abroad.

ADMISSION REQUIREMENTS

Requirements for admission to this program are:

1. admission to The Graduate School;
2. chemistry including organic, mathematics including calculus, and 3 semester hours of ecology at the upper division level;
3. departmental application and 3 rating forms;
4. Graduate Record Examination.

Application forms for admission should be obtained from The Graduate School and the Ecology Program. Inquiries concerning the admission procedures should be directed to the Director, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37968-1610.

THE MASTER’S PROGRAM

Within the minimum requirements of The Graduate School, the program of study must include Ecology 573 and 574 or an approved equivalent and one course from an approved list of quantitative methods offerings. The list is available from the ecology office and is updated annually by the Ecology Curriculum Committee. The remainder of a student’s course program is determined in consultation with the graduate committee. A listing of approved campus-wide ecology offerings is provided to each student during orientation. A graduate minor in ecology is available on an individual basis.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of The Graduate School. The doctoral program must include Ecology 573 and 574 or an approved equivalent and one course from an approved list of quantitative methods offerings. A student cannot enroll for dissertation hours until the research proposal has been discussed and approved by the doctoral committee. A foreign language is required.

ADVISORS

Advisors are selected from ecologists on the shared faculty 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 committee. The Master’s committee need not have more than three members. Doctoral committees consist of the major professor as chairperson, one additional member who should have an appointment in the same department, and at least two additional faculty from other departments.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. SJ/N/JC only. E

510 Special Problems in Ecology (1-3) Individual investigations in ecology. May be repeated with consent of instructor. Maximum 6 hrs.

520 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused changes have on living organisms. Lectures and field trips. Appropriate for students in Planning and Environmental Engineering.

530 Implementation of Environmental Policy (3) Goals and problems of environmental legislation. National Environmental Policy Act: purpose, preparation, and evaluation of environmental impact statements and similar multidisciplinary studies. Prereq: 520 or 573 or course work or experience in environmental law.

537 Natural Resource Management and Environmental Assessment in Developing Nations (3) Assessment of environmental and resource development issues. Scientific basis for integrated resource management and environmental assessment in developing nations. Prereq: General ecology or equivalent. (Same as Planning 553 and Botany 537.)

552 Development Planning in the Third World (3) (Same as Planning 552.)

555 Environmental Planning (3) (Same as Planning 555.)

561 Environmental Toxicology (3) (Same as Biochemistry 561.)

572 Techniques in Environmental Toxicology (1) (Same as Biochemistry 562.)

573 Population Biology (3) (Same as Zoology 573 and Botany 573.)

574 Communities and Ecosystems (3) Patterns underlying principles behind short and long term community and ecosystem organization, dynamics, energetics and nutrient cycling.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

604 Current Topics in Environmental Toxicology (1) (Same as Biochemistry 604.)

610 Special Topics in Ecology (3) Seminars on advanced topics and recent developments. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

620 Seminar in Ecology (2) May be repeated. Maximum 12 hrs.

627 Applied Ecology (3) Review of contemporary and historical issues. Analysis of scientific basis of environmental assessment and natural resource management. Analysis of careers and career planning in applied ecology. Prereq: 573-74 or equivalent or consent of instructor. (Same as Botany 637.)

Economics (College of Business Administration)

MAJORS

DEGREES

Economics ........................................ M.A., Ph.D.
Business Administration .................................. MBA

Anne Mayhew, Head

Professors:

R. A. Bohm, Ph.D. Washington (St. Louis);
R. L. Bowlby, Ph.D. Texas; S. L. Carroll,
Ph.D. Harvard; H. S. Chang, Ph.D. Vanderbilt;
W. E. Cole, Ph.D. Texas; P. Davidson
(Distinguished Professor), Ph.D.

Pennsylvania; G. R. Feiwel (Alumni
Distinguished Service Professor), Ph.D.
McGill; C. B. Garrison, Ph.D. Kentucky;
H. W. Herzig, Ph.D. Maryland; H. E. Jensen,
Ph.D. Texas; F. Y. Lee, Ph.D. Michigan State;
A. Mayhew, Ph.D. Texas; J. R. Moore, Ph.D.
Cornell, W. C. Neale, Ph.D. London School of
Economics; K. E. Quinney (Emeritus), Ph.D.
Kentucky; A. M. Schlottman, Ph.D.
Washington (St. Louis); G. A. Spiva, Ph.D.

Associate Professors:

D. P. Clark, Ph.D. Michigan State; W. F. Fox,
Ph.D. Ohio State; E. Giustof, Ph.D. Stanford;
K. E. Phillips, Ph.D. Washington (Seattle).

Assistant Professors:

J. A. Gauger, Ph.D. Iowa State; R. A. Hofer,
Ph.D. North Carolina; D. M. Mandy, Ph.D.
Illinois; J. W. Mayo, Ph.D. Washington (St.
Louis); M. N. Murray, Ph.D. Syracuse;
H. Thompson, Ph.D. Houston.

The Department of Economics offers graduate programs leading to the M.A. and Ph.D. The M.A. may be completed by either a thesis or non-thesis option, while the Ph.D. requires successful completion of a dissertation. Applicants to these programs should contact the Director of Graduate Studies, Department of Economics, for further information. The Department offers an area of concentration for the MBA degree. Students interested in the MBA program should contact the Associate Dean for Graduate Programs, College of Business Administration.

THE MASTER’S PROGRAM

Admission to this program is based on undergraduate academic performance and on scores from the general portion of the GRE or on scores from the GMAT. The student may choose either the thesis or non-thesis option. The non-thesis option requires 30 hours of course work at the 400 level or above. Of these, at least 24 hours (at least 18 hours of which are in economics) must be at the 500 level or above. Of the minimum of 18 hours in economics at the 500 level or above, 12 hours must consist of 511, 512 and 513, 514, and the remaining 6 hours must be in one field of economics. Of the 30 hours, a maximum of 9 hours of courses approved by the department may be taken in fields other than economics. Students electing the non-thesis option are required to pass a final comprehensive examination.

The thesis option requires 30 hours of course work at the 400 level or above, including at least 24 hours at the 500 level or above (no more than 6 hours of which may be thesis hours). Of the remaining 18 hours at the 500 level or above, at least 15 hours must be in economics and must include 511, 512, 513, and 514. A maximum of 6 hours may be in an area other than economics.

THE DOCTORAL PROGRAM

Admission to the Ph.D. program is based on promise of outstanding scholarship, as demonstrated by past academic performance and by scores achieved on the general portion of the GRE or on the GMAT. Requirements for successful completion of the program consist of the four components listed below.
1. Students are required to complete the following core requirements:
   a. Economic Theory: Microeconomic theory by comprehensive examination or by completion of 511, 512 with a B+ average or higher, and macroeconomic theory by comprehensive examination or by completion of 513, 514 with a B+ average or higher.
   c. Mathematical and Quantitative Economics: 581, 582. The 582 requirement may be waived for students completing 681, 682.
   Students must achieve a grade average of B or higher over the courses offered to fulfill requirements in subparagraphs b and c, or, as an alternative, may petition to satisfy either or both of these two core areas by some other means such as a comprehensive written examination.
   2. Students are required to demonstrate their competence by comprehensive examination or by satisfactory performance in two fields of specialization with the approval of the department, at least one of which must be selected from the following: comparative systems, economic development, economic history, economics of labor and income, resources, industrial organization, international economics, public finance, and regional and urban economics.
   3. Students are required to complete with a grade of C or better two elective economics courses at the 400 level or above, outside the core subject areas and outside the two fields of specialization.
   4. Students are required to complete a dissertation, including an oral defense, to give at least 24 hours of graduate credit (500).

**BUSINESS ADMINISTRATION CONCENTRATION**

For complete listing of MBA program requirements, see Business Administration.

**MBA Concentration: Economics**

Minimum Courses Requirements for MBA Concentration: As approved by the area MBA faculty advisor.

400 Special Topics (3) Topics vary. Prereq: Determined by department.
415 History of Economics (3) Methods of study of doctrinal history. Origins and evolution of major doctrines: classical and neoclassical economics, economics of Keynes and his followers, principal developments of second half of 20th century. Major writing requirement. Prereq: 201 or equivalent and consent of instructor.
424 Political Economy of World Development (3) Topics vary: Latin America, Asia, Soviet Union and Eastern Europe, and development of major economic strategies, policies, and problems. Prereq: 201. This course includes a major writing requirement.
462 Economics of Resources and Environmental Policy (3) Economic analysis of environmental policy and allocation of resources. Benefits and costs of development of natural resources and impacts of growth on environment. Major writing requirement. Prereq: 201.
471 Public Finance: Optimal Government Functions and Expenditure Analysis (3) Problems of collective consumption, externality effects, public investment, social decision making. Prereq: 201.
472 Public Finance: Taxation and Intergovernmental Relations (3) Analysis of individual taxes and of tax systems, major sources of revenue, fiscal federalism. Prereq: 201.
482 Introduction to Mathematical Economics (3) Application of algebra, matrix algebra, differential and integral calculus to micro and macroeconomics. Prereq: 201 and Mathematics 121-22 or 141-42.
500 Thesis (1-15) P/NP only. E
501 Managerial Economics (3) Application of economic concepts to business decision making. Analysis and forecasting of demand, cost analysis, pricing behavior, and application of optimizing techniques.
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E
503 Business Conditions Analysis (3) Macroeconomic environment and determinants of level of output, employment and prices for economy as whole. Implications of aggregate fluctuations for individual firms. Role of forecasting techniques and stabilization policies.
510 Fundamentals of Microeconomics (3) Theory of consumer behavior and demand, theory of production and cost, behavior of the firm in perfectly competitive and monopolistic environments. For non-economics majors. Not available for students with credit for 511. Prereq: 311 or equivalent.
511-12 Microeconomic Theory (3,3) Theory of consumer choice and demand, theory of revealed preference, attributes of goods and implicit prices, market demand, labor supply, individual behavior under uncertainty, theory of firm, theory of production and cost, market structures, derived demand and factor pricing, introduction to welfare economics, market failure and theory of second best, pure exchange.
512-14 Macroeconomic Theory (3,3) Determination of national income, prices, and employment. Results using Keynesian, market-clearing, monetarist, and rational expectations paradigms.
515 History of Economics (3) Purpose and methods of history of economics. Background for and origins, concerns, methods and conclusions of classical political economy: From Adam Smith through J. Dupuit and H.H. Gossen.
525 Economic History of Europe (3) Nature and functioning of economic systems and policies in history of Western civilization, major issues of method and interpretation. Prereq: Graduate standing in economics or consent of instructor.
526 Economic History of the U.S. (3) Interpretation of American economic structure and policies from colonial times. Prereq: Graduate standing in economics or consent of instructor.
562 Labor Relations and Collective Bargaining (3) (Same as Management 522.)
600 Doctoral Research and Dissertation (3-15) P/NP only. E
612 Advanced Microeconomic Theory (3) Prereq: 512 or equivalent.
613 Advanced Macroeconomic Theory (3) Prereq: 514 or equivalent.
623 Economic Development: Theories and Policies (3) Principal theories explaining economic behavior in developing countries and policies and strategies used to promote development. Prereq: Undergraduate degree in economics or consent of instructor.
624 Economic Development: Western Impact on Asia and Africa (3) Studies of consequences of contact between developed world and developing countries of Asia and Africa. Prereq: 21 hrs of upper division undergraduate social science or consent of instructor.
634 Comparative Economic Systems (3) Study and appraisal of alternative economic systems in comparative perspective.
641 Labor Economics (3) Theory of labor markets and wage determination under competitive conditions. Labor markets under conditions which interfere with competition, unions and discrimination. Human capital and estimation of returns to schooling. Topics vary. Prereq: 311 and 313, or equivalent.
642 Labor History and Legislation (3) Development of organized labor as important economic and political force in U.S., from Colonial times. Evolution of legal status of labor unions and of individual workers vis-a-vis their employers.
651 Monetary Theory (3) Study of money, credit, and liquidity as related to real output determination, interest rates, employment, and inflation. Prereq: 513.
652 Topics in Monetary Theory (3) Advanced monetary models, issues in monetary policy, open economy monetary theory and policy. Student participation. Prereq: 615.
661 Regional and Urban Location and Development Theory (3) Theory of industrial and agricultural location and human migration. Economic basis for land use patterns, central places, and urban form. Spatial interactions and urban development problems. National policies for regional and urban assistance.
662 Methods of Regional and Urban Analysis (3) Theory of regional/urban economic structure and growth. Regional income and product accounts, shift and share analyses, economic base studies, and regional/urban input-output models. Theory and problem solution.
663 Environmental and Resource Economics (3) Topics in environmental quality, natural resource allocation by private markets, and issues in formulating public policy toward environmental problems.
672 Public Finance: Taxation and Intergovernmental Relations (3) Theory of taxation; tax incidence and tax efficiency; policy analysis of U.S. tax structure at federal, state, and local levels. Theory of fiscal federalism and intergovernmental relations.

681-82 Econometric Methods (3,3) Theory and techniques of statistical testing of economic hypotheses and construction and estimation of econometric models. Review of classical least squares regression model, and approaches to simultaneous equation models with application to current econometric research. Prereq: 582 or equivalent.

690 Workshop (3) Advanced topics in economics. Student participation. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Education (College of Education)

MAJOR DEGREE
Education ........................................ Ph.D.

The Ph.D. program with a major in Education provides six concentrations. The departments participating in the Ph.D. program are Curriculum and Instruction; Educational Leadership; Educational and Counseling Psychology; Health, Leisure, and Safety; Physical Education and Dance; Special Services Education; and Technological and Adult Education.

The program requirements and the concentrations and specializations are:

Requirements Minimum Hours
Research Area 14
Foreign or Computer Language (demonstrate proficiency) 6
General Core Requirements Courses in history of education, philosophy of education (two areas must be represented) 4
Courses in learning theory, curriculum theory, and administrative theory (three areas must be represented) 6
Trans-college seminar—three consecutive semesters 3
Alternative Core Requirements Courses in philosophy of science 3
Courses in philosophy of science (including summer) 3
Seminar in area of specialization 3
Courses in learning theory/group or independent study 3
Concentrations Primary Concentration—A minimum of 16 hours normally selected from one or two specializations within the primary concentration 16
Supporting Specialization—A minimum of 9 hours selected from a specialization in a concentration other than the primary concentration 9
Cognate—A minimum of 6 hours selected from outside the college in addition to the designated research courses 6
Dissertation 24

CONCENTRATIONS

Administrative Theory and Practice
1. School administration
2. Higher education administration
3. Organizational leadership and policy studies

Theories of Curriculum Development and Foundations of Education
Specializations
1. Anthropological, historical, philosophical, and sociological bases for educational planning and curriculum
2. Principles and models for planning, developing, and evaluating educational programs
3. Research design for educational programs

Instructional Theory and Practice
Specializations
1. Principles and models for instructional improvement
2. Elementary and early childhood instruction and practice
3. Secondary/community colleges: (English, foreign language, mathematics, science, social studies education)
4. Elementary: mathematics, science, social studies education
5. Reading education
6. Instructional media and technology
7. Vocational—technical fields of instruction and practice
8. Special education and rehabilitation

Theories and Practice of Educational and Personal Adjustment
Specializations
1. Counselor education
2. Counseling psychology
3. Educational psychology

Foundations of Human Movement
Specializations
1. Adapted physical education
2. Philosophical foundations of sport
3. Sociological foundations of sport
4. Physical activity and positive health
5. Metabolic and cardiovascular adaptations to acute and chronic exercise
6. Motor behavior: motor control
7. Motor learning
8. Psychology of sport

Health Education
Specializations
1. Public health
2. Safety

See College of Education for additional departmental listings.

601 Trans-College Seminar (1) Introduction to Ph.D. program in Education: research requirements, meaning of scholarship in academe and issues/problems in education. Minimum of two consecutive semesters preceded or followed by summer term required of all Ph.D. students. Prereq: Admission to Ph.D. program or consent of Ph.D. program coordinator. May be repeated. May not be used to meet 600 requirement. S/NC only.

Educational and Counseling Psychology (College of Education)

MAJORS DEGREES
Guidance ........................................ M.S., Ed.D
Educational Psychology ........................... M.S., Ed.D
and Guidance .................................... Ed.S., Education

Michael J. Patton, Head

Professors:

Associate Professors:

The Department of Educational and Counseling Psychology offers graduate programs leading to the following: Master of Science with a major in Educational Psychology, concentrations in educational psychology and community agency counseling; Master of Science with a major in Guidance, concentrations in elementary guidance, secondary guidance, and school counseling; Educational Specialist with a major in Educational Psychology and Guidance, concentrations in community agency counseling, educational psychology, school psychology, and school counseling; and Doctor of Education with a major in Educational Psychology, concentrations in counselor education and educational psychology. The department also participates in the college-wide Ph.D. program with a major in Education. The concentration area is theories and practice of educational and personal adjustment with specializations in counselor education, counseling psychology, and educational psychology. The application deadline for admission to the doctoral programs is March 1, and to the Ed.S. and M.S. programs, March 1 and November 1. For information about the various programs of study and admissions, write the departmental admissions secretary.

MASTER'S PROGRAMS

Admission requirements include up-to-date scores from the GRE, the departmental admissions application form and letters of recommendation. All programs include thesis and non-thesis options. The program in edu-
School psychology requires a minimum of 36 hours, and the program in counseling and community agency counseling require 42 and 37 hours respectively. The programs in community agency counseling and in guidance each require supervised practicum and internship experiences working with clients. A final examination is required of all Master's degree students.

**SPECIALIST PROGRAMS**

Admission requirements include up-to-date scores from the GRE, the departmental admissions application form and letters of recommendation. All programs include thesis and non-thesis options. The program in school psychology requires a minimum of 52 hours. When students are admitted to the Ed.S. programs in educational psychology, school counseling or community agency counseling, it is assumed that they have completed a Master's degree. In this case, the minimum hours beyond the Master's required to complete the Ed.S. are as follows: educational psychology, 24; school counseling, 22; and community agency counseling, 25. The specialist programs require supervised practicum and internship experiences with students or clients, either in the program school or in community human service agencies. A final examination is required of all specialist students.

**THE DOCTORAL PROGRAMS**

The Ph.D. with a major in Education includes concentrations and specializations as listed under Education. For students applying to the Ph.D. program in concentration located in this department, the following two applications are required: one for the Ph.D. in Education program and one for the department that specifies which specialization is desired (i.e., counseling psychology, counselor education, or educational psychology). Applicants for the Ed.D. with a concentration in either counselor education or educational psychology fill out only the departmental application form. Departmental admissions requirements include up-to-date scores from the GRE; the department admissions application form; letters of recommendation; a writing sample; and, in the case of the counselor education program only, an audio or video-taped sample of the applicant's counseling work with a client.

The following minimum number of hours is required in each program concentration: specialization in counseling psychology - 98; counselor education, Ph.D. - 96, Ed.D. - 79; educational psychology, Ph.D. - 92, Ed.D. - 89. Residency for the Ph.D. programs is four consecutive semesters of full-time course work and three consecutive semesters for the Ed.D. The Ph.D. program requires course work in both a supporting specialization and a cognate, as well as either foreign language or a second major. Course work in statistics and research design is a requirement in all doctoral programs. Pre-dissertation research participation is a requirement in the Ph.D. program. The concentrations/specializations in counseling psychology and counselor education each require a year-long counseling practicum sequence and the equivalent of a year's full-time work as an intern in an appropriate counseling setting. The concentrations/specializations in educational psychology and counselor education also require supervised practicum experience in classroom teaching. All doctoral students take written comprehensive examinations in the program concentration, supporting specialization and cognate areas. The guidelines for each program concentration may be consulted for further requirements.

404 Special Topics (1-3) Instructor-initiated course offered at convenience of department on topics of current interest. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

410 Sex Role Development: Implications for Education and Counseling (3) Theories and research concerning development of person's sexual role and its relevance in educational and counseling settings. E

431 Personality and Mental Health (3) Various perspectives of mental health with application to education and other social institutions. E

432 The Disadvantaged Student: Psychosocial Developmental Perspectives (3) Theory and research regarding psychosocial behavior and appropriate interventions. E

450 Self-Management in the Helping Professions (3) Applications of self-management strategies to career, social, emotional, and health domains for both helping professionals and clientele. Prereq: Introductory course in psychology or consent of instructor. S/NC or letter grade. E

453 Independent Study (1-15) Independent investigation of problems in educational and counseling psychology. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

503 Problems in Lieu of Thesis (1-3) May be repeated. Maximum 12 hrs. S/NC only. E

504 Special Topics (1-3) Instructor-initiated course offered at convenience of department on topics of current interest. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

510 Psychological Theories of Human Development Applied to Education (3) Theory and research on emotional, intellectual and psychological development. Life span with applications to educational and therapeutic settings. F,Su

511 Cognitive Development: Implications for Education (3) Applications of theory and research related to higher mental processes. Prereq: 510 or consent of instructor. Sp

515 Educational Applications of Behavioral Theories of Learning (3) Behavioral theories and research, conditioning, observational learning, and ethological learning as systems apply to student motivation, discipline and learning. F,Su

516 Educational Applications of Cognitive Learning Theories (3) Cognitive theory and research, social learning, attribution and information processing as systems apply to education. Prereq: 515 or consent of instructor. Sp

518 Educational Specialist Research and Thesis (1-9) May be repeated. Maximum 9 hrs. P/NP only. E

520 Statistics and Research Design: Conceptual (3) Consumer-oriented, conceptual treatment of statistical, research design, and quantitative testing of data. E

521 Statistics and Research Design: Application (3) Data collection and analysis. Descriptive techniques, estimation, hypothesis testing and selected parametric and nonparametric tests. E

524 Formal Measurement in Education and Counseling (3) Principles of test construction and item analysis. Survey of standardized tests of intelligence, achievement, aptitude, vocational interest, attitudes and personality. Prereq: 525 or equivalent. F

526 Informal Methods of Assessment (3) Development and use of rating scales, check-lists, observation, test scores and case reports in assessment and counseling of children and adults. Prereq: 525. Sp

540 Seminar in School Psychology (1-3) Essentials of theory and practice of school psychology as professional specialty. Consideration of history and current issues in school psychology. S/NC only. F

541 Psychoeducational Assessment (3) Direct, psychometric and naturalistic assessment methods in learning environments. Prereq: Admission to school psychology program or consent of instructor., and 525 or equivalent. May be repeated. Maximum 6 hrs. F,Sp

542 Practicum in Psychoeducational Assessment (3) Application of assessment skills to clients in learning environments. Coreq: 541 or consent of instructor. May be repeated. Maximum 8 hrs. F,Sp

545 Psychoeducational Consultation (3) Use of two and three person model and the theory and practice of parametric and nonparametric tests. Maximum 12 hrs. (Same as Psychology 549.) S/NC only. E

550 Development and Operation of Pupil Personnel Services (3) History, philosophy, trends, standards of preparation, certification, and role identity of counselors and other personnel service specialists. Program administration and organization. F,Su

551 Theory and Practice of Counseling (3) Philosophical bases of helping relationship, development of counselor and client self-awareness; counseling theory/techniques. E

552 Career Development: Vocational Theory, Research and Practice (3) Relationship of vocational theory, career development research and societal factors to life career roles. F,Su

553 Career Development: Vocational and Educational Resources (3) Application and use of career and educational resources in personnel planning and program development. Sp,Su

554 Group Dynamics and Methods (3) Theory and types of groups, descriptions of group practices, methods, dynamics, and facilitative skills, supervision of leadership skills. E

555 Practicum in Counseling (3) Supervised practice and application of counseling skills with individual clients. Prereq: Admission to program, 431, 525, 551 and consent of instructor. May be repeated. Maximum 9 hrs. E

556 Seminar in Community Agency Counseling (1) Theory of professional counseling, code of ethics, certification requirements, and role identity of community agency counselors. May be repeated. Maximum 2 hrs. E

558 Internship in School Counseling (1-6) Supervised postpracticum employment at departmentally approved site. Prereq: 550 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

559 Internship in Community Agency Counseling (1-6) Supervised postpracticum employment at departmentally approved human services agency. Prereq: Admission to community agency program, 555 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E
669 Internship in Educational Psychology (1-6) Supervised employment in departmentally-approved educational psychology internship sites. May be repeated. Maximum 12 hrs. S/NC only. E


671 Personality and Vocational Assessment (3) Use and interpretation of personality and vocational measures in assessment of clients. Prereq: 525, 552 or consent of instructor. F

672 Psychological Dysfunction (3) Classification methods, dynamics and treatment of dysfunctional individuals in counseling. Prereq: 625 and course in abnormal psychology, or consent of instructor. Sp

673 Advanced Theory and Practice in Group Counseling (3) Theories and supervised practice. Prereq: 554, 555, and consent of instructor. Sp

674 Practicum in Counseling Psychology (3) Supervised practice of individual counseling. Minimum 155 clock hrs required each semester. Prereq: Admission to counseling psychology doctoral program, 555, and consent of instructor. May be repeated. Maximum 6 hrs. E

678 Theory and Practice of Counseling Supervision (3) Theory and practice of supervision in counseling. Prereq: 555, or 674, or consent of instructor. S/NC only. Sp

679 Internship in Counseling Psychology (1-4) Supervised employment in departmentally approved counseling psychology internship sites. Prereq: Admission to counseling psychology doctoral program and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

693 Independent Study (1-18) Independent investigation of problems in educational and counseling psychology. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

Educational Leadership
(College of Education)

MAJORS
College Student Personnel..........................M.S.
Education and Supervision..........................M.S., Ed.S., Ed.D.
Education..........................Ph.D.

Frederick P. Venditti, Acting Head


The Department of Educational Leadership offers graduate programs leading to the Master of Science with majors in Educational Administration and Supervision and in College Student Personnel (higher education), the Specialist in Education, the Doctor of Education with a major in Educational Administration and Supervision, and the Doctor of Philosophy with a major in Educational Administration. Specializations may be developed in research, major central office positions, the principalship, and in other educational and social roles.

The Ed.D. program also offers a concentration in higher education. The instructional program combines theory and practice in an innovative demonstration of scholarly study and research. A blend of classroom instruction, individualized advising, and supervised practice and internships allows students to develop a specialization in academic administration, community-junior college administration, student personnel administration, financial management, and college teaching.

For additional information, contact the department head.

ADMISSION REQUIREMENTS
General test of the Graduate Record Examination; writing sample if GRE verbal is below 50th percentile; leadership potential judged by activities in organizations; and rating forms or letters of recommendation. The Ed.D. applicant must also interview with at least 3 faculty members on campus or elsewhere. Application deadlines are February 1, July 1, and October 1.

M.S. IN EDUCATIONAL ADMINISTRATION AND SUPERVISION

Thesis Option A minimum of 33 credit hours including 6 hours of Thesis 500. A major internship consists of a minimum of 18 hours. An internship is highly recommended but not required. A final oral examination is required with a written exam at the option of the committee.

Non-Thesis Option A minimum of 36 credit hours is required with a minimum of 18 hours in the major. An internship is highly recommended but not required. A final written comprehensive examination is required with an oral exam at the option of the committee.

M.S. IN COLLEGE STUDENT PERSONNEL
This program is designed for individuals interested in entering the field of student personnel administration in colleges and universities and in community or junior colleges. The program has both a thesis and non-thesis option. A minimum of 39 hours, which includes 6 hours of practicum experience, is required in either option.

Students entering any of the M.S. options are advised to first complete the introductory core consisting of Educational Administration and Supervision 513, 515, 516, and 535 or a demonstration of computer proficiency. The
courses are prerequisites to other courses in the department.

EDUCATIONAL SPECIALIST DEGREE

Theology

A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 518 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the thesis.

Non-Thesis Option

A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 503 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the problem papers.

THE DOCTORAL PROGRAM

For the Ed.D. program, the minimum hours are determined by the student's doctoral committee. Six to 9 hours must be in a cognate area within the college and 6-9 hours outside the college unless the student has a Master's degree in a field outside the College of Education. Three consecutive semesters of 604 must be taken during residency. An internship is highly recommended but not required. A foreign language requirement is at the discretion of the committee. A written comprehensive examination is given as well as an oral exam over the dissertation.

The Ph.D. with a major in Education includes concentrations and specializations as listed under Education.

Educational Administration and Supervision

500 Thesis (1-15) P/NP only. F

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeatable. S/NC only. E

503 Problems in Lieu of Thesis (3-5) May be repeated. S/NC only. E

513 Administrative and Organizational Theory in Education (3) Introduction to theoretical administrative and organizational foundations of management and leadership of educational programs and institutions. F,Su

515 Human Relations and Communication in Administration (3) Development and use of effective interpersonal communication skills and channels, interpersonal relations, supportive work climates, personnel motivation, conflict management skills, and role of values, attitudes, and expectations in administration. F,Su

516 Research for School Administrators (3) Descriptive, experimental, and quasi-experimental designs to help students without quantitative backgrounds to read and understand technical professional literature. Introduction to inferential statistics, needs assessment, and evaluation procedures. Sp,Su

518 Educational Specialist Research and Thesis (3) May be repeated. Maximum 6 hrs. P/NP only. E

529 Politics of Education and Educational Environment (3) School district interactions, functions, costs, goals, and policies of modern, complex society. Administrator and supervisory competencies: political, social, ethnic, cultural, and racial environments in which schools operate. Prereq: M.S. introductory core or consent of instructor. F,Su

535 Administrative Applications of Micro Computers (3) DOS, word processing, data based management, spreadsheet and microcomputer communications. Review and development of specific administrative applications such as scheduling, attendance, student record systems, and accounting. F,Su

544 School Finance and Business Management (3) For prospective building level administrators. Financial and logical management tasks and procedures in individual school setting. Prereq: M.S. introductory core or consent of instructor. F,Su

547 Educational Facility Planning (3) Concepts and skills for development, evaluation, construction, renovation, maintenance, and operations of quality educational environments and facilities. Prereq: M.S. Introductory core of instruction. F,Su

548 Introductory Supervision and Person nel (3) Basic supervisory and personnel concepts and related competencies; building (or micro-organizational level) interviewing, selection, placement, orienting, and maintaining employee information, supervision of instructional and non-instructional personnel, clinical supervision, staff evaluation, and staff development. Prereq: Introductory M.S. core or consent of instructor. F,Su

553 Strategies of Educational Planning (3) Processes for improving decision-making function through use of both qualitative and quantitative planning techniques. Prereq: 544 or consent of instructor. F,Su

554 School Law (3) Logical arrangement of case and statutory materials for public school administrators and teachers; problems concerning law and public education. Prereq: Introductory, introductory core or consent of instructor. Sp,Su

580 Internship in Educational Administration (3) Field experience in appropriate educational setting working directly with administrator. At end of planned program of study. Placement by department assignment. Some on-campus classes in conjunction with 583 or 582. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F,Su

583 Educational Leadership and District-Level (3) Role of central administrative team; relationships, behaviors, concepts and competencies for developing and maintaining effective school organization. At end of planned program of study. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F,Su

585 Educational Leadership—Principalship (3) Knowledge, skills and relationships for principal to be effective instructional leader. Simulation materials and field-based activities. Culminating course with internship and problems paper. At end of planned program of study. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F,Su

590 Special Topics (3) May be repeated. E

592 Field Problems in Educational Administration and Supervision (3) Topic to be assigned. May be repeated. S/NC or letter grade. E

593 Independent Study in Educational Administration (3) Prereq: Consent of instructor. May be repeated. E

595 Elementary Principals Seminar (1-3) For in-service training of elementary school administrators.

596 Middle School Principals Seminar (1-3) For in-service training of middle school administrators. Development, problems, programs, and trends of middle school administrators. Prereq: Presently middle school administrator or consent of instructor. May be repeated. S/NC or letter grade. F,Sp

597 Secondary Administrator Seminar (1-3) For in-service training of secondary school administrators.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

604 Seminar in Educational Administration and Supervision (1) Current educational issues, problems and research. Required two consecutive semesters during doctoral residency. May be repeated. S/NC only. E

610 Internship in Educational Administration (3) Opportunity for doctoral students and advanced graduate students to gain experience in performance of critical functions of educational administration under supervision of practitioner and University representative. May be repeated at discretion of student's committee. Maximum 12 hrs. S/NC only. E

611 Current Issues in Educational Administration (3) Current topics for secondary, junior high, and elementary school administrators. Prereq: Selected each semester and presented by specialist. Prereq: Presently school supervisor or administrator, or consent of instructor. May be repeated. S/NC or letter grade. E

614 Statistical Methods for School Administrators (3) Descriptive and experimental research methods, parametric and non-parametric statistical techniques used in research in educational settings. F

615 Research Designs (3) Statistical methods through one- and two-variable techniques and applications to various research designs. Prereq: 614 or consent of instructor. Sp

616 Research Methods (3) Overview of descriptive and experimental research designs; data collection, statistical analysis and interpretation of results, and use of school surveys. Conduct of survey. Prereq: Basic statistics and computer skills or consent of instructor. E

622 Programs for the Professional Preparation of Educational Administrators and Supervisors (3) Exploring designs and methodology for training school administrators at both pre-service and in-service levels.

629 Seminar in Politics of Education (3) Political theories and practices as they affect operation of public school systems and higher educational institutions. Interdisciplinary discussions of community power structures and political systems in the United States and Canada, and research from education, sociology, and political science. Field inquiry. Prereq: 529, 516 or equivalent or consent of instructor. E

638 Advanced Supervision (3) Supervision at district level; roles, responsibilities, and operations; goal development, instructional supervision, staff development, curriculum development, program evaluation, and personnel evaluation. Prereq: 548 or consent of instructor. F,Su

644 Educational Finance and Business Management (3) Contemporary educational finance policies and their influence upon education, nation and others. Superintendence team concept; management of school logistical services. Prereq: 544 or consent of instructor. F,Su

646 School Personnel Administration (3) Personnel administration of functions for professional and support staff in educational organizations. Recruitment, selection, placement, personnel policies; employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development and staff evaluation. Prereq: 548 or consent of instructor. F,Su

653 Seminar in Educational Planning Methods (3) Exploration of alternative futures and advanced plan-
Higher Education

455 Seminar in Student Leadership (1) Knowledge and skills in leadership roles for resident assistants, student government leaders, student activities, and other student organizations. Topics to be assigned. May be repeated. E

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

503 Problems in Lieu of Thesis (3-6) May be repeated. S/NC only. E

524 The College Student and the Court (3) Legal precedent affecting student personnel services in public higher education. Student discipline, housing, dress, organizations, activities fees, tuition and related federal regulations. F

543 American Higher Education in Transition (3) History, philosophy, purposes, functions, organizations and programs in American higher education. F

570 Introduction to Student Personnel Work in Higher Education (3) Historical, philosophical and organizational perspective. Functional areas comprising field and major issues. F

572 Theory and Practice in Student Personnel Services (3) Theoretical framework of college student personnel services and practical application of theory in student services environment. Applicable administrative theory, human development theory and evaluation assessment techniques. E

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

593 Independent Study (3) Prereq: Consent of supervisor. May be repeated. S/NC or letter grade. E

599 Practicum in College Student Personnel (1-5) Prereq: Consent of instructor. May be repeated. S/NC only. E

619 Administration and Governance of Higher Education (3) Trends, structure and process of collegiate governance. Development of understanding of administrative theory and practice in higher education. Prereq: 543 or consent of instructor. F

630 Special Topics (1-3) May be repeated. E

640 College and University Law (3) Legal precedent affecting organizations, administration, and finance of higher education. Academic freedom, faculty termination, religion, tort liability, administrative law, academic due process and affirmative action in employment. Sp

645 Curriculum and Instruction in Undergraduate Higher Education (3) Content and organization of institutional strategies and curricular structure in higher education. F, Su

650 Fiscal Problems in Higher Education (3) Revenue sources, appropriation process, budget procedures, cost analysis, and fiscal management in public and independent colleges and universities. Sp

653 Independent Study (3) Prereq: Consent of supervisory instructor. May be repeated. S/NC or letter grade. E

655 Administration of Complex Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational programs and organizations. Prereq: 513 or consent of instructor. Sp, Su

677 Seminar in Educational Facility Planning (3) Concepts and techniques for evaluating educational facilities, conducting comprehensive school surveys, and developing educational specifications. Prereq: 547 or consent of instructor. Sp

690 Specialized Seminar (3) Prereq: Consent of instructor. May be repeated. E

693 Independent Study in Educational Administration and Supervision (3) Prereq: Consent of instructor. May be repeated. E

Electrical and Computer Engineering

(Majors of College of Engineering)

MAJOR

DEGREES

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

Walter L. Green, Head

Professors:
I. Alexeff, Ph.D. Wisconsin, P.E.; J. M. Bailey, Ph.D. Georgia Institute of Technology; A. O. Bishop, Ph.D. Clemson; T. V. Blalock, Ph.D. Tennessee; R. C. Gonzalez (Distinguished Professor), Ph.D. Valencia; D. Boudlin, Ph.D. Vanderbilt; J. W. Cunningham (UTSI), Ph.D. Tennessee; R. C. Gonzalez (Distinguished Professor), Ph.D. Florida; J. M. Googe, Ph.D. Georgia Institute of Technology; W. L. Green, Ph.D. Florida; A. M. G. W. Hoffman, Ph.D. Harvard; J. C. Hung (Distinguished Professor), Ph.D. New York; P.E.; E. J. Kennedy, Ph.D. Tennessee, P.E.; W. O. Loffell (Emeritus), M.S. Tennessee; W. McGregor (UTSI), Ph.D. Tennessee; H. P. Neff, Ph.D. Auburn, P.E.; M. O. Pace, Ph.D. Georgia Institute of Technology, P.E.; J. F. Pierce (Distinguished Professor), Ph.D. Pittsburgh, P.E.; T. W. Reddoch, Ph.D. Louisiana State; R. W. Rochelle, Ph.D. Maryland; J. R. Roth, Ph.D. Cornell; F. W. Symonds, Ph.D. Nottingham (UK); J. D. Tillman, Ph.D. Auburn; C. H. Weaver, Ph.D. Wisconsin, P.E.

Associate Professors:
R. A. Belz (UTSI), Ph.D. Tennessee; J. D. Birdwell, Ph.D. Massachusetts Institute of Technology; B. W. Bomar (UTSI), Ph.D. Tennessee; J. S. Lawler, Ph.D. Michigan State; A. Pujol (UTSI), Ph.D. Vanderbilt; D. Rosenberg, Ph.D. Tennessee; J. M. Rochelle, Ph.D. Tennessee; J. W. Waller, Ph.D. Tennessee.

Assistant Professors:
D. Brzakovic, Ph.D. Florida; J. A. Chapman (UTSI), Ph.D. Tennessee; M. A. Scott (UTSI), Ph.D. Tennessee.

The Electrical and Computer Engineering Department has a graduate committee to administer, promote, and coordinate the Electrical and Computer Engineering Department. A limited number of Graduate Research Assistantships are available at each location. Further information about this program is available from the department.

MASTER OF SCIENCE PROGRAM

Graduate work leading to the Master of Science with a major 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.

MASTER OF ENGINEERING PROGRAM

A graduate program leading to the Master of Engineering is available to qualified graduates of ABET (Accreditation Board for Engineering and Technology)-accredited undergraduate curricula in electrical engineering or its equivalent. 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.

ADMISSION REQUIREMENTS

Students applying for admission to the Master of Science or Master of Engineering program and who hold a B.S. in Electrical Engineering are considered for admission on an individual basis. The minimum expectation is an undergraduate cumulative grade point average of 3.0 out of 4.0 and a GPA of 3.0 for the senior year.

Students who hold the B.S. or B.A. in a field other than electrical engineering are also expected to have a minimum cumulative grade point average of 3.0 and a minimum senior year average of 3.0 in that field. These students should also have a background equivalent to that obtained by earning credit with a minimum 3.0 grade point average in the following undergraduate Electrical Engineering courses: 201, 202, 203, 301, 302, 311, 312, 315, 321, 322, 329, 331, 332, 339, 341, 342, 345, 351, 352, 359,
78 Fields of Instruction/Electrical and Computer Engineering

361 and two 400-level courses in the student's major area of concentration in the Master's program. Students from fields other than electrical engineering who have met the admission standards will be admitted only as non-degree students until a program of study is developed by each student and his/her advisor and is approved by the Electrical and Computer Engineering Graduate Committee. The program of study should include recommended undergraduate courses and graduate courses in electrical and computer engineering.

MASTER'S DEGREE REQUIREMENTS

Specific degree requirements which must be met include:

1. Electrical and Computer Engineering 503 and 504.
2. Six semester hours of graduate credit in mathematics consisting of mathematics courses of 400 level or higher which have been approved by the E.C.E. Graduate Committee.
3. An additional 12 semester hours of 500-level work in electrical and computer engineering courses or 6 semester hours of 500-level technical courses in electrical and computer engineering courses and 6 semester hours of 500-level work in another area approved by the student's Master's committee. The 12 semester hours of 500-level work in electrical and computer engineering courses must be divided equally between two different electrical and computer engineering areas.
4. Master's thesis, totaling 6 semester hours or more.
5. A final oral examination covering the thesis and related course work.

DOCTORAL PROGRAM

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

Applicants must submit scores on the General Graduate Record Exam. Specific, departmental requirements for the Ph.D. include the following:

1. A Master of Science or Master of Engineering degree.
2. A minimum of 48 semester hours of course work beyond the B.S. excluding thesis, research, and dissertation credit.
   a. A minimum of 24 semester hours of work in electrical and computer engineering courses at the 500 and 600 levels.
   b. A minimum of 9 semester hours of 600-level course work. At least 3 semester hours of this work must be in an area other than the student's major area.
   c. A minimum of 12 hours of mathematics courses approved by the Electrical and Computer Engineering Graduate Committee. All 12 hours must be 400-level or above, and at least 6 hours must be at 500-level or above.
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 qualifying and comprehensive examination. The qualifying examination is prepared by the electrical and computer engineering faculty and consists of a 3-hour written examination in each of four areas. Areas (1) mathematics and transform methods, and (2) basic electrical network analysis, are required of all students. Areas (3) and (4) are usually chosen from two of the graduate course divisions in the department and cover material from undergraduate courses and first year graduate courses. A student who fails the qualifying examination must take and pass the examination the next time it is offered to remain in the Ph.D. program. The qualifying examination is normally taken after the completion of 24 hours of graduate course work or immediately after completion of a Master's degree. A minimum of 18 hours of graduate course work must be completed after the student has taken the qualifying examination the first time.
5. Participation in departmental seminars.

Many of the electrical and computer 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.

Courses required in the Electrical and Computer Engineering undergraduate curriculum cannot be used in either the M.S. or Ph.D. programs. No 400-level course may be used toward a graduate degree in Electrical and Computer Engineering.

413 Passive and Active Network Synthesis (3) Review of network analysis techniques, passive network driving point synthesis, transfer function synthesis, approximation theory, topics in active network synthesis. Prereq: 312.
421 Power Systems (3) Bulk power system planning and control; reliability; system stability. Prereq: 322.
422 Machines (3) Dynamic behavior of rotating machines; transient functions for common modes of operation of d.c. machines; response to different waveforms in supply; describing equations for a.c. machines and their numerical solutions. Prereq: 322; Coreq: 426.
423 Power Electronics (3) Industrial motor controls, phase control, variable frequency, motor characteristics; power HVDC, rectification, inversion, electromagnetic compatibility; VAr control; uninterruptable power systems; surge arresters. Prereq: 322.
425 Direct Electrical Energy Conversion (3) Principles and practices of energy conversion devices and industrial applications. Prereq: 411.
426 Machines Lab (1) Experiments and projects demonstrating machines. Coreq: 422.
429 Power Electronics Lab (1) Experiments and projects demonstrating power electronics.
431 Digital and Analog Integrated Electronics (3) Basic processing and fabrication of active and passive components for monolithic integrated circuits; characteristics of bipolar, MOS and JFET transistors in typical analog and digital integrated circuit designs; standard digital logic circuit designs; operational amplifier circuits; analog to digital and digital to analog conversion; digital logic circuit design; standard digital logic circuit designs; operational amplifier circuits; phase locked loops; feedback amplifiers. Prereq: 322; Coreq: 436.
433 Electronic Amplifiers (3) Feedback amplifier principles; wideband linear amplifier design; radio frequency and audio power amplifier design; linear regulated power supply design; oscillator principles. Prereq: 332; Coreq: 436.
436 Analog Signal Processing Electronics (3) Transducer signal and interchanging characteristics, analog integrated circuits: operational, instrumentation, and isolation amplifiers, rms and logarithmic converters, multipliers, and function generators; integrated circuit applications: active filters, level and phase detection, multiplexers, modulator and demodulator, sampling and hold, and comparators. Prereq: 332; Coreq: 436.
441 Digital Communications (3) Pulse and digital communication system principles. Sampling theorems; pulse amplitude, duration, and position modulation methods. Random signals and spectral analysis of noise as applied to communication systems. Quantization, coding, communication of digital signals, carrier modulation with digital waveforms. Delta, adaptive delta, delta-sigma, delta PCM systems. Networking and network standards. Prereq: 342.
442 Antennas and Propagation (3) Linear antennas, arrays, very small apertures, transmission-line antennas, communication link parameters. Wave propagation in earth bound free space, earth's troposphere and ionosphere. Reflections from earth; affects on link reliability. Prereq: 342.
443 Microwave Circuits and Electronics (3) Scattered wave description of circuits: isolators and amplifiers, couplers and power dividers, circulators, phase shifters. Loading and interconnection of systems. Power generation and amplification by vacuum devices and by solid state (bulk and junction) devices. Microwave switching, filtering and multiplexing devices. Transmission line and waveguide components. Prereq: 342; Coreq: 449.
449 Microwave Circuits and Electronics Laboratory (1) Experiments and projects demonstrating microwave circuit and electronics. Coreq: 443.
451 Microprocessors in Computer Engineering (3) Project-oriented course introducing students to microprocessor-based microcomputer program and development systems with cross-assemblers, file management, and emulation capability. Interfacing and hardware/software trade-offs in
interrupt driven applications. Term grade dependent on number of projects completed, homework solutions, and engineering notebook. Prereq: 352. Coreq: 455.


453 Data Acquisition Systems Laboratory (1) Experiments and projects demonstrating digital systems. Prereq: 452.

455 Microprocessor Laboratory (1) Experiments and projects demonstrating microprocessors. Coreq: 451.

456 Digital System Design Laboratory (1) Experiments and projects demonstrating digital systems. Coreq: 452.

459 Data Acquisition Systems Laboratory (1) Experiments and projects demonstrating digital systems. Coreq: 452.

461 Plasma Magnetohydrodynamic Engineering (3) MHD approximation; MHD waves and instabilities; MHD in static and dynamic systems; MHD in pulsed and steady-state power systems; high power wave generation; Applications for fusion energy, industry, and astrophysics. Prereq: 361.

462 Plasma Kinetic Theory Engineering (3) Kinetic theory; beam-plasma system; driven waves in plasma; transition from multiple beams to continuum, Vlasov and Landau theory; microwave generation in plasmas and traveling wave tubes; free electron masers in circular geometry; gyrotron and orbitron. Design of plasma devices. Prereq: 391; 451 or consent of instructor.

463 Introduction to Fusion Energy I (3) High temperature plasma physics relevant to fusion plasmas, principles of fusion reactors, and engineering physics constraints on fusion reactors. Prereq: 361 or consent of instructor. (Same as Nuclear Engineering 463.)

464 Introduction to Fusion Energy II (3) Principles and phenomenology of tokamak reactor, alternate magnetic confinement concepts, advanced fusion fuel, fusion technology, plasma engineering, and fusion reactor design studies. Design project. Prereq: 463 or consent of instructor. (Same as Nuclear Engineering 464.)

469 Plasma Laboratory (1) Experiments and design projects for 461, 462, and 463. 464.

471 Introduction to Pattern Recognition (3) Design of learning and adaptive machines. Elementary decision theory, perception algorithm, Bayes classification rule, learning algorithms, elements of syntactic pattern recognition. Prereq: Consent of instructor.

472 Introduction to Digital Image Processing (3) Basic methods for digitizing, storing, processing, and displaying images. Computational procedures for image enhancement, restoration, coding, and segmentation. Prereq: Consent of instructor.


489 Electro-Optics Laboratory I (1) Experiments and projects demonstrating electro-optics. Coreq: 481.

494 Special Problems in Electrical Engineering (1-3) Problems involving library and experimental research. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

495 Senior Seminar (1) Topics of interest discussed in weekly seminar. Prereq: Consent of Instructor. May be repeated. Maximum 2 hrs.

499 Electro-Optics II Laboratory (1) Experiments and projects demonstrating electro-optics. Coreq: 482.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required, may be repeated. Maximum 2 hrs.


512 Radiation and Propagation (3) Linear antennas, loop antennas, aperture antennas, optical transfer function. Canonical problems of modern geometrical theory of diffraction (GTD) for electromagnetic waves: geometric optics approximation, and accountings of far fields and near fields due to edge and surface diffraction. Horn, lens, and reflector antennas, computation of radiation crossection. Prereq: 541.

513 Pattern Recognition (3) Mathematical treatment of information transmission in communication systems; modulation and demodulation; discrete and analog systems. Performance of random signals and noise with bandwidth constraints, sampling theorem. Quantization effects; digital filter design in real time and real frequency; digital signal processing. Prereq: 504.

514 Information Systems I (3) Mathematical treatment of information transmission in communication systems; modulation and demodulation; discrete and analog systems. Performance of random signals and noise with bandwidth constraints, sampling theorem. Quantization effects; digital filter design in real time and real frequency; digital signal processing. Prereq: 504.

515 Information Systems II (3) Wiener's theory of filtering and prediction; optimal filters for linear Gaussian systems; detection for sampled signals; extension to nonlinear systems. Detection of signals in noise. Application to radar tracking, target resolution and accuracy; low-noise receivers. Prereq: 543.

516 Passive and Active Network Analysis and Synthesis I (3) Frequency and time domain techniques for network analysis; network reliability, synthesis algorithms. Prereq: 517.


521 Power Systems Analysis I (3) Matrix-vector representations of power networks, sequence modeling of power system components, unbalanced shunt and series faults. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 421 or equivalent.

522 Power Systems Analysis II (3) Operation and control of interconnected power systems, transient and dynamic stability. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 521.


528 Advanced Electrical Machines I (3) Fundamental processes of electromechanical energy conversion; application in conventional devices. Differential equations for motor and generator, state-space model, equivalent circuits. Prereq: 522 or equivalent.

529 Advanced Electrical Machines II (3) Park's transformation and two-axis model, transient behavior of isolated and interconnected rotating machines. Prereq: 528.

531 Advanced Analog Electronics I (3) Physical operation of microwave amplifiers, modulators, transmission devices: diodes, bipolar transistors, JFETs, and MOSFETs. Small-signal equivalent circuits and noise models of amplifiers and noise measurement. Prereq: 431, 432, 433, or consent of instructor.


544 Information Systems II (3) Wiener's theory of filtering and prediction; optimal filters for linear Gaussian systems; detection for sampled signals; extension to nonlinear systems. Detection of signals in noise. Application to radar tracking, target resolution and accuracy; low-noise receivers. Prereq: 543.


547 Pattern Recognition (3) Decision-theoretic and structural approaches to pattern recognition. Deterministic and statistical decision rules, feature extraction and selection, decision theory, and learning and decision methods. Prereq: 421 or consent of instructor.


554 Information Systems I (3) Mathematical treatment of information transmission in communication systems; modulation and demodulation; discrete and analog systems. Performance of random signals and noise with bandwidth constraints, sampling theorem. Quantization effects; digital filter design in real time and real frequency; digital signal processing. Prereq: 504.


561 Plasma Diagnostics I (3) Principles of active, passive, and noninterfering techniques. Methods based in low power, high power, and high power plasma of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor based data handling and analysis, and reduction of time series data. Prereq: 461, 463, or consent of instructor. (Same as Nuclear Engineering 561.)

566 Plasma Diagnostics II (3) Laboratory investigation in operation of plasma diagnostic instruments in plasma science laboratory, experience with high voltage, vacuum, RF, and digital data handling techniques. Prereq: 561. (Same as Nuclear Engineering 466.)

568 Plasma Engineering (3) (Same as Nuclear Engineering 568.)

570 Fusion Technology (3) (Same as Nuclear Engineering 564.)

571 Pattern Recognition (3) Decision-theoretic and structural approaches to pattern recognition. Deterministic and statistical decision rules, feature extraction and selection, decision theory, and learning and decision methods. Prereq: 421 or consent of instructor.


573 Robot Sensing (3) Design and applications of optical systems.
various sensors such as vision, range, proximity, force, and torque. Multi-sensor integration and robotics applications. Prereq: 572 or consent of instructor.


588 Measurement Science I (3) (Same as Nuclear Engineering 588, Chemical Engineering 586, Civil Engineering 589, Engineering Science and Mechanics 586, Mechanical Engineering 588, and Aerospace Engineering 586.)

589 Measurement Science II (3) (Same as Nuclear Engineering 589, Chemical Engineering 586, Civil Engineering 589, Engineering Science and Mechanics 586, Mechanical Engineering 589, and Aerospace Engineering 589.)

596 Graduate Seminar (1) Topics of interest discussed in weekly seminar. May be repeated. Maximum 6 hrs.

599 Special Topics (1-3) May be repeated. Maximum 9 hrs.

600 Doctoral Research and Dissertation (1-5) P/NP only. E.


612 Advanced Systems Theory (3) Game theory, dual control problem, hierarchical systems, and information structures. Prereq: 611.


614 Optimal Control (3) Deterministic and stochastic dynamic programming in continuous and discrete time, minimum principle and matrix minimum principle, computational methods in optimal control. Prereq: 611.

615 Analysis of Nonlinear Networks and Systems (3) Systematic study and analysis of nonlinear electric circuits. Network elements and equation, linear systems, nonlinear O.D.E.'s, geometric analysis and numerical techniques. Prereq: Consent of instructor.

616 Active Network Synthesis (3) Theory and design of active analog filters and practical RC realizations. Prereq: Consent of instructor.

617 Special Topics in Systems Theory I (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

618 Special Topics in Systems Theory II (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

621 Modern Techniques for Electric Energy Systems I (3) Analysis of electric energy systems. Prereq: Consent of instructor.


631 Advanced Topics in Electronic Instrumentation I (3) Based on particular interests of students. Fundamental physical processes in instrumentation transducers: thermoelectric, magnetoelectric, electromechanical and quantum-mechanical devices. Prereq: 531-52 and consent of instructor.


641 Electromagnetic Diffraction and Scattering (3) Diffraction of electromagnetic waves by spheres, corners and cylinders; ground wave propagation; modern approximate methods; creeping waves, leaky waves. Prereq: Consent of instructor.

642 Asymptotic Techniques in Wave Propagation (3) Electromagnetic waves with spatial and temporal dispersion and with fluctuations. Geometric theory of diffraction for electromagnetic waves, supported by results from canonical approximations of geometrical optics and physical optics. Field and power flux scattering. Single scattering radiative transport in tenuous particulate media; multiple scattering theory; coherent and incoherent transport. Prereq: Consent of instructor.

643 Advanced Topics in Information Science I (3) Detection theory; coding theory; system identification. Signals with unknown parameters; adaptive systems; sequential detection, suboptimal detection. Prereq: 504 or consent of instructor.

644 Advanced Topics in Information Science II (3) Structure of algebraic and probabilistic codes; linear codes, convolutional codes, error-correcting codes, decoding methods, identification schemes, deterministic, stochastic, and hierarchical methods. Prereq: 643.

645 Advanced Topics in Microwave Networks (3) Multisport scattering and transfer representations. Narrow band and wide band synthesis of networks containing lumped and distributed components; interstate matching and response equalization. Low noise, low distortion and low power amplifiers and oscillators. Prereq: Consent of instructor.

646 Advanced Topics in Microwave Networks (3) Reciprocal and nonreciprocal devices, directional devices, high frequency switches and multiplexers, operating principles of microwave devices, design of microwave devices. Prereq: Consent of instructor.

651 Computer-Aided Design of VLSI Systems I (3) Fabrication of microelectronic devices; computer architecture design; algorithmic state machines; partitioning; structured design methodology. Prereq: 551-52 or consent of instructor.

652 Computer-Aided Design of VLSI Systems II (3) Computer-aided design tools; design and implementation of fully custom very large scale integrated (VLSI) circuits; design for testability; testing of fabricated chips. Prereq: 651.

653 Advanced Plasma Physics I (3) Basic concepts of high temperature plasma physics. Magnetohydrodynamics and kinetic descriptions of plasma, plasma transients, plasma waves, equilibrium, and stability. Prereq: Physics 541-42, 451-52 or 563-64, or consent of instructor. (Same as Physics 663.)

664 Advanced Plasma Physics II (3) Plasma heating and radiation phenomena. Advanced topics of current interest. Must be taken in sequence. Prereq: 663. (Same as Physics 664.)

671 Image Processing and Robotics I (3) Three-dimensional scene modeling and recognition, multi-sensor systems. Prereq: 572 or 573 or consent of instructor.

672 Image Processing and Robotics II (3) Stereovision, shape theory. Prereq: 671.

673 Image Processing and Robotics III (3) Time-varying imagery, path planning and navigation. Prereq: 672.

681-82 Quantum Electronics (3,3) Prereq: Consent of instructor.

691 Advanced Graduate Seminar (1) Research in department. May be repeated.

692 Special Topics (1-3) Advanced topics of current interest to Ph.D. students in Electrical Engineering. May be repeated. Maximum 6 hrs.

Engineering Science and Mechanics

(College of Engineering)

MAJOR

DEGREES

Engineering Science

M.S., Ph.D.

Jerry E. Stoneking, Head

Professors:


Research Professor:

T. F. Moriarty, Ph.D. Illinois, P.E.

Associate Professors:

J. E. Caruthers (UTSI), Ph.D. Georgia Institute of Technology; R. C. Engels (UTSI), Ph.D. Virginia Polytechnic Institute; A. Mathews, Ph.D. Illinois, P.E.; M. H. McCoy (UTSI), Ph.D. Florida; C. J. Myers (UTSI), Ph.D. Indiana; M. O. Soliman, Ph.D. Tennessee, P.E.; J. S. Steinhoff (UTSI), Ph.D. Chicago.

Assistant Professors:

J. A. M. Boulet, Ph.D. Stanford; G. N. Brooks, Ph.D. Stanford.

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 concentrations include solid mechanics, fluid mechanics, computational mechanics, biomedical engineering, and optical engineering (UTSI only) in each of these concentrations, interdisciplinary programs are arranged to meet individual needs or interests. Each applicant is advised as to any prerequisite
courses before entering a program; the student's program of study must be approved by his/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; however, at least one member of the student's graduate advisory committee must be on the faculty of the Department of Engineering Science and Mechanics.

A departmental application is required in addition to The Graduate School application. The names and addresses of four references must be included with the departmental application.

The flexibility and interdisciplinary aspect of the program concentrations 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 to be of particular interest to prospective students. The names and addresses of four references must be included with the departmental application.

The names and addresses of four references must be included with the departmental application.

THE MASTER'S PROGRAM

Two M.S. options are offered; option I requires a thesis, while option II does not. The second plan is normally restricted to those students who have had significant engineering work experience.

In option I, a minimum of 30 semester hours, including the thesis, is required. In option II, a minimum of 33 hours is required. The requirements include the following:

<table>
<thead>
<tr>
<th>Hours Credit</th>
<th>Mathematics</th>
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<tbody>
<tr>
<td>4</td>
<td>6</td>
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</tbody>
</table>

Engineering courses (Major concentration may include but is not restricted to courses offered by the Engineering Science and Mechanics Department.)

12 18

Related courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.) 6 9

Thesis 6

*Engineering courses under option II may include advanced laboratory work or special problem work; for example, Engineering Science and and Mechanics 581 or analogous courses in other departments.

A final examination is required under both options covering graduate course work and the thesis.

THE DOCTORAL PROGRAM

Specific departmental requirements for the Ph.D. include:

1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the Master's thesis. These shall include a minimum of 24 semester hours in Doctoral Research and Dissertation and a minimum of 48 semester hours in other courses.

2. A minimum of 24 semester hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 500 and above, with at least 9 semester hours of 600-level courses, which constitutes one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.

3. A minimum of 12 semester hours in mathematics or computer science in courses numbered 400 and above, exclusive of a first course in ordinary differential equations.

4. A minimum of 6 semester hours of courses numbered 500 and above, offered in departments other than mathematics, computer science, and the student's major department and not included in the areas of concentration selected by the student subject to the approval of the department's Graduate Studies Committee.

5. Attendance and participation in graduate seminars and colloquia.

6. Two doctoral examinations must be passed to be admitted to candidacy for the Ph.D. in Engineering Science.

After being admitted as a potential candidate for the Ph.D., a qualifying examination must be taken at the first offering after the student has either completed a Master's degree or completed 24 semester hours of graduate credit. The purposes of qualifying examinations are:

a. To determine the qualifications of the student to continue the Ph.D. program.

b. To identify the areas of strengths and weaknesses to guide the student's graduate course work and research.

The qualifying examination will be administered by the department's Graduate Studies Committee. The examination will be written and will cover at least four graduate level subject areas. One subject area will be mathematics, and the others will be designated by the student subject to the approval of the department's Graduate Studies Committee.

The comprehensive examination is to be taken by students within 6 credit hours of completion of graduate course work required for the Ph.D. degree. This examination is to be administered by the student's advisory committee and shall consist of both a written and oral portion.

After successfully passing the qualifying and comprehensive examinations, the student must present the Ph.D. dissertation research proposal to the student's advisory committee and receive committee approval of the proposal before being admitted to candidacy for the Ph.D.

8. A final examination on the student's dissertation and related fields will be taken by the student after completion of the Ph.D. dissertation and course requirements.

GRADUATE CREDIT FOR 400-LEVEL COURSES

Four hundred-level courses in engineering may be used for graduate credit at the discretion of the advising committee. However, at least two-thirds of minimum required credit hours in a Master's degree program must be at or above the 500 level.

<table>
<thead>
<tr>
<th>Hours Credit</th>
<th>Materials of Engineering (3) Mechanical properties of engineering materials; data collection and processing; time dependent and cyclic dependent properties. Prereq: 321, Materials Science and Engineering 201. 3 hrs or 2 hrs and 1 lab.</th>
</tr>
</thead>
</table>

423 Fracture-Safe Design (3) Critical review of variables controlling fracture, brittle, and ductile failure of materials; fatigue limits, fatigue crack growth, fracture toughness, fracture criterion, and fracture mechanics. Recommended preparation: fracture mechanics. Prereq: 201, Materials Science and Engineering 201. (Same as Civil Engineering 451.) 3 hrs or 2 hrs and 1 lab.

425 Principles of Nondestructive Testing (3) Principles and theory of nondestructive testing methods; liquid penetrant, magnetic particle, eddy current, ultrasonic, acoustic emission, and radiographic methods. Laboratory. Prereq: 321, Materials Science and Engineering 201. (Same as Physics 475.)

431 Fundamentals of Vibrations (3) Free and forced vibrations of damped undamped lumped parameter systems; energy methods; free vibration of continuous bodies. Prereq: 231, Mathematics 231.

433 Dynamic Systems (3) Three dimensional dynamics of particles and rigid bodies; vibrational systems; effects of damping; central force motion; Lagrange's equations; stability; transfer functions. Prereq: 231, 431.

435 Engineering Acoustics (3) Concepts of acoustics, measures of sound and their units; noise generation and transmission, noise control principles and application, methods and procedures for noise abatement. Prereq: Introductory course in vibrations or acoustics.

442 Fluid Mechanics I (3) Continuum arms of basic laws; compressibility, isentropic flow, shocks, duct flows with heat transfer and friction; open channel flow, critical flow, energy methods; internal and external viscous flows, boundary layers, laminar and turbulent flow. Prereq: 321, Mathematics 231.

451 Similitude and Dimensional Analysis (3) Dimensional analysis, Buckingham's theorem, dynamic similarity, scale modeling; dimensionless forms of well-known equations, invariance of differential equations under transformation groups; reduction of systems using group invariants. Prereq: 321, 341, Mathematics 231.

455 Computer-Aided Design (3) Use of computer graphics and analysis programs for design of selected machine and structural components and systems; evaluation of design alternatives. Prereq: 311.

461 Experimental Stress Analysis (3) Theory, techniques, and instrumentation of resistance strain gauges; theory and techniques of brittle fracture method; introduction to other strain measuring devices. Prereq: 311, Electrical and Computer Engineering 301, 2 hrs and 1 lab.

463 Photomechanics (3) Introduction to photoelasticity, photoelastic coating method, Moiré method, interferometry, and holography. Prereq: 321, Physics 232. 2 hrs. and 1 lab.

465 Dynamic Data Acquisition (3) Use and calibration of instrumentation for measuring and recording dynamic events; Fourier analysis, transfer function analysis, digital signal processing, transduction, and experimental parameter estimation with applications to modal vibration analysis. Prereq: 431, Electrical and Computer Engineering 301.

471 Clinical Engineering and Bioinstrumentation (3) Function and characteristics of health care delivery systems: hospital organization and health care economics; development and management principles for hospital-based clinical engineering programs. Prereq: 431, Electrical and Computer Engineering 301.

472 Biomechanics (3) Mechanical properties of living
563-54 Advanced Topics in Finite Element Structural Analysis (3) Field problems: singularity solutions, non-linear constitutive problems, variable stiffness, initial strain and initial stress methods, plasticity, creep; unified finite-element theory; geometrically non-linear problems, large deformation, stability; shell structures; analysis of accuracy, convergence; adaptive grids. Prereq: 553.

661 Advanced Photoelasticity (3) Scattered light three-dimensional photoelasticity, dynamic photoelasticity; photoplasticity and photoviscoelasticity; holographic photoelasticity. Recent developments. Prereq: 561. 2 hrs and 1 lab.

681 Advanced Topics in Engineering Mechanics (3) Advanced problems in mechanics, group or individually. Prereq.: Consent of instructor. May be repeated with consent of department.

English

(College of Liberal Arts)

MAJOR DEGREES

English,.................M.A., Ph.D.

Joseph B. Trahern, Head

Professors:

J. M. Armistead, Ph.D. Duke; E. W. Bratton (Associate Head); Ph.D. Illinois; R. Y. Drake, Jr., Ph.D. Y. A. R. Ensor, Ph.D. Indiana; J. H. Fisher (John C. Hodges Professor); Ph.D. Pennsylvania; R. M. Kelly, Ph.D. Duke; D. Leggett, Ph.D. Florida; R. B. Miller, Ph.D. Brown; A. R. Penner, Ph.D. Colorado; J. E. Reese (Chancellor), Ph.D. Kentucky; N. J. Sanders (Lindsay Young Professor), Ph.D. Shakespeare Institute, Stratford-upon-Avon; D. Schneider (Alumni Distinguished Service Professor), Ph.D. Northwestern; W. Shurr, Ph.D. North Carolina; J. B. Trahern, Ph.D. Princeton; T. V. Wheeler, Ph.D. North Carolina; J. M. White (Lindsay Young Professor), M.A. Cambridge.

Associate Professors:

L. H. Burghardt, Ph.D. Chicago; D. A. Carroll, Ph.D. North Carolina; D. R. Cox, Ph.D. Missouri; B. K. Dumas, Ph.D. Arkansas; D. F. Goslee, Ph.D. Yale; N. M. Goslee, (Director of Graduate Studies), Ph.D. Yale; J. E. Gill, Ph.D. North Carolina; T. J. A. Heffernan, Ph.D. Cambridge; M. Kallet, Ph.D. Rutgers; M. Keene, Ph.D. Texas; I. Leki, Ph.D. Illinois; M. A. Lofaro, Ph.D. Maryland; C. J. Maland, Ph.D. Michigan; M. P. Richards, Ph.D. Wisconsin; F. K. Robinson, Ph.D. Texas.

Assistant Professors:


Visiting Lecturer:

W. Dykeman, B.A. Northwestern.

Detailed information about the Master's and doctoral programs, and about individual graduate courses, may be obtained by writing the Director of Graduate Studies in English, McClung Tower. For admission forms, write to The Graduate School.

THE MASTER'S PROGRAM

1. A minimum of 24 semester hours in the Department of English beyond the B.A.: a. Six hours in the 600 level. b. Twelve additional hours at the 500-600 level. (A student may apply only 3 hours of 593 - Independent Study - toward the M.A. in English.) c. Six hours for graduate credit at any level, including the 400 level.

In this course work, students must maintain at least a B average.

2. A thesis, for which 6 semester hours credit are given. It will be written under the direction of a faculty member of the department and approved by him or her and two other members; or (non-thesis option) 6 hours of additional courses at the 500-600 level, making a total of 30 hours.

3. Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:
   a. The completion of a second year of a language college level with a grade of C or better.
   b. The completion of French 302 or German 332 at The University of Tennessee with a grade of B or better.
   c. The passing of the regular Ph.D. foreign language examination as currently administered at The University of Tennessee.

4. A final examination. A candidate presenting a thesis must pass a ninety-minute oral examination, consisting chiefly of questions covering the general history of English and American literature, not merely the courses he or she has taken; a reading list of primary works designed to help the student prepare for these questions is available in the office of the Director of Graduate Studies in English. A non-thesis student must pass a written examination, or a one-hour oral examination, both of the same nature as the examinations taken by the thesis student.

Writing Concentration

The Master's with writing concentration is intended for those students who plan to do free-lance writing, specialize in teaching writing courses at the college level, or work as professional writers in business or industry. Students who go on to complete the Ph.D. may also find the Master's with writing concentration helpful when they are seeking teaching positions.

1. A minimum of 24 semester hours beyond the B.A.: a. Six hours at the 600 level. b. Twelve additional hours at the 500-600 level. (A student may apply only 3 hours of 593 - Independent Study - toward the M.A. in English.)
   c. Six hours of graduate credit at any level, including the 400 level. (Note: Writing students may substitute two 400-level writing courses for two 500-level courses.)

In this course work, students must maintain at least a B average.

A student must take at least 9 hours in writing and in literature, the remaining 6 to be selected from any English courses at the proper level. Of the courses in writing, at least 3 hours must be taken at the 500 level; additional 500-level courses are strongly recommended.

2. Students in the program may choose one of the following writing projects, each for six hours:
   a. A thesis, using research to analyze some aspect of writing or rhetorical theory. The nature and length of each project will be determined by the Director of Graduate Studies after consulting with the student and his or her project director. In addition to the director, two other English Department faculty members will supervise and approve the project; at least one should be drawn from the literature faculty.
   b. A creative project. A collection of poems or short stories, a short novel, a play, or a creative work of non-fiction prose are acceptable as creative projects. The nature and length of each project will be determined by the Director of Graduate Studies after consulting with the student and his or her project director. In addition to the director, two other English Department faculty members will supervise and approve the project; at least one should be drawn from the literature faculty.

3. Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:
   a. The completion of a second year of language at college level with a grade of C or better.
   b. The completion of French 302 or German 332 at The University of Tennessee with a grade of B or better.
   c. The passing of the regular Ph.D. foreign language examination currently administered at The University of Tennessee.

4. A final examination. A candidate presenting a thesis or creative project must pass a ninety-minute oral examination, consisting of questions covering the general history of English and American literature, not merely the courses which he or she has taken; a reading list of primary works designed to help the student prepare for these questions is available in the office of the Director of Graduate Studies in English. These reading lists may be modified by the M.A. examining committees, meeting in a body with the student, to reflect the candidate's particular writing emphasis, but most of the oral examination should focus upon the literature outlined in the original reading list.

There is no residency requirement for the M.A. degree, but students should attempt to pursue a full-time program whenever possible.

THE DOCTORAL PROGRAM

1. Completion of a program of study normally 6 full semesters - approved by the candidate's committee or the Director of
Graduate Studies in English. This program will include:

- At least 57 semester hours beyond the B.A., divided as follows:
  - (1) At least 24 semester hours at the 600 level.
  - (2) At least 15 semester hours at the 500 level or above (a student may apply only 3 hours of 593 - Independent Study - toward the M.A. and 3 after the M.A.)
  - (3) A special course in teaching composition.

- Fifteen additional hours at any level, including the 400 level. Up to six of these hours may be taken in some cognate field or fields such as history, philosophy, French, or some other related disciplines. These courses must be drawn from those approved for graduate credit.

In this course work, students must normally maintain a 3.5 average.

NOTE: Students who have taken the M.A. with a thesis at The University of Tennessee, Knoxville, may omit one 500-level course and one 600-level course. Upon recommendation of the department, other doctoral candidates may include M.A. thesis credits as part of the required hours. If the student has an M.A. from another institution, he or she may normally transfer at least 24 hours, but the level of credit (400, 500, 600 level) for each course transferred will be determined by the Director of Graduate Studies in English. This program will include:

- At least 57 semester hours beyond the B.A., divided as follows:
  - (1) At least 24 semester hours at the 600 level.
  - (2) At least 15 semester hours at the 500 level or above (a student may normally transfer at least 24 hours, but the level of credit (400, 500, 600 level) for each course transferred will be determined by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D., and anyone electing this language option may not take the Ph.D. linguistics examination.
  - (3) One modern language approved by the Director of Graduate Studies.
  - (4) Fifteen additional hours at any level, including one from a field other than English language. This requirement must be fulfilled in the following way: completion of a, b, or c in option 1 for one foreign language; completion of 6 semester hours in English language courses with grades of B or better, at least three of which must be from English 508 or 509, History of the English Language. For the other 3 hours, the student may either complete the history of the language sequence or choose one other course in language taught in the sequence or choose one other course in language taught in the Department of English at the 500 or 600 level and approved by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D., and anyone electing this language option may not take the Ph.D. linguistics examination.

b. Successful completion of a language requirement in one of the following ways:
   - (1) Two languages approved by the Director of Graduate Studies. The requirement for each language may be fulfilled in any of the following ways:
     - Completion of French 302 or German 332 with a grade of B or better.
     - Completion at The University of Tennessee of any two courses on the 300 level, or above, in the foreign language or literature with at least a grade of B in each course.
     - Completion of the regular Ph.D. foreign language examination as currently administered at The University of Tennessee.
   - (2) One modern language approved by the Director of Graduate Studies in English. This requirement must be fulfilled in the following way: a passing mark on the language examination given by The University of Tennessee and completion of two courses given in the foreign language at the 400 level or above, one course at least to be at the 500 or 600 level. A minimum grade of B must be received in each course.
   - (3) One modern language approved by the Director of Graduate Studies in English and intense study of the English language. This requirement must be fulfilled in the following way:
     - Completion of a, b, or c in option 1 for one foreign language; completion of 6 semester hours in English language courses with grades of B or better, at least three of which must be from English 508 or 509, History of the English Language. For the other 3 hours, the student may either complete the history of the language sequence or choose one other course in language taught in the sequence or choose one other course in language taught in the Department of English at the 500 or 600 level and approved by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D., and anyone electing this language option may not take the Ph.D. linguistics examination.

   d. Successful completion of several written comprehensive examinations divided as the department directs; see the English Department graduate brochure. The comprehensive examinations are given twice a year, normally in February and September. Before a student may begin to take them, he or she must have completed nearly all the course work required. A student must have met requirements for at least one of the foreign languages before beginning to take these comprehensive examinations; he or she must complete all language requirements before completing the examinations. Normal grading is P or F; an unusually fine examination may receive a grade of Distinction. A one-hour examination on the dissertation and other related areas.

- 2. Teaching two courses under the supervision of a faculty member of the department.
- 3. Residency for 2 consecutive semesters as a full-time student. For students not on teaching assistantships, full-time employment consists of 9 or more hours of course work or dissertation hours each semester. For students on assistantships, full-time employment consists of at least 6 hours of courses or dissertation hours and 3 hours of teaching each semester.

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.
402 Chaucer (3) Reading and analysis of Canterbury Tales and Troilus and Criseyde in Middle English.
404 Shakespeare I: Early Plays (3) Shakespeare's dramatic achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night; English histories, including Henry IV; and early tragedy, including Hamlet.
405 Shakespeare II: Later Plays (3) Shakespeare's dramatic achievement between 1601 and 1613. Reading and discussion of selected plays from great tragedies, including Othello; problem plays, including Measure for Measure, and dramatic romances, including The Tempest.
406 Renaissance Drama (3) English theatre between 1590 and 1640 through reading of representative plays by Shakespeare's contemporaries: Marlowe, Webster, Jonson.
409 Spenser and his Contemporaries (3) Principal achievements in prose and poetry of fourteenth century authors; Spenser, Wyatt, Marlowe, More, Sidney, and Bacon.
410 Milton, Donne and their Contemporaries (3) Principal achievements in prose and poetry of first two-thirds of seventeenth century: poetry of Milton, Donne, Marvell; and prose of Browne, Bacon, Walton.
411 Restoration and Eighteenth-Century Poetry and Prose (3) Dryden, Swift, Pope, Johnson, and their contemporaries; major works: Mac Flecknoe, Rape of the Lock, Gulliver's Travels, and Rasselas.
412 British Drama from 1660 to 1800 (3) Playwrights from Dryden and Wycherley to Goldsmith and Sheridan; formal developments: heroic play, cynical comedy, affective tragedy, and exemplary drama.
413 The Eighteenth-Century British Novel (3) Defoe to Austen.
414 Romantic Poetry and Prose I (3) Wordsworth, Coleridge, and Blake; readings from Lamb, De Quincey, and other prose writers.
415 Romantic Poetry and Prose II (3) Keats, Shelley and Byron; readings from Hazlitt, Peacock, and other prose writers.
416 Victorian Poetry and Prose I (3) Tennyson, Pre-Raphaelites, Carlyle, Newman, and Mill.
419 Victorian Poetry and Prose II (3) Browning, Arnold, Hopkins, Hardy, Ruskins, Darwin, and Wilde.
420 The Nineteenth-Century British Novel (3) Scott to Hardy.
421 Modern British Novel (3) Lawrence, Joyce, and Woolf.
422 Women Writers in England (3) Literary consciousness and works of British women writers in nineteenth and twentieth centuries. (Same as Women's Studies 422.)
431 Colonial, Federal, and Early National American Literature (3)
432 American Romanticism and Transcendentalism (3)
433 American Realism and Naturalism (3)
434 Modern American Literature (3) World War I to present.
435 American Novel before 1900 (3) From earliest sentimental novels through Brown and Cooper, and major figures to 1900; Hawthorne, Melville, Stowe, Clemens, and James.
441 Southern Literature (3) Southern writing from colonial period into twentieth century: frontier humorists, local color writers, and Southern literary renaissance.
442 American Humor (3) Early nineteenth century into twentieth century: Mark Twain.
443 Topics in Black Literature (3) Contents vary; particular genres, authors, or theories from 1845 to present: Langston Hughes and Harlem Renaissance, Richard Wright and Gwendolyn Brooks, writing by Black women, international Black literature in English, and Black American autobiography.
451 Modern British and American Poetry (3) From Yeats and Frost to Auden, Stevens, and more recent poets.
452 Modern British and American Drama (3) O'Neill's works as precursors to modern dramatists: Williams,
453 Continental Drama (3) Selection of plays (in English translation) by major European writers from late Renaissance to present; twentieth-century achievements.

454 Twentieth-Century International Novel (3) Joyce, Camus, Kafka, Nabokov.

455 Persuasive Writing (3) Persuasive strategies in both student and professional writing. Practice in mastering effective logical and emotional appeals.

456 Professional Writing (3) Principles and practices of writing for publication. Dissertation, theses, articles, and reports on reference and technology. Prereq: 459 or consent of instructor.

459 Advanced Technical Writing (3) For students planning careers in industry, education, and government who need technical writing skills. Writing of definitions, process descriptions, sets of instructions, descriptions of mechanisms, recommendation reports, abstracts, proposals, and major reports. Prereq: Junior standing in student's major or consent of instructor.

460 Technical Editing (3) Editing technical material for publication. Principles of style, format, graphics, layout, and production management. Prereq: 456 and 459, or consent of instructor.

463 Advanced Poetry Writing (3) Further development of skills acquired in basic writing poetry course. Prereq: 363 or consent of instructor.

464 Advanced Fiction Writing (3) Further development of skills acquired in basic writing fiction course. Prereq: 365 or consent of instructor.

471 Sociolinguistics (3) Study of language in relation to social, historical, and theoretical focus. Large-scale units: tribes, nations, social groups. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 471 and Sociology 471.)

472 American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English: origins, functions, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 472.)

474 Teaching English as a Second or Foreign Language I (3) Grammatical structures of English; particular grammatical difficulties of non-native learners of English; Basic phonological structures of English. Teaching grammar and phonology to non-native speakers: contrastive analysis of English with other languages. Prereq: 474. (Same as Linguistics 474.)

475 Teaching English as a Second or Foreign Language II (3) Second language acquisition theory. Issues in teaching four language skills to learners of English. Materials and methods of language teaching and testing: preparation of materials. Observations of and team teaching with experienced staff member. Prereq: English 474. (Same as Linguistics 475.)


483 Topics in Literature (3) Topics vary. May be repeated. Maximum 6 hrs.

484 Special Topics in Writing (3) Original writing intended for electing, usually taught by professional author. Topics vary. May be repeated. Maximum 6 hrs.

485 Special Topics in Language (3) May be repeated. Maximum 6 hrs with consent of department. (Same as Linguistics 485.)

486 Special Topics in Criticism (3) Content varies. Theoretical and practical approaches to British and American literature. May be repeated with consent of department. Maximum 6 hrs.

489 Special Topics in Film (3) Content varies. Particularly directors, film genres, national cinema movements, or other topics. May be repeated with consent of department. Maximum 6 hrs.

497 Senior Honors I (3) Admission by consent of department.

498 Senior Honors II (3) Admission by consent of department.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May be used toward degree requirements. May be repeated. S/NC only. E

505 Teaching Freshman Composition (3) Introduction to teaching Freshman English through study of various techniques and philosophies of composition. Required of all first-year teaching assistants.

506 Introduction to Literary Research (3) Critical examination of aims of English studies, profession of English teacher, theory of literature, and methods of research; collecting of information, evaluation of material, and transmitting of results of scholarship.

507 Applied Criticism: The Rhetoric of Literary Forms (3) Study and application of ways in which major critics have analyzed form in poetry and prose fiction.

508 History of the English Language I (3) Phonological, morphological, and syntactic development of English language. Old and Middle English.

509 History of the English Language II (3) Phonological, morphological, and syntactic development of the English language with concentration on developments after 1500, especially in American English. Prereq: English 508.

513-14 Readings in Medieval Literature (3,3) Reading and analysis of selected masterpieces of Old and Middle English literature and their Continental sources in Modern English.

520-21 Readings and Analysis in Selected Areas of Sixteenth- and Seventeenth-Century Prose, Poetry, and Drama (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

530-31 Readings in English Literature of the Restoration and Eighteenth Century (3,3) Topics vary. Genre, poetry, prose, fiction, drama; or period: Restoration, earlier eighteenth century, later eighteenth century.

540-41 Readings in English Literature of the Nineteenth Century I and II (3,3) Content varies: genre, theme literary movement, or other coherent emphasis.

550-51 Readings in American Literature from the Colonial Period to the Present (3,3) Content varies: genre, theme literary movement, or other coherent emphasis.

552 Readings in Black American Literature (3) Content varies: genre, theme literary movement, or other coherent emphasis.

560-61 Readings in Twentieth-Century Literature (3,3) Content varies: genre, theme literary movement, or other coherent emphasis.

565 Fiction Writing (3) Advanced fiction projects under supervision of instructor and time for independent study. Prereq: Extensive background in reading and writing fiction.

581 Colloquium in Poetry Writing (3) Major poetic project or continuation of project begun in 483. Individual consultation with instructor supplements class analysis; readings in contemporary poetry and theory. Prereq: 483 or consent of instructor.

582 Special Topics in Writing (1-3) Topics vary. May be repeated. Maximum 6 hrs. Enrollment by consent of director of graduate studies only.

583 Analysis of Technical Writing (3) Theory and practice of technical writing. Exploration of current theories of rhetoric, business, technical, academic, and government rhetoric. Analysis of shared elements and practice in producing such writing. Prereq: 459 or consent of instructor.

584 Rhetoric and Composition: History and Theory (3) Modern developments in rhetorical theory, their origins in Plato, Aristotle, and others.

590 Topics in Critical Theory (3) Topics vary.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Film History, Rhetoric, and Analysis (3) Film as narrative art form: historical development of film; the 'rhetoric' of film; critical approaches to film study: genre, author, formalist, and historical. Critical analysis of individual films.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

610 Studies in Old English Language and Literature (3) Old English grammar with readings in prose and poetry.

611 Studies in Beowulf (3) Translation and critical study of Beowulf. Prereq: English 610 or consent of instructor.

620 Studies in Medieval English Literature (3) Seminars in literary and literary genres of Medieval English literature, read in Old and Middle English. Subject matter varies from year to year.

621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer's writings. Prereq: Previous course in Chaucer.


650 Studies in English Romanticism (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.

651-52 Studies in Victorian Literature (3,3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.

660-61-62 Studies in American Literature (3,3,3) Southem literature before 1830, frontier, regionalism, women's literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whistman, Dickinson, James, and Twain.

670-71-72 Studies in Twentieth-Century Literature (3,3,3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.

680 Topics in English Language (3) May be repeated with consent of director of graduate studies. Maximum 9 hrs.

690 Special Topics (3) Content varies. History of ideas, humor, biography, autobiography, extra-literary disciplines.

Entomology and Plant Pathology (College of Agriculture)

MAJOR

| DEGREE | Entomology and Plant Pathology |..............| M.S. |

Carroll J. Southards, Head

Professors: E. C. Bernard, Ph.D. Georgia; R. R. Gerhardt, Ph.D. North Carolina State; J. W. Hilty, Ph.D. Ohio State; L. F. Johnson, Ph.D. Louisiana State; P. L. Lambdin, Ph.D. Virginia Polytechnic Institute; C. D. Pless, Ph.D.
Clemson; C. J. Southards, Ph.D. North Carolina State.

Assistant Professors: J. F. Grant, Ph.D. Clemson; B. B. Reddick, Ph.D. Clemson; M. T. Windham, Ph.D. North Carolina State.

The Department of Entomology and Plant Pathology offers a graduate program leading to the Master of Science with a concentration in entomology or plant pathology. Students in entomology may specialize in crop entomology, medical and veterinary entomology, insectology, insect pest management, or biological control. Students in plant pathology may specialize in foliar and stem fungus diseases, soil-borne diseases, plant nematology, or virology. For specific information, contact the department head.

ADMISSION REQUIREMENTS
For admission to the M.S. degree program, a student must meet all requirements of The University of Tennessee Graduate School and must have completed (1) general botany or biology, 8 hours; (2) advanced biological sciences, 8 hours; (3) general inorganic chemistry, 6-8 hours; (4) organic chemistry, 3 hours. In addition, three completed rating forms and a written statement of career goals and interest in entomology or plant pathology are required.

DEGREE REQUIREMENTS
The program requires a written thesis based on original research and the completion of a minimum of 24 hours of course work for graduate credit, approved by the student's advisory committee. Included in the course requirements are two acceptable seminar presentations for 1 hour each. An oral final exam must be completed to the satisfaction of the advisory committee after the thesis has been completed. A minor is not required but may be selected at the option of the student. The minor will include at least 6 hours and not more than 10 hours of graduate-level credit in the minor department. The student's committee shall include a member of the faculty from the minor department to assist in designating courses required for the minor.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Maximum 15 hrs. E

510 Plant Disease Fungi (4) Morphology, taxonomy, biology, and genetics of plant pathogenic fungi. Isolation and identification of plant pathogenic fungi. Prereq: Consent of instructor. 2 hrs and 1 lab. F, S, A

511 Plant Disease Diagnosis (3) Diagnosis of plant disease, disease symptoms, causal agents and control measures. Prereq: 510 or consent of instructor. 1 hr and 2 labs. S, A

512 Soil-Borne Plant Diseases (3) Causal agents, host-parasite soil environment interactions, epidemiology, and control of soil-borne plant diseases. Prereq: 312. 2 hrs and 1 lab. F, A

520 Plant Parasitic Nematodes (4) Morphology, physiology, taxonomy, ecology, and management of plant parasitic nematodes, host-parasite relationships. Prereq: 6 hrs biological science or consent of instructor. 2 hrs and 2 labs. S, A

521 Plant Virology (3) Symptomatology, epidemiology, and management of virus infection: structure, morphology, replication, transmission, purification, characterization, and classification of plant viruses; serology; plant pathogenic viroids, mycoplasmas and virophages. Prereq: 313 or consent of instructor. 2 hrs and 1 lab. F, A

523 Field Crop and Vegetable Insects (2) Identification, biology and management of insects affecting commercial vegetable and home garden crops. Prereq: 521 or basic entomology course. 1 hr and 1 lab. F, A

525 Medical and Veterinary Entomology (3) Morphology, taxonomy, biology and control of arthropod parasites and vectors of pathogens of humans and animals. Ecology and behavior of vectors in relation to pathogen transmission and control. Prereq: 321 or 325, or Zoology 380, or consent of instructor. 2 hrs and 1 lab. S, A

530 Integrated Pest Management (3) Principles and application of biological, cultural, genetic, behavioral, and chemical methods of control to maintain pest populations below economic threshold levels. Prereq: 321, or consent of instructor. (Same as Plant and Soil Science 330.) F, A

531 Special Problems in Entomology (1-3) Comprehensive individual study of current problems. May be repeated. Maximum 6 hrs. E

532 Special Problems in Plant Pathology (1-4) Comprehensive individual study of current problems. May be repeated. Maximum 6 hrs. E

533 Concentrated Study in Entomology (1-3) Selected subjects in entomology for advanced students, concentrated in time and subject matter. Prereq: 321 or basic entomology course. May be repeated. Maximum 6 hrs. F, S, P

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

Environmental Practice
(College of Veterinary Medicine)

MAJOR DEGREE
Veterinary Medicine ....................... D.V.M.

J.B. Jones, Head


Assistant Professor: C. D. Lothrop, D.V.M., Ph.D. Tennessee.

Instructors: R. S. Funk, D.V.M. Ohio State; P. J. Morris, D.V.M. California (Davis).

See Veterinary Medicine for program description.

PROFESSIONAL COURSES

861 Pharmacology (4) Principles of pharmacokinetics and pharmacodynamics properties of veterinary drugs: mode of action, pharmacologic effects, chemical and physical properties, metabolism, toxicities, important idiosyncrasies and clinical application.

865 Clinical Rotation in Environmental Practice (2) Clinical training in avian medicine, laboratory animal and zoo animal medicine, epidemiology, public health, and other related disciplines.

857 Special Problems in Environmental Practice (1-8) Extramural and specially designed study for students interested in select topics in avian medicine, laboratory animal medicine, zoo animal medicine, epidemiology, public health, pharmacology or toxicology.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E

501 Special Topics in Environmental Medicine (1-3) Aberrant metabolism, pharmacokinetic studies, toxicokinetic studies, epidemiology and techniques in molecular biology: atomic absorption, gas chromatography, ultrafiltration, extractive techniques and radioimmunoassay. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

503 In Vitro Evaluation of Toxicity (3) Principles and techniques of in vitro evaluation of toxicity, mutagenesis, carcinogenesis, and teratogenesis. Prereq: Biochemistry 561 and consent of instructor. S, A

504 Experimental Animal Surgery (3) Competence in performing human surgical modifications of experimental animals. Techniques of anesthesia. Drug administration and postoperative care. Prereq: Embryology, parasitology, physiology and/or consent of instructor. 1 hr and 2 labs. F

561 Pharmacology (4) Principles of pharmacokinetics and pharmacodynamics properties of drugs: mode of action, pharmacologic effects, chemical and physical properties, metabolism, toxicities, important idiosyncrasies and clinical applications. Prereq: Consent of instructor. F

600 Doctoral Research and Dissertation (3-15) P/NP only. E

610 Advanced Topics in Environmental Medicine (1-3) Current and future research methodology, laboratory situation, recent advances in instrumentation in analytical techniques for environmental medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

Finance
(College of Business Administration)

MAJOR DEGREES
Business Administration .................... M.B.A., Ph.D.

H. A. Black, Head

Professors: H. A. Black, Ph.D. Ohio State; W. W. Dotterweich (Wm. Voigt Professor of Insurance), Ph.D Pennsylvania; W. C. Goolsby, Ph.D. Wisconsin (Milwaukee); G. C. Philippatos (Distinguished Chaired Professor of Banking and Finance), Ph.D. New York; R. E. Shrieves (Faculty Scholar), Ph.D. California (Los Angeles).

Associate Professors: A. L. Auxier, Ph.D. Iowa; T. P. Boehm, Ph.D. Washington (St. Louis); R. J. Clayton, Ph.D. Georgia; J. M. Wachowicz, Jr., Ph.D. Illinois (Champaign-Urbana), C.P.A.

Assistant Professors: M. C. Ehrhardt, Ph.D. Georgia Institute of
Food Technology and Science (College of Agriculture)

MAJOR DEGREES

Food Technology and Science .... M.S., Ph.D.

Hugh O. Jaynes, Head

Professors:


Associate Professors:

P. M. Davidson, Ph.D. Washington State; B. J. Demott, Ph.D. Michigan State; F. A. Draughon, Ph.D. Georgia; H. D. Loveday, Ph.D. Kansas State; J. R. Mount, Ph.D. Ohio State; M. J. Riemann, Ph.D. Kansas State.

Assistant Professors:


The Department of Food Technology and Science offers the Master of Science and Doctor of Philosophy degrees. Students in the doctoral program may choose research in the concentration area of food products, food chemistry, food microbiology, or sensory evaluation of foods. Commodity interests (meats, dairy, fruits, vegetables, bakery products) can be emphasized in any of the areas by careful selection of courses and the research topic. Minors are available in cognate fields. For detailed information, contact the department head.

Graduate School rating forms or letters of recommendation from at least three people are required. Respondents should be familiar with the applicant's scholastic ability and professional potential.

THE DOCTORAL PROGRAM

1. Completion of a Master's degree in the field, or a closely related field, or passing a special qualifying examination is required for admission. Scores on the GRE aptitude test are also required.

2. A dissertation is required for the Ph.D. Each student must develop a detailed written plan for the dissertation research.

3. A minimum of 72 hours beyond the Bachelor's degree, excluding credit for the Master's thesis, is required. Of this, 24 semester hours must be 600 Doctoral level courses. All candidates will complete the following courses or their equivalent: 510, 521, 522, 531, 532, 641, 642, 651, 652, 655.

4. At least 24 hours of course work numbered above 500 are required exclusive of dissertation credit. Scores on the GRE aptitude test are also required.

5. A minimum of 6 hours of courses for graduate credit must be taken outside the Department of Food Technology and Science.

6. All candidates will complete the following courses or their equivalent: 510, 521, 540, Animal Science 571, 572, and Nutrition and Food Sciences 511. All candidates must complete 601 and 640 and are expected to attend 601 during their Ph.D. program.

7. Each candidate must pass both written and oral comprehensive examinations prior to admission to candidacy. A final oral examination is required that includes a defense of the dissertation and subject matter that the student's committee considers appropriate.

410 Food Chemistry I (3) Reactions of proteins, enzymes, and additives in foods. Physicochemical interactions of food materials. Prereq: Chemistry 110 or equivalent. 2 hrs and 1 lab. F

411 Food Chemistry II (3) Reactions of inorganic compounds, carbohydrates and vitamins in foods. Prereq: Chemistry 110 or equivalent. 2 hrs and 1 lab. Sp
590 Special Topics in Food Technology and Science (1) Critical reviews of current research and production concerns of food industry. May be repeated. Maximum 3 hrs. F,Sp

593 Directed Studies (1-3) Research on non-thesis topics chosen by student and major professor. Supervised experience in food industry or governmental laboratories. May be repeated. Maximum 5 hrs. E

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Seminar (1) Reports and directed discussion on research topics from current literature. May be repeated. Maximum 3 hrs. F,Sp

620 Food Toxicology (2) Basic and applied concepts in food toxicology; toxicological aspects of processed foods. Mode of action, prevention and control of food toxicants in food supply. Prereq: 410-11, 521, or consent of instructor. Sp, A

640 Advanced Food Processing (3) Role of processing treatments in modification of food properties; texture, flavor and color characteristics. Prereq: 440, 510, 511 or consent of instructor. Sp, A

**Forestry, Wildlife and Fisheries (College of Agriculture)**

**MAJORS**

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<th>DEGREES</th>
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<td>M.S.</td>
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<td>Wildlife and Fisheries Science</td>
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<td>M.S.</td>
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**Professors:**

- J. W. Barrett (Emeritus), Ph.D. Syracuse; E. R. Buckner, Ph.D. North Carolina State; J. L. Byford, Ph.D. Auburn; H. A. Core (Emeritus), Ph.D. Syracuse; R. W. Dimmick, Ph.D. Wisconsin; W. E. Hammitt, Ph.D. Michigan; R. L. Little, Ph.D. North Carolina State;
- C. E. McGee (Adjunct), D. F. Duke;
- D. M. Ostlermeier, Ph.D. Syracuse;
- M. R. Pelton, Ph.D. Georgia; T. H. Ripley (Adjunct), Ph.D. Virginia Polytechnic Institute;
- G. Schneider, Ph.D. Michigan State;

**Associate Professors:**

- B. L. Dearden, Ph.D. Colorado State;

**Assistant Professors:**

- G. M. Hopper, Ph.D. Virginia Polytechnic Institute; S. E. Schlarbaum, Ph.D. Colorado State; P. M. Winstorfer, Ph.D. Colorado State.

**Graduate study leading to the Master of Science with majors in Forestry and in Wildlife and Fisheries Science is offered by the Department of Forestry, Wildlife and Fisheries.**

**The Master's Programs**

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor's degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must also have taken the general Graduate Record Examination (GRE). Graduate School rating forms or letters of recommendation from three individuals familiar with the applicant's academic ability are required. The department also has an application that must be submitted at the time of application to The Graduate School.

**Thesis Option**

1. Prior to research for the thesis, the student is required to develop a detailed written research proposal. A minimum of 6 hours of Thesis (Forestry 500 or Wildlife and Fisheries Science 500) is required.

2. A graduate committee of no fewer than 3 faculty members must be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the thesis requirement, a minimum of 24 hours of graduate course work is required. This work must be approved by the student's committee and no more than 10 hours of the minimum can be below the 500 level. The committee may require additional course work if the student's progress or background indicates such need.

3. All students are required to include Forestry 512 or Wildlife and Fisheries 512 in their program. This is required of each graduate student in residence fall semester.

4. An oral examination covering the thesis and course work is required.

**Non-Thesis Option (Forestry only)**

1. Thirty-five hours of graduate course work of which 23 must be at the 500 level or above is required.

2. A graduate committee of no fewer than 3 faculty members will be selected. At least one member shall be from outside the department. The committee will meet and schedule the student's program during the first semester in residence.

3. Three hours of Forestry 511 are required.

4. Nine hours of course work in the department must be at the 500 level or above, exclusive of Forestry 511.

5. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 28 hours of approved study.
Forestry

421 Forest and Wildland Resource Economics (3) Production functions, supply-demand market analysis; market programs and projects; economic analysis and decision models; investment and financial analysis; managerial economics; taxes; forest products marketing. Prereq: 324 or consent of instructor. F

422 Forest and Wildland Resource Policy (3) Policy formulation; criteria for policy determination; forest and wildland law and regulation; theory of conflict resolution; formal and informal resolution. Prereq: Senior standing. F

423 Forest Recreation Planning and Management (3) Planning processes, master and site planning, design projects; management strategies, methods of visitor and recreation site management; case studies; weekend field trips. Prereq: 321, 323, Ornamental Horticulture and Landscape Design 280, or consent of instructor. 1 hr and 2 labs. F

431 Solid Wood Processing (3) Production processes for solid wood products: sawmilling, secondary machining, drying and preservation. Prereq: 331 and 332, or consent of instructor. 2 hrs and 1 lab. Sp

432 Wood Composites and Gluing (3) Principles of adhesive bonding and measurements of plywood and composite panel manufacture. Evaluation resin properties; testing bond strength and durability. Prereq: 331 and 332, or consent of instructor. 2 hrs and 1 lab. F

434 Measurement and Marketing of Wood Products (3) Measurement systems used for sale and transfer of wood products. Application of market principles and analysis to wood products markets and economic structure of wood products industry. Prereq: 431, 433 and Forrestry, Wildlife and Fisheries 313, or consent of instructor. Sp

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resources management. Identify, analyze and prepare written report. Topic and report must have approval of graduate committee. Available only to students in non-thesis option for M.S. in Forestry. E

512 Seminar (1) Current developments in forestry. Required of all graduate students in residence in fall. May be repeated. Maximum 2 hrs. S/NC only. F

520 Planning and Administration of Fisheries and Wildlife Programs (2) Factors influencing policy and program planning activities of fisheries and wildlife agencies. Decision-making policies, case histories. Sp/A

530 Wildlife Diseases (2) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 yr biology, 444 or 445, or consent of instructor. F

540 Predator Ecology (2) Dynamics of terrestrial vertebrate predator populations in human-altered and relatively unaltered environments. Prereq: 444 or 445 or consent of instructor. F

550 Fish Physiology (3) Mechanisms of circulation, excretion, osmoregulation, and neural/hormonal control of these systems in fishes. Pracitical applications of fish physiology in water pollution assessment, fish culture and management. Prereq Senior or graduate standing in biological sciences. Sp/A

550 Advanced Topik in Wildlife and Fisheries Science (3) Recent advances and concepts, research techniques and analysis of current problems. Prereq: 443, 444, 445, or consent of instructor. Prereq may be repeated. Maximum 6 hrs. E

553 Independent Study in Wildlife and Fisheries Science (1-4) May be repeated. Maximum 6 hrs. E

French

See Romance Languages

Geography

(College of Liberal Arts)

DEGREES

MAJOR

GEOGRAPHY

Sidney R. jumper, Head

Professors:

C. S. Aiken, Ph.D. Georgia; T. L. Bell, Ph.D. Iowa; E. H. Hammond (Emeritus), Ph.D. California (Berkeley); S. R. Jumper, Ph.D. Tennessee; G. Long (Emeritus), Ph.D. Northwestern; C. W. Minkel, Ph.D. Corpus Christi; C. T. Fulgencio, Ph.D. Syracuse; L. W. Minkel, Ph.D. Denver; T. H. Schmude, Ph.D. Wisconsin; J. L. Wilbanks (Adjunct), Ph.D. Syracuse.

Associate Professors:

W. B. Brinkman, Jr., Ph.D. Wisconsin; J. R. Carter, Ph.D. Georgia; R. Foresta, Ph.D. Rutgers; L. Pulisher, Ph.D. Southern Illinois; B. Rusławski, Ph.D. Northwestern; J. B. Reider, Ph.D. Louisiana State.
The department offers the Master of Science degree in Geography. The program is designed to provide an opportunity to become an advanced scholar in the field. At both the Master's and doctoral levels, the student's program of study is carefully developed by the student working with a faculty committee. Graduate concentrations include nonmetropolitan areas, land use, urban geography, transportation geography, geography of resources, geography of development, and regional and historical geography of the United States.

THE MASTER'S PROGRAM

The department offers both the thesis and non-thesis options for the Master of Science. Both options require a minimum of 30 semester hours beyond the completion of a sound undergraduate major program. At least two-thirds of the total hours in the degree program must be at or above the 500 level. The thesis option requires 7-12 hrs. The non-thesis option requires 15-20 hrs. In the thesis option, 503, 504 and 3 semester hours at the 600 level. In the non-thesis option, the student must include 504, 515, 599, and (at least) 12 hrs. at the 600 level. Additional tools, including language, mathematics, and advanced course work in geography and other disciplines, are required. Competence in cartography and quantitative techniques is required. Additional tools, including language, will be required as appropriate to the student's areas of research specialization. Examination for admission to candidacy include a written comprehensive examination, written examinations on two special fields, and oral examination on the student's program, the special fields, and the dissertation proposal. Also required is a final oral examination on the dissertation and on other aspects of the program as determined by the student's doctoral committee.

411 Computer Mapping and Geographic Information Systems (3) Concepts, management, and presentation of digital data for spatial analysis: cartographic data structures. Prereq: 310 and knowledge of computer language or consent of instructor. 2 hrs and 1-2 hr lab.

412 Cartography (3) Cartographic techniques applied to design, compilation, and reproduction of maps and other graphics. Prereq: 310 or consent of instructor. 2 hrs and 1-2 hr lab.

413 Remote Sensing: Types and Applications (3) Principles and uses of remote sensing imagery, digital data, and spectral data; geographic interpretation and mapping techniques. Prereq: 310 or consent of instructor.

415 Quantitative Methods in Geography (3) Geographical application of statistical techniques, pattern analysis, and analysis of areal units. Prereq: Mathematics 115 or two semesters of calculus or consent of instructor.

421 Geography of Folk Societies (3) Geographical study of folk culture, traditional material culture and rural settlement, examples from eastern North America and selected foreign areas. Prereq: 101-02 or 320 or consent of instructor.

425 Historical Geography of the United States (3) Survey of changing human geography of United States during four centuries of settlement and development. Changing population patterns, development of agricultural, and patterns of urban-industrial development. Prereq: 361 or consent of instructor.

433 The Land-Surface System (3) Nature and regional variations in relationships among surface form, water, vegetation, and surface materials. People as evaluators and agents of change. Prereq: 131-32 or 330 or consent of instructor.

434 Climatology (3) Overview of general circulation system leading to world pattern of climates. Climatic change and modification, and interrelationships of climate and human activity. Prereq: 131-32 or 330 or 343 or consent of instructor.

441 Urban Geography (3) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities. Prereq: 101-02 or 141 or 340 or consent of instructor. (Same as Urban Studies 441.)

443 Rural Geography (3) Geographical appraisal of rural areas of United States: small towns and urban fringes. Problems and potentials of rural America. Prereq: 101-02 or 141 or 340 or consent of instructor.

445 Geography of Resources (3) Study of factors related to variations in resource availability from time to time and place to place; energy and metallic resources. Prereq: 101-02 or 141 or 340 or consent of instructor.

449 Geography of Transportation (3) Examination of transportation systems, their effects on trade patterns, land use, location problems, and development. Prereq: 141 or 340 or consent of instructor.

450 Process Geomorphology (3) (Same as Geology 450.)

500 Thesis (1-15) P/NP only. E

501 Colloquium in Geography (1) Discussion of departmental research, current research literature, and general topics. Registration required of resident graduate student whenever offered. May be repeated. Maximum 4 hrs. May be applied toward graduate degree. S/NC only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/ or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

503 Introduction to Geographical Research (3) Aims of geographical research; survey of printed source materials; practice in effective presentation of research findings.

504 Research Design (3) Development of research problems; preparation of appropriate study designs, and practical field application. Prereq: 503 or consent of instructor.

505 Directed Research (2-6) Research on problems as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hrs. S/NC only.

506 Directed Readings (2-6) Readings on topics of interest as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hrs. S/NC only.

509 Topics in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

512 Topics in Cartography (3) Trends, concepts, problems and methods in cartography. Prereq: 411 and 412 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

513 Topics in Remote Sensing (3) Applied research using imagery for interpretation and mapping of geographic data. Prereq: 413 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

515 Topics in Quantitative Geography (3) Multivariate analysis applied to problems in geography; research problems utilizing appropriate computer programs; usefulness to geographic research of techniques developed by other disciplines. Prereq: 415 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

519 Graduate Practicum in Cartography/Remote Sensing (2-6) Prereq: Written consent of department prior to registration. May be repeated with consent of instructor. Maximum 6 hrs.

521 Topics in Cultural Geography (3) Examination of trends, concepts, and methods in cultural geography. Prereq: 425 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

524 Topics in Political Geography (3) Geographic consequences of public decisions; understanding how administrative and political processes affect public land management, spatial distribution of public goods, and urban morphology. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

525 Topics in Historical Geography (3) Examination of trends, concepts, and methods in historical geography. Prereq: 425 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

533 Topics in Physical Geography (3) Examination of trends, problems, and methods in geography of land surface system or in modern climatology. Prereq: 433 or 434 and consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

541 Topics in Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 441 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

549 Topics in the Geography of Transportation (3) Examination of trends; problems, and methods in transportation geography and transportation networks. Prereq: 449 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

550 Regional Geomorphology (3) (Same as Geology 550.)

591 Foreign Study (1-15) See page 31. Prereq: Written consent of department prior to registration.

592 Off-Campus Study (1-15) See page 31. Prereq: Written consent of department prior to registration.

593 Independent Study (1-15) See page 31. Prereq: Written consent of department prior to registration.

595 Geographic Concept and Method (3) Traditional and emerging geographic thought: readings on nature, scope, problems, and methods of geography. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

605 Seminar in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

625 Seminar in Historical Geography (3) Prereq: 525 or consent of instructor. May be repeated. Maximum 6 hrs.
533 Seminar in Physical Geography (3) Prereq: 533 or consent of instructor. May be repeated. Maximum 6 hrs.
641 Seminar in Urban Geography (3) Prereq: 541 or consent of instructor. May be repeated. Maximum 6 hrs.
643 Seminar in Rural Geography (3) Prereq: 443 or consent of instructor. May be repeated. Maximum 6 hrs.
649 Seminar in Geography of Transportation (3) Prereq: 544 or consent of instructor. May be repeated. Maximum 6 hrs.
663 Seminar in Geography of the American South (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
673 Seminar in Geography of Latin American (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Geological Sciences

(Major of Liberal Arts)

MAJOR DEGREES
Geology .................................M.S., Ph.D.

Kenneth R. Walker, Head

Professors:
R. D. Hatcher (Distinguished Scientist), Ph.D. Tennessee; H. J. Klepsner (Emeritus), Ph.D. Ohio State; O. C. Kopp, Ph.D. Columbia; R. E. McCaughlin (Emeritus), Ph.D.

Tennessee; K. C. Misra, Ph.D. Western Ontario; L. A. Taylor, Ph.D. Lehig; K. R. Walker (Carden Professor), Ph.D. Yale; J. G. Walls (Emeritus), Ph.D. North Carolina.

Associate Professors:
T. W. Broadhead, Ph.D. Iowa; D. W. Byerly, Ph.D. Tennessee; G. M. Clark, Ph.D. Pennsylvania State; T. C. Labotka, Ph.D. California Institute of Technology; H. Y. McSwee, Ph.D. Harvard; R. T. Williams II, Ph.D. Virginia Polytechnic Institute.

Assistant Professor:

The Department of Geological Sciences offers both the M.S. and Ph.D. degrees in Geology. Persons interested in these programs should contact the Director of Graduate Admissions in the department.

For admittance, an applicant must provide transcripts of previous university work, two rating forms or letters of recommendation, and GRE scores, including the subject exam in geology (or in another area if geology was not the area of previous university-level concentration). Students are not admitted under provisional or non-degree status.

THE MASTER'S PROGRAM

Prerequisites are the Bachelor's degree including course work in mineralogy, petrology, stratigraphy/sedimentation, paleontology, structural geology, optical mineralogy, and field geology; one year of course work at the introductory level in chemistry, calculus, and either physics, biology, or statistics.

Completion of the degree includes maintenance of a minimum 3.0 average in all graduate course work and successful defense of the thesis. Failure to achieve a 3.0 GPA for two successive semesters will terminate a student's status in the degree program.

Course requirements include a minimum of 30 hours of graduate credit that include 6 hours of Thesis 500 and at least 14 hours of graduate course work at or above the 500 level. At least 23 hours must be taken within the department. Students who have not had an undergraduate field course must take 440 or an approved equivalent. Registration for 595 is required each semester; however, not more than 2 hours S/NC credit may be applied toward the degree.

THE DOCTORAL PROGRAM

Prerequisites are the Bachelor's degree requirements of the M.S. plus a Master's degree in geology or related field.

Completion of the degree includes maintenance of a minimum 3.0 average in all graduate course work, satisfactory performance on the comprehensive exam taken not later than the end of the second year, and successful defense of the dissertation. Failure to achieve a 3.0 GPA for two successive semesters will terminate the student's status in the degree program.

Course requirements include a minimum of 26 hours of graded courses for graduate credit and at least 24 hours of Dissertation 600. The 26 hours must include a minimum of 18 hours of 500 level or higher with at least 6 hours must be at the 600 level. Students who have been granted the opportunity to bypass the M.S. must take at least 38 hours of graded courses for graduate credit of which a minimum of 25 hours must be at the 500 level or above with at least 6 hours at the 600 level.

410 Advanced Mineralogy (3) Crystal chemistry of rock-forming minerals. Interaction of electromagnetic and crystalline solids. Optical properties of minerals, visible and infrared spectroscopy, and x-ray diffraction. Laboratory emphasizes thin section and x-ray diffractometer methods of mineralogy. Prereq: 310. 2 hrs and 1 lab.

420 Paleoecology (4) Principles of ecological analysis as applied to fossils and fossil assemblages: data collection and interpretation. Laboratory designed around preparation of scientific reports based on field and laboratory analysis. Writing emphasis. 3 hrs and 1 lab.

421 Invertebrate Paleontology I (3) Survey of preservational processes and geologically important representatives of Protista, Porifera, Cnidaria, Bryozoa, and Brachiopoda. Functional morphology, skeletal structures, ecologic, and stratigraphic distribution. Prereq: 320 or consent of instructor. 2 hrs and 1 2-hr lab.

422 Invertebrate Paleontology II (3) Survey of 'higher invertebrates': Annelida and other worms, Mollusca, Arthropoda, Echinodermata, Graptolida, Coelenterata. Functional morphology, skeletal structures, ecology, and stratigraphic distribution. Prereq: 320 or consent of instructor. 2 hrs and 1 2-hr lab.

425 Evolution and Geologic Record (3) Evolution of life viewed from the fossil record. Examination of major evolutionary and evolutionary rates. Prereq: 320. 2 hrs and 1 seminar.

426 Paleobotany and Palynology (3) Historical history of terrestrial plant life through examination of fossil record of macrobotanical remains, spores, and pollen grains. Origin and diversification of Gymnosperms and Angiosperms; changes in floras.

through geologic time. Prereq: 102. Botany 310-20 or consent of instructor. (Same as Botany 426). 3 hrs and 1 lab.

440 Field Geology (8) Summer field course for advanced undergraduate students. Majors and first-year graduate students in geology. Taught off-campus at Geology Field Station and requires full time of student. Field techniques demonstrated, practiced, and applied to solution of geologic problems. Prereq: Completion of major core courses and consent of instructor.


450 Process Geomorphology (3) Integrative approach to development of surface of earth based upon case histories, maps, remote sensing imagery. Prereq: 101-02. (Same as Geography 450). 2 hrs and 1 2-hr lab.

455 Basic Environmental Geology (3) Applications of geological sciences toward comprehension of effects of geological processes on humans and effects of human activities on earth's environments. Prereq: 12 hrs of geology courses. 2 hrs and 1 3-hr lab or field period.

460 Principles of Geochemistry (3) Application of chemical principles to geologic problems. Crystal chemistry and relation between basic atomic structure and properties of elements in earth's crust. Prereq: Chemistry 120-30. Recommended prereq: 330. 2 hrs and 1 lab.

470 Applied Geophysics (3) Basic principles and applications of seismic, gravity, magnetic, and electrical prospecting methods. Recommended prereq: Mathematics 141-42 or 147-48 and Physics 131. 2 hrs and 1 lab.

480 Principles of Economic Geology (3) Ore-forming processes, classification of mineral deposits, survey of different types of mineral deposits, and metallogeny. Prereq: 310 and 350 or equivalent. Recommended prereq: 490. 2 hrs and 1 2-hr lab.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeat- ed. E/NP only. E

510 Clay Mineralogy (3) Origin, chemistry, structures, and properties of clay minerals; application of mineralogical techniques to mineral studies. Prereq: 310 and 568 or equivalent. 2 hrs and 1 lab.

520 Advanced Paleontology (3) Detailed analysis of selected groups of fossil organisms; functional morphology, evolutionary development.

521 Data Analysis in Geology and Paleobiology (3) Application of statistical and other quantitative techniques to geological and palaeontological data. 2 hrs and 1 seminar.

525 Biostratigraphy (3) Examination of principles of stratigraphy and biostratigraphy through selected case histories. 1 hr and 1 2-hr seminar.

530 Petrogenesis of Crystalline Rocks (4) Origin and characteristics of igneous and metamorphic rocks, magmatic and subduction processes and physical conditions. Laboratory involves petrographic study of crystalline rocks in thin section. Prereq: 410. 3 hrs and 1 lab.

540 Seminar in Local Geology (1) Introduction of geology of Southern Appalachians. 1 hr plus field trips.

545 Sandstone Petrology/Physical Sedimentology (4) Field and microscopic analysis of terrigenous clastic rock types; physical processes of sedimentation, transport of sediment, and formation of sedimentary structures. Prereq: 340 or equivalent. 3 hrs and 1 lab.

546 Carbonate Sedimentology (4) Environments of deposition of carbonates; processes of sedimentation, and diagenesis of resultant rocks; field and laboratory analysis of sample material and preparation of scientific reports. 3 hrs and 1 lab.

590 Geological Sciences/Fields of Instruction 91
550 Regional Geomorphology (3) Integrative approach to study of natural geomorphological regions stressing links and similarities across boundaries, unique characteristics of major divisions, provinces, sections, and districts. May be repeated with consent of instructor. Maximum 6 hrs. (Same as Geography 550.)

555 Seminar in Quaternary Studies (3) Interdisciplinary examination of major issues in the evolution of pattern and process in Quaternary landscapes; responses of plant, animal and human populations to environmental changes during glacial/interglacial cycles. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs. (Same as Botany 555 and Zoology 555.)

556 Quaternary Geology of North America (3) Interpretation of geomorphic, stratigraphic, and sedimentologic evidence in order to reconstruct Quaternary landscapes in glaciated, periglacial, and nonglacial regions of North America; correlation of major episodes of North American glacial with paleo-oceanographic changes in Atlantic and Pacific Oceans. Prereq: 501 or consent of instructor.

557 Quaternary Paleocology (3) Perturbation, process, and pattern within Quaternary ecosystems; climatic change and vegetational responses during last 2.5 million years. Prereq: Consent of instructor.


561 Aqueous Geochemistry (4) Introduction to and applications of equilibrium thermodynamics to earth surface environments; geochemistry of natural water, weathering reactions, and early sediment diagenesis. Prereq: Chemistry 120-30. 3 hrs and 1 lab or seminar.


568 Geochemical Analysis (3) Collection and treatment of geochemical data using electron microprobe, x-ray fluorescence, and atomic absorption spectrophotometry techniques. Prereq: 310 or consent of instructor. 2 hrs and 1 lab.

569 Experimental Geochemistry Laboratory (1-3) Independent lab study of problems in geochemistry using experimental and analytical techniques. Prereq: Consent of instructor.

570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; recent literature. Prereq: 370 or equivalent, or consent of instructor. 3 hrs and 1 lab or seminar.

575 Plate Tectonics and Orogeny (4) Tectonic development of orogenic belts in context of newest aspects of plate tectonic theory current literature, and ongoing research for both modern and ancient examples. Prereq: 370 or consent of instructor. 3 hrs and 1 seminar.

580 Ore Petrology (3) Detailed study of selected ore deposits; petrology of orogenic assemblages. Prereq: 480 or consent of instructor. 2 hrs and 1-2 hr lab.

590 Special Problems in Geology (1-3) Directed study or special topics. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Field Problems in Geology (1-2) Literature study and seminars on specific regions of geologic interest, supplemented by extended field trip. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs.

595 Selected Topics in Geology (1) Presentation of graduate, faculty, and visiting scientist research. Registration required each semester except summer for resident full-time graduate students. S/NC only.

600 Doctoral Research and Dissertation (3-15) Prerequisite only. E

610 Seminar in Mineralogy (2) May be repeated with consent of department. Maximum 6 hrs.

620 Seminar in Paleontology (2) May be repeated with consent of department. Maximum 6 hrs.

630 Seminar in Petrology (2) May be repeated with consent of department. Maximum 6 hrs.

640 Seminar in Sedimentary Geology (2) May be repeated with consent of department. Maximum 6 hrs.

650 Seminar in Geomorphology and Quaternary Geology (2) May be repeated with consent of department. Maximum 6 hrs.

660 Seminar in Geochemistry (2) May be repeated with consent of department. Maximum 6 hrs.

670 Seminar in Structural Geology (2) May be repeated with consent of department. Maximum 6 hrs.

680 Seminar in Economic Geology (2) May be repeated with consent of department. Maximum 6 hrs.

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**Germanic and Slavic Languages**

*(College of Liberal Arts)*

**MAJORS**

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**Henry Kratz, Head**

Professors:

J. E. Falen, Ph.D. Pennsylvania; D. M. Fiere, Ph.D. Indiana; H. W. Fuller (Emeritus), Ph.D. Wisconsin; H. Kratz, Ph.D. Ohio State; J. C. Osborne, Ph.D. Northwestern; M. P. Rice, Ph.D. Vanderbilt.

Associate Professors:

N. A. Laukkner, Ph.D. Wisconsin; D. E. Lee, Ph.D. Stanford; C. J. Mellor, Ph.D. Chicago; U. Ritzenhoff, Ph.D. Connecticut.

Assistant Professors:

C. Hodges, Ph.D. Chicago; J. I. Kolodziej, Ph.D. Indiana.

The Department of Germanic and Slavic Languages offers two advanced degrees: the Master of Arts in German and the Doctor of Philosophy in Modern Foreign Languages. Inquiries should be addressed to the head of the department.

**THE MASTER'S PROGRAM**

The department requires a minimum of 30 semester hours including 15 hours of course work above the 500 level and 6 hours of Thesis 600.

**THE DOCTORAL PROGRAM**

The Ph.D. in Modern Foreign Languages is offered jointly by the Department of Germanic and Slavic Languages and the Department of Romance Languages and requires advanced training in at least two foreign languages.

**Admission Requirements**

Applicants must have completed a B.A. in either French, German or Spanish to be accepted into this program. Both graduates of institutions in the United States and those with undergraduate degrees from institutions outside the United States must have a grade point average of at least 3.0. Consideration will also be given to applicants who do not have an undergraduate degree in one of the three foreign languages but do have the equivalent of an undergraduate major in one of them. Applicants should present scores that are no lower than the 40th percentile on the Graduate Record Examination (GRE) subject test in the foreign language of their first concentration.

**Requirements for the Ph.D.**

Candidates must complete a minimum of 63 semester hours of course work beyond the Bachelor's degree in addition to 24 hours of doctoral research and dissertation. The program shall consist of a first concentration, a second concentration, and a cognate field.

1. First Concentration: French, German or Spanish. It will consist of a minimum of 39 semester hours beyond the Bachelor's degree, distributed as follows:

   A minimum of 21 hours at the 500 level (exclusive of thesis hours) including French 584 (3), German 560 (3), or Spanish 550 (3); and 3 hours beyond the Bachelor's degree with departmental approval.

   B. Second Concentration: French, German, Italian, or Spanish (different from the first concentration). It will consist of at least 18 hours beyond the Bachelor's degree, at least 12 of which must be at the 500 or 600 level.

2. Cognate Field: Six hours must be in courses numbered 400 and above in a field outside the department of the first concentration but related to the student's principal area of research. If the cognate field is yet a third foreign language, a reading proficiency exam will be administered after completion of the 6 cognate hours by the language section concerned.

3. Additional Requirements: A student must demonstrate competence in languages of both his/her first and second concentrations by passing a test in each language. The test will include reading, writing, listening and speaking, and should be completed by the time the student reaches 40 hours of study beyond the Bachelor's degree. Standardized examinations that may be used for this purpose include applicable portions of either the National Teachers Examination, the MLA Examination for Teachers and Advanced Students, or the proficiency standards of the United States Foreign Service Institute (FSI).

If the student has not chosen a third language as his or her cognate area, basic competence (determined by a reading examination of translation into English administered by the department concerned) in a third language is required. If the student's first and second languages are Romance languages, the third language should be chosen from another language branch.

4. A comprehensive examination on the language and literature of the first and second concentrations must be passed before the student may be admitted to candidacy. The candidate will be required to defend his/her
dissertation in an oral examination. Central emphasis is put on the doctoral dissertation as a final test of the candidate's scholarly qualifications.

Graduate Teaching Assistants in the program should have the opportunity and will be strongly encouraged to instruct in at least two foreign languages, subject to staffing needs.

Doctoral students will be strongly encouraged to reside and study abroad and will be assisted in identifying potential sources of financial support (e.g., Fulbright, McClure, Rotary fellowships).

For additional courses, refer to Romance Languages.

German

411-12 Advanced Conversation and Composition (3,3)
Prereq: 311-12 or equivalent or consent of department.

420 Selected Topics in German Literature from 1750 to the Present (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

421 German Lyric Poetry (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

422 German Drama (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

423 German Narrative Prose (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

424 German Literary Movements (3) Survey of major periods in development of German literature since 1750: problems and pitfalls of periodization.

425 Introduction to Descriptive Linguistics (3) (Same as French 425, Spanish 425, Linguistics 425, and Russian 425.)

426 Methods of Historical Linguistics (3) Phonetics, distinctive feature analysis, sound change types, nature of sound change, principles of reconstruction and fundamental assumptions about language change through time. Survey of non-phonological linguistic change, language families, Proto-Indo-European and other proto languages. Prereq: 6 hrs of upper division foreign language courses (excluding courses in translation or graduate reading courses). (Same as Russian 426, French 426, Spanish 426, and Linguistics 426.)

435 Structure of the German Language (3) Contrastive English-German segmental and suprasegmental phonemes, contrastive English-German linguistic structures, selected topics in advanced German grammar and syntactic analysis. Prereq: 6 hrs of upper division German language courses (excluding courses in translation and graduate reading courses). (Same as Linguistics 435.)

436 History of the German Language (3) Development of German language from Indo-European through Proto-Germanic, Old High German, Middle High German to New High German. Internal and external linguistic history of German speech. Prereq: 6 hrs of upper division German language courses (excluding courses in translation or graduate reading courses). (Same as Linguistics 436.)

485 Business German (3) Survey of German used in fields of business, government, administration and economics. Prereq: 6 hrs of upper-division German excluding courses in translation and graduate courses.

500 Thesis (1-15) P/NC only, E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 German Phonetics and Advanced Grammar (3) Advanced work in phonetics, pronunciation, and selected topics in German grammar. For teachers and prospective teachers. Prereq: Consent of instructor.

520 Proseminar (3) Bibliography; methods; illustrative problems; preparation of papers.

521-22 College Teaching of German (1,1) Required for all M.A. or Ph.D. candidates except those whose previous teaching experience warrants excuse from this requirement or those who wish to pursue vocations other than teaching.

541-42 Medieval German Language and Literature (3,3) 541—Introduction to Middle High German; 542—Readings in Medieval German Literature.

550 Studies in German Literature (3) Content varies. May be repeated. Maximum 6 hrs.

551 German Humanism, Reformation and Baroque (3)

552 German Enlightenment, Rococo and Sturm und Drang (3)

553 German Classicism and Romanticism (3)

554 German Realism and Naturalism (3)

555 Modern German Literature 1890-1945 (3)

556 Modern German Literature 1945-Present (3)

560 German Literary Theory and Criticism (3)

561-62 Directed Readings in German Language and Literature (3,3)

571-72 Old Norse Language and Literature (3,3)

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

600 Doctoral Research and Dissertation (3-15) P/NC only, E

610 Gothic (3) Phonology, morphology, and syntax of Gothic language. Relationship to Indo-European languages and other Germanic languages. Readings from Gothic Bible.

611 Old High German (3) Phonology, morphology, and syntax of Old High German. Representative readings.

612 Old Saxon (3) Phonology, morphology, and syntax of Old Saxon. Representative readings.

621-22 Seminar in German Literature (3,3) May be repeated. Maximum 18 hrs.

631-32 Seminar in German and Germanic Philology (3,3)

Russian

425 Introduction to Descriptive Linguistics (3) (Same as French 425, German 425, Spanish 425, and Linguistics 425.)

426 Methods of Historical Linguistics (3) (Same as French 426, German 426, Spanish 426, and Linguistics 426.)

Health, Leisure, and Safety

(College of Education)

MAJORS DEGREES

Public Health.......................... M.P.H.
Recreation and Leisure Studies........ M.S.

Safety Education and Service........ M.S., Ed.S.
School Health Education.............. M.S.
Health Education........................ Ed.D.
Education.............................. Ph.D.

Charles B. Hamilton, Head

Professors:
J. Gorski, Ph.D. California (Los Angeles);
C. B. Hamilton, Dr.P.H. Oklahoma;
G. E. Hayes, Ph.D. North Texas State;
R. H. Kirk, H.S.D. Indiana; B. C. Wallace,
Ed.D. Northern Colorado.

Associate Professors:
K. L. Krick, Re.D. Indiana; J. L. McGuire,
Ph.D. Michigan; J. J. Neutens, Ph.D. Illinois;
R. J. Pursey, Ph.D. Iowa; A. F. Thompson,
Ph.D. Michigan State.

Assistant Professors:
T. E. Aldrich, Ph.D. Texas; J. R. Blackmon,
Ed.D. Tennessee; M. D. Blanton, Re.D.
Indiana; J. Ellison, Ed.D. Tennessee;
B. Levin, M.D. California (San Francisco); P. D. Mcconath, Ph.D. Utah; V. W. Pressly,
Ed.D. Tennessee.

Lecturer:
M. Dufy, M.D. Pennsylvania.

The Department of Health, Leisure, and Safety offers graduate programs leading to the Master of Science, the Master of Public Health, the Specialist in Education, the Doctor of Education, and the Doctor of Philosophy with a major in Education. Inquiries should be directed to the department head.

Health

Graduate programs are available leading to the Master of Science with a major in School Health Education (thesis and non-thesis options) and to the Doctor of Education with a major in Health Education.

The Master of Science, with thesis and non-thesis options, requires completion of 30 semester hours.

The Doctor of Philosophy with a major in Education offers a concentration in health education and choice of supporting specializations from public health or safety as listed under Education.

400 Consumer Health (3) Survey of major consumer health care providers and health care services; selecting, purchasing, evaluating and financing medical and health care services/products. (Same as Public Health 400.) E

405 Alcoholism and Alcohol Education (3) Problems of alcoholism. Factors which make alcoholism serious health and safety problem. Various types of instructional/educational and intervention programs. F,Sp

406 Death, Dying and Bereavement (3) Aspects of dying, death and handling trauma of loss. Medical, financial, physical, legal and social implications of death. F,Sp

414 Physical Activity and Fitness (2) (Same as Physical Education 414.)

420 Sex Education As It Relates to Human Sexuality (3) Exploration of science of human sexuality. Trends, issues, and content of sex education. E
660 International Health (3) Study of quality of health, wellness of individual. (Same as Public Health 650.) Status of nation. (Same as Public Health 655.) F
610 Critical Analysis of Writing and Research (3) F (Same as Safety 601.)
600 Doctoral Research and Dissertation (3-15) P/NP tor before registration. May be repeated. Maximum 12 hrs. May not be used toward degree requirements. May be repeated under different topic. Maximum 6 hrs.
580 Seminar in Health (3) Ramifications of health and health education innovations in relation to evolving field and discipline. Prereq: Advanced standing as doctoral candidate. Sp

Public Health
Graduate study with a major in Public Health leads to the Master of Public Health (M.P.H.). Three professional preparation concentrations are available: community health education (accredited by the Council on Education for Public Health), health planning/ administration, and occupational/environmental health and safety.

ADMISSION REQUIREMENTS
A statement of the applicant's educational and career goals and three rating forms are required. Appropriate forms are available from the department's program in Public Health. Preferential consideration for admission to degree status shall be given to those with a minimum undergraduate grade point average of 2.8 and with one year of professional experience in a health-related occupation.

THE MASTER'S PROGRAM
The M.P.H. is a non-thesis program requiring completion of 36 semester hours of course work including 10 weeks of field practice. Field practice provides a full-time experience with an affiliated health agency or organization offering one or more health programs. Of importance, field practice allows the student to apply academic theories, concepts, and skills in a realistic setting. Students must complete two-thirds of their courses with a minimum overall GPA of 3.0 prior to placement in the field.

400 Consumer Health (3) (Same as Health 400.)
410 Health in the Work Environment (3) Fundamentals of industrial health aimed at reducing health problems for employees. Workplace health hazards and problems of concern to nurses, medical staff, management, engineers and others in industrial health and safety fields. Prereq: Consent of Instructor. May not be taken for credit by occupational health concentration majors. F
480 Special Topics (3) Prereq: Consent of Instructor. May be repeated under different topic. Maximum 6 hrs.
493 Directed Independent Study (1-3) Individual in-depth study of selected issues. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

500 Thesis (1-15) P/NP only. E
525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control, and analysis of industry financial statements. Prereq: 520 or consent of instructor. Sp
530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputer applications, use and interpretation of vital statistics and introductory research methodology preparatory for first course in epidemiology. Prereq: Introductory statistics or consent of instructor. F
540 Research Methods in Epidemiology (3) Basic measurement science of public health, Epidemiologic principles; application of discipline's research methodologies and statistical techniques. Prereq: 530. Sp
550 Principles and Practices of Community Health Education (3) Theoretical foundations for community health education: applications for program planning and community health needs assessment, educational interventions, and application to health policy making and practice. Prereq: Consent of instructor. F
552 Community Health Problem Solving (4) Dynamics of community organization, community needs assessment, educational interventions, and applica-
555 Health and Society (3) Understanding of social and behavioral factors which influence health status and health care delivery systems. Application to behavior in health-related organizations. Social and psychological aspects of disease, sociological aspects of health care delivery systems, political economy of health and illness, impact of social movements on health, and social consequences of health legislation. Sp

560 Theories and Techniques in Health Planning (4) Overview of health planning concepts and methodologies; systems-critical, planning process. Major elements of planning: formulation and conceptualization of problem, plan design, evaluation and implementation. Health problems of institutions, communities and selected population groups, appropriate diagnoses, and programs for addressing needs. Sp

562 Group Processes in Health Planning (3) Application of group process techniques used in health planning, tailoring group processes, leadership roles and techniques to encourage innovation and creativity in health planning groups. Su

568 Physical Activity and Positive Health (3) (Same as Physical Education 568.)

569 Fitness Testing, Programming, and Leadership for Diverse Populations (1) (Same as Physical Education 569.)

580 Special Topics (3) Prereq: Consent of instructor. May be repeated under different topics. Maximum 6 hrs.

587-88 Internship (3,3,3) Internship in either approved organizational or research setting under supervision of designated preceptor. Prereq: MPH major, one semester advance notice and consent of major advisor. S/NC only. E

590 Research Methods in Health (3) (Same as Health 590.)

593 Directed Independent Study (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

590 Graduate Practicum (1-6) Required of all graduate students, teachers, supervisors, and administrators. May be repeated. Maximum 12 hrs.

600 International Health (3) (Same as Health 660.)

605 Health Aspects of Gerontology (3) (Same as Health 650.)

655 Seminar in Nation's Health (3) (Same as Health 655.)

660 International Health (3) (Same as Health 660.)

Recreation and Leisure Studies

Graduate study with a major in Recreation and Leisure Studies leads to the Master of Science. Professional preparation concentrations are available in therapeutic recreation, general recreation, and sport administration/management. The third concentration is optional and is an interdisciplinary program with the department of Physical Education and Dance. The M.S., with thesis and non-thesis options, requires completion of 32 semester hours.

410 Maintenance and Management of Recreation and Sports Related Facilities (3) Principles for operating modern facility maintenance systems and management strategies. Cost tracking, inventory systems, specialized maintenance techniques, safety guidelines, maintenance management systems and security. Prereq: 110, 310 or consent of instructor. F

430 Organization and Administration of Leisure Services (3) Principles of administration applied to provision of leisure services. Application to behavior in public, private and/or commercial enterprises. Organizational structures, personnel management, evaluation, legal authority, introduction to budgeting and fiscal procedures. Prereq: 310 or consent of instructor. F

440 Dimensions of Private and Commercial Recreation Businesses (3) Nature and function of recreation in private, commercial, and industrial settings. Survey of development and management of commercial goods and services offered in leisure market. Factors influencing participation, management considerations, and research in commercial recreation and tourism. Prereq: 110, junior standing, or consent of instructor. Sp

450 Specialized Study in Leisure Education (1-6) Special interest leisure activities; developing positive attitudes toward leisure. Demonstrates how leisure contributes to mental and physical health. May be repeated. Maximum 6 hrs. E

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required of all graduate students, teachers, supervisors, and administrators. May be repeated. Maximum 12 hrs.

591 Directed Study in Leisure & Recreation (1-6) May be repeated. Maximum 6 hrs. E

Safety

Graduate programs are available leading to the Master of Science with a major in Safety Education and Service (thesis and non-thesis options), requiring completion of 30 semester hours.

441 Driver & Traffic Safety Education (3) 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. 2 hrs and 2 labs. E

442 Advanced Driver & Traffic Safety Education (3) Preparation of teachers of competence in teaching of driver education through use of simulation, multimedia, and multipurpose cars. Teaching skills and supervision. 2 hrs and 2 labs. Sp

443 Sports & Recreational Safety (3) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors affecting sports injury and control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hrs and 2 labs. Sp

590 Thesis (1-15) P/NP only. E

592 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities at or before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

593 Directed Independent Study (1-3) Individual consent of instructor. May be repeated. Maximum 6 hrs. E

600 International Health (3) (Same as Health 660.)

605 Health Aspects of Gerontology (3) (Same as Health 650.)

655 Seminar in Nation's Health (3) (Same as Health 655.)

660 International Health (3) (Same as Health 660.)

History/Fields of Instruction

The M.S., with thesis and non-thesis options, requires completion of 30 semester hours.

The Specialist in Education (Ed.S.) requires 30 semester hours beyond the M.S.
John Morrow, Head

Professors:
- P. H. Bargeron, Ph.D. Vanderbilt
- E. V. Chmielowski, Ph.D. Harvard
- R. E. Duncan, Ph.D. California (Berkley)
- J. R. Finger, Ph.D. Washington; L. P. Graf (Emeritus) (Distinguished Service Professor), Ph.D. Harvard; A. G. Haas, Ph.D. Chicago
- Y. P. Hao, Ph.D. Harvard; R. W. Haskins (Emeritus), Ph.D. California (Berkley)
- C. O. Jackson, Ph.D. Emory; M. M. Klein (Emeritus) (Alumni Distinguished Service Professor) Ph.D. Columbia; J. Morrow, Ph.D. Pennsylvania.

Associate Professors:
- S. D. Becker, Ph.D. Case-Western Reserve
- J. D. Bing, Ph.D. Indiana; J. Bohstedt, Ph.D. Harvard
- C. W. Johnson, Ph.D. Michigan
- J. Muldowny (Associate Head), Ph.D. Yale
- P. J. Pinckney, Ph.D. Vanderbilt
- E. H. Trainer, Ph.D. Emory; J. G. Utey, Ph.D. Illinois
- W. B. Wheeler, Ph.D. Virginia.

Assistant Professors:
- R. Brummett, Ph.D. Chicago; J. R. Farr, Ph.D. Northwestern
- W. W. Farris, Ph.D. Harvard
- C. G. Fleming, Ph.D. Duke; C. L. Lansing
- Ph.D. Michigan; C. D. Matson, Ph.D. Columbia; J. D. Miller, Ph.D. Duke.

The Department of History offers graduate study leading to the Master of Arts and Doctor of Philosophy. The M.A. program includes a thesis and non-thesis option and also offers a non-thesis concentration in historic preservation. The doctoral program has concentrations in American or European history with specializations in regional/local American, military/foreign relations, and socioeconomic history. Detailed information may be obtained from the Director of Graduate Studies in History.

All incoming students will be advised by the Director of Graduate Studies.

THE MASTER'S PROGRAM

Admission Requirements
1. Successful completion of a baccalaureate degree, preferably with a major in History.
2. Acceptable scores on the Graduate Record Examination (general and subject history).

Academic Standards
A 3.0 overall GPA is required of graduate students to remain in good standing. The Graduate Awards and Review Committee monitors the progress of all graduate students each semester.

Thesis Option
Twenty-four hours of course work and 6 hours of Thesis 500 for a total of 30 hours are required. The student must complete 510. 3 hours of reading courses (521) and 3 hours of a 600-level seminar. A two-hour oral examination covering both the thesis and the general field in which the thesis is written is given at the end of the program.

Non-Thesis Option
A total of 30 hours of course work is required. A student must complete 510, 6 hours of reading courses (521) and 6 hours of 600-level seminars. A two-hour written examination on one field and a one-hour oral examination on the second field are given at the end of the program.

As many as 9 related hours may be taken in courses outside the department for either option.

Concentration in Historic Preservation
This option is a non-thesis program requiring 33 total hours: 18 hours outside the history department and 15 hours within. Required courses are 6 hours of 521, 3 in historic preservation and 3 in either early American or recent American history. Students will be examined in two fields: historic preservation and either early American or recent American history.

THE DOCTORAL PROGRAM

Admission Requirements
1. Acceptable scores on the Graduate Record Examination (general and subject history). 
2. Successful completion of the M.A.

Residence and Course Work
Students are required to complete a minimum of 50 hours in course work beyond the Bachelor's degree. Students must take 510 or its equivalent. Students transferring from another institution may count up to 24 hours of course work toward the required 50 hours. All students pursuing the Ph.D. must take a minimum 6 related hours outside the department. No fewer than 3 semesters of the 6 semesters of residence work (2 of which must be consecutive semesters) shall be under the supervision of the staff of UTK.

Language Requirements
Candidates must possess a reading knowledge of one foreign language and such additional languages as may be determined by the student's committee. Under normal circumstances, those concentrating in European history will need two languages. The committee may also specify any other research tools, such as statistics, essential for the student's preparation. Upon student petition, the committee may accept in place of a language a B or better performance in an appropriate statistical course and History 526.

The foreign language requirements may be satisfied in one of two ways:
1. By examination. When the student is ready to take a language examination, he/she should consult with an advisor. The appropriate forms and the time of the examination may be obtained from The Graduate School.
2. By course work. Upon consultation with the advisor, a student may elect to complete an appropriate sequence in a language department or an intermediate sequence in a language in which no appropriate sequence is available. Satisfactory completion requires that a student must have at least a B in the final semester.

Comprehensive Examination
The comprehensive examination which will be both written and oral must be taken after all course work is completed, language requirements fulfilled, and at least nine months before the degree is expected. This exam should normally be taken before beginning the sixth semester of work toward the doctorate. The candidate must present two fields, one from group I and one from group II.

Group I
- Premodern Europe
- Modern Europe
- Early American
- Recent United States

Group II
- Socio-economic
- Military/Foreign Relation
- Regional/Local (U.S.)
- National/Regional (non-U.S.)

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.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Foundations to Graduate Study in History (3) Assumptions and methods of historians. Required of all candidates for advanced degrees. F


533 Topics in European National History (3) Reading seminar: secondary sources on pre-modern topics, usually British, Russian, German or French. Focus varies. May be repeated. Maximum 15 hrs.

541 Topics in Early American History (3) Reading seminar: secondary sources on early North American history. Focus varies. May be repeated. Maximum 15 hrs.

542 Topics in 19th- and 20th-Century United States (3) Reading seminar: secondary sources on 19th- and 20th-century United States. Focus varies. May be repeated. Maximum 15 hrs.

551 Topics in the History of Foreign Relations (3) Reading seminar: secondary sources on foreign relations. Focus varies. May be repeated. Maximum 15 hrs.

552 Topics in Military History (3) Reading seminar: secondary sources on military history; military operations, social impact of war and military strategy in foreign policy. May be repeated. Maximum 15 hrs.

554 Topics in Comparative Social and Economic History (3) Reading seminar: secondary sources on multinational topics, comparatively structured. Focus varies. May be repeated. Maximum 15 hrs.

555 Topics in United States Social and Economic History (3) Reading seminar: secondary sources on
U.S. social and economic history. Focus varies. May be repeated. Maximum 15 hrs.

558 Topics in European Social and Economic History (3) Reading seminar: secondary sources on social or economic history of European nations. Focus varies. May be repeated. Maximum 15 hrs.

557 Topics in Cultural and Intellectual History (3) Reading seminar: secondary sources on cultural and intellectual history. Focus varies. May be repeated. Maximum 15 hrs.

558 Topics in United States Regional and Local History (3) Reading seminar: secondary sources on regions, states, and cities of the South. Focus varies. May be repeated. Maximum 15 hrs.


562 Topics in Asian History (3) Reading seminar: secondary sources on Asian history; East Asia and Middle East. Focus varies. May be repeated. Maximum 15 hrs.

566 Topics in U.S. Religious History (3) (Same as Religious Studies 566.)

571 Topics in Applied History (3) Seminar to develop practical skills applicable to museology, historical preservation, and museum education. Focus varies. May be repeated. Maximum 15 hrs.

580 Topics in History (3) Reading seminar: secondary sources for new topics. Focus varies. May be repeated. Maximum 15 hrs.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

600 Doctoral Research and Dissertation (3-15) Pr/NP only. E

621 Directed Readings (3) Directed readings to prepare candidate for doctoral comprehensive examination. May be repeated. Maximum 1 per doctoral field. S/NC only.


632 Seminar in Modern European History (3) Research seminar in primary sources culminating in scholarly paper in modern European history. Focus varies. May be repeated. Maximum 15 hrs.

641 Seminar in Early American History (3) Research seminar in primary sources culminating in scholarly paper in early American history. Focus varies. May be repeated. Maximum 15 hrs.


651 Seminar in Military and Foreign Relations History (3) Research seminar in primary sources culminating in scholarly paper in military or foreign relations history. Focus varies. Not restricted by national grouping. May be repeated. Maximum 15 hrs.


658 Seminar in United States Regional and Local History (3) Research seminar in primary sources culminating in scholarly paper in regional and local history. Focus varies. May be repeated. Maximum 15 hrs.


680 Seminar in History (3) Research seminar in primary sources culminating in scholarly paper in aspect of history not covered in another 600-level research seminar. Focus varies. May be repeated. Maximum 15 hrs.

Home Economics (College of Human Ecology)

MAJOR DEGREE

Human Economics ......................... M.S.

THE MASTER'S PROGRAMS

Students pursuing graduate study in Home Economics Education or Extension are encouraged to enroll in the multidisciplinary Master's degree in Home Economics. Home Economics Education courses (HEED prefix) may be selected to meet requirements of that program. Graduate course work in Home Economics Education may also be selected for development of a concentration or minor within other areas of specialization.

The M.S. in Home Economics is designed to meet graduate study needs of professionals who work in programs encompassing all areas of home economics. Home-economics teachers may choose courses within this area for updating and certification renewal. Thesis (33 hours) and non-thesis (36 hours) options are offered. The program includes 3-6 hours in research methodology, 6-9 hours in program planning and implementation (agricultural extension, home economics education, other areas of education), 3 hours in the integrative nature of home economics, and 12-15 (thesis) to 15-18 (non-thesis) hours in home economics subject matter. At least one course is to be from each department in the college. The non-thesis option requires a practicum. An oral/written comprehensive examination will be administered at the end of the program.

510 Curriculum in Home Economics (3) Development of home economics educational materials and instruction. Prereq: 429 or equivalent or consent of instructor. F

515 Evaluation in Home Economics Education (3) Assessment of programs and pupil progress; techniques, methods, and purposes. Prereq: 420 or equivalent. F,Sp,A

520 Supervision of Home Economics in the Public Schools (3) Program planning, organization and administration of vocational home economics education. Supervision of pre-service and in-service home economics professionals. Prereq: Classroom teaching experience. Su,A

525 Home Economics Adult Education (3) Development and administration of community-based home economics programs for adults. Prereq: Consent of instructor. Sp,A

530 College Teaching in Home Economics (3) Instructional effectiveness, techniques, organization, and evaluation. Prereq: Consent of instructor. F,A

583 Family Life Education Programs (3) (Same as Child & Family Studies 583.)

580 Special Topics in Home Economics Education (1-3) Current issues and trends in home economics. Prereq: Consent of instructor. May be repeated. Su,A

581 Directed Study in Home Economics Education (1-3) Prereq: Consent of instructor. May be repeated. E

500 Thesis (1-15) Pr/NP only. E

501 Microcomputer Research Applications in Human Ecology (3) Advanced microcomputer concepts and applications for research. Overview of statistical anal
MAJOR DEGREES

Industrial and Organizational Psychology.......................... M.S., Ph.D.

Committee:
R. T. Ladd; J. M. Larsen, Jr.; J. W. Lounsbury;
R. G. O'Brien, M. C. Rush; J. E. A. Russell;
E. Sundstrom.

(For complete Faculty Listing, see Departments of Management and Psychology.)

The Master's and doctoral programs are offered jointly by the Department of Psychology and the Department of Management. They are designed to prepare students for professional, managerial, and organizational research; for university teaching; and for consulting relationships with industry. The program emphasizes a scientist/practitioner model in applying and conducting research based on accepted theory, organizational behavior, psychology, management, and statistics. The programs are administered by a joint committee of the two departments, appointed by the Vice Provost and Dean of The Graduate School. The committee includes representatives from the two department heads.

It is intended that students entering the I/O Program will represent widely different undergraduate and graduate backgrounds including psychology, management, social psychology, engineering, science, and liberal arts. The first-year program provides the opportunity to take courses that will assist the students in attaining a reasonable level of sophistication in areas of deficiency.

ADMISSION REQUIREMENTS

Applicants for admission should request information and application forms from both The Graduate School and the Director, Industrial and Organizational Psychology Program, 408 Stokely Management Center, The University of Tennessee, Knoxville, TN 37996-0545.

Two separate applications must be completed: one application for admission to The Graduate School (apply for major in "Industrial and Organizational Psychology") and one application for admission to the Industrial and Organizational Psychology program. Deadline: New students are admitted in fall semester only, and applications must be received by the Graduate Admissions and Records Office by March 1.

General Requirements

At least one year of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade point average of 3.0 or above is required with no evidence of special weakness in mathematics and physical sciences.

Test scores on each section of the general portion (verbal and quantitative) of the Graduate Record Examination (GRE) and the Subject GRE (Psychology-81) are required. Customarily, those students admitted to the program have performed at or above the 68-79th percentile on the general tests. (This corresponds to a raw score of approximately 600 on each of the tests.) The Subject GRE (Psychology-81) score will be used in making admission decisions, although special consideration will be given in the case of non-psychology majors.

THE MASTER'S PROGRAM

A thesis is required with a minimum of 6 semester hours of Management or Psychology 500.

The Master's degree can be completed with a minimum of 33 semester hours in the major as follows:

Management 567, 568 or Psychology 517-18; Psychology 557, Statistics 537, 538.

Twelve hours of additional course work to be selected primarily from the following with the approval of the student's advisor: Management 511, 522, 610; Management/Psychology 625, 626, 627, 638; Psychology 550, 610, 620, 624.

Electives, as approved for an individual's plan of study, may be selected from graduate courses in psychology, social work, sociology, management, education, planning, etc. Students who wish to pursue special research interests aside from their thesis may register for Management 525, 526 or Management/Psychology 690.

An internship, practicum, or field experience is recommended. A student is expected to be in residence full time one year (two years recommended).

The doctoral degree can be completed with a minimum of 54 semester hours in the major as follows:

Management 567-68 or Psychology 517-18, Psychology 557, Statistics 537-38.

A minimum of five doctoral seminars (15 hours) selected from: Management 610; Management/Psychology 625, 626, 627, 638; Psychology 620, 624. (Five doctoral seminars are viewed as the absolute minimum; more are recommended. Statistics 671 is recommended.)

Electives, as approved for an individual's plan of study, may be selected from graduate courses in psychology, social work, sociology, management, education, planning, etc. Students who wish to pursue special research interests aside from their dissertation may register for Management 525, 526 or Management/Psychology 690.

An internship, practicum, or field experience is recommended. A student is expected to be in residence full time one year (two years recommended).

Doctoral candidates must pass a final oral examination on their dissertation research. In addition to course requirements, a doctoral student must attain a score of 650 (90th percentile) on the Subject GRE (Psychology-81) within two years of entry, successfully complete the comprehensive examination part I covering scientific methodology before or during the third fall semester, and successfully complete the comprehensive examination part II in the areas of the student's major research and professional interests.

An overall B average is required in the course sequence Management 567-68 or Psychology 517-18 to continue in the program beyond the first year.

Industrial Engineering

(Continued)

MAJOR DEGREE

Industrial Engineering.............................. M.S.

Professors:
W. W. Claycombe, Ph.D. Virginia Polytechnic Institute, P.E.; E. L. DePorter, Ph.D. Virginia Polytechnic Institute; D. C. Doulet, M.S. Tennessee, P.E.; H. P. Emerson (Emeritus), S.B. Massachusetts Institute of Technology, P.E.; G. Garrison (Part-time) (UTSI), Ph.D. North Carolina State; R. M. LaForge (Emeritus) M.S. Georgia Institute of

Associate Professors:
J. C. Hungerford, Ph.D. Ohio; D. H. Hutchinson, Ph.D. Georgia Institute of Technology, K. E. Kirby, Ph.D. Tennessee.

Assistant Professors:

Instructor:
D. F. Jackson, M.S. Tennessee.

Lecturers:
J. A. Bontadelli (Part-time), Ph.D. Ohio State; S. Douglas (Part-time), Ph.D. Tennessee; J. C. Mitchell (Part-time) (UTSI), Ph.D. Vanderbilt.

THE MASTER OF SCIENCE PROGRAM
A graduate program leading to the degree of Master of Science in Industrial Engineering consists of 30 credit hours of A.B.E.T.-accredited undergraduate curricula in industrial engineering or to graduates of other technical curricula who take prerequisite course work depending on their academic background. These courses will be determined by the graduate committee. The thesis program requires 24 hours of course work and 6 hours of Thesis. A non-thesis option with 30 hours of course work plus a 3-hour design project is available. Graduate work in Industrial Engineering provides for concentrations in operations research, engineering management, manufacturing systems, human factors engineering, information systems, reliability and quality control, and traditional industrial engineering. Either one or two minors can be elected in engineering, mathematics, psychology, business, computer science, statistics or economics.

Any 400-level course required in the Bachelor of Science in Industrial Engineering program at The University of Tennessee may not be used for graduate credit in the M.S. graduate program in Industrial Engineering.


402 Production System Planning and Control (3) Theory and application of forecasting systems, regression and time series models, independent demand inventory models, development of safety stock. Coverage of all modules of Manufacturing Resource Planning (MRP) Systems: master production scheduling, resource requirements planning, bill of material and inventory file structures, material requirements planning, capacity planning, shop floor and purchase order control. Overview of just-in-time inventory concepts and MRPs role in manufacturing automation. Prereq: 301.

403 Production Facilities Design and Material Handling (3) Design of production facilities: plant layout, analysis and planning for overall moving, packaging and storage of materials. Office layout and service areas. Design of facilities for such diverse groups as hospitals, banking, industry. Prereq: 302, 401.

405 Engineering Economy (2) Methods and problems in selecting investments among capital recovery, economic life of equipment, and rate of return on investment.


500 Thesis (1-15) P/NP only. E

501 Design Project (1-3) Enrollment limited to industrial engineering graduate students. Student must develop a thesis project. May be repeated. Maximum 6 hrs. S/NC only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E


513 Facilities Planning and Design (3) Modern materials handling techniques, computer-aided layout techniques, application of computer-aided design, and use of these to design manufacturing facility. Production facilities planning or consent of instructor.

514 Information Systems II (3) Systems analysis and systems control concepts applied to systems of information. Role of IE in office and factory of future. Management support systems, decision support systems, and integrated support systems.


518 Advanced Engineering Economy (3) Financial and economic aspects of capital budgeting, present and future worth, net present value, and evaluation of after-tax cash flow projections; separation theorem and basic horizon models; stochastic analysis of capital budgeting problems; Monte Carlo simulation techniques; multiple attribute decision analysis. Prereq: Statistics 252.


520 Human Factors Engineering II (3) Design of man/machine interfaces and environments. Specific applications of human factors engineering and special problems areas. Prereq: 519.

521 Human Factors Engineering Methodology (3) Background in methodology used by human factors engineering designer and systems analyst. Observational methods, interview/questionnaire, design-of-experiments, computerized methods, human reliability and human error prediction, training analysis, evaluation of man-machine interface, subjective and objective techniques, scaling techniques, questionnaire and survey design, critical incident technique, concensus techniques (Delphi), accident investigation behavioral instrumentation, performance measurement, statistical techniques in experimental design, and expert systems. Prereq: 520.

522 Optimization Methods in Industrial Engineering (3) Classical optimization theory, unidimensional and N-dimensional search techniques, Lagrangean relaxation, separable programming, linearization techniques, quadratic programming, and dynamic programming. Prereq: 301 or 537.

523 Linear Programming and Extensions (3) Simplex and revised simplex methods, duality, parametric and sensitivity analysis, use of LP software integrator programs, branch and bound and cutting planes, network programming. Prereq: 301 or 537.


531 Motivational Theories, Systems and Practices in Organizations (3) Application of motivational theories and concepts in use in technology based organizations. Impact of concepts evaluated according to results in various types of organization structures.

532 Productivity and Quality Engineering (3) Production and quality measures defined and used to analyze current competitive position of important sectors of American industry with respect to both internal and external competition. Techniques which promote or inhibit productivity or quality improvements.

533 Theory and Practice of Engineering Management I (3) Comparison of classical management principles and theory with environment, needs, and practices of research and development and other scientific-engineering organizations. Cases used to illustrate contemporary problems and environments. Technical management function, marketing of technical services and products.

534 Engineering Management Control Systems (3) Underlying framework of accounting principles and practice reviewed as basis for evaluating productivity costs, requirements for new ventures, changes in strategic financial condition. Computer data bases examined for control system alternatives.

535 Organizational Behavior and Managerial Decisions (3) Theories of individual and group behavior and their applications to managerial decision making processes. Role of various people categories in managerial decision making processes in normal mode. Case studies used to identify causes of irrational decision, policies, and organizational behavior and to suggest corrective action.

536 Project Management (3) Management and control of multifaceted engineering and technological projects. Coordination and interactions between client and vendor. Principles of project organization and selection of project manager and progress and management, typical problems associated with various phases of life cycle of projects. Case studies illustrate theories and concepts.

537 Industrial Engineering Analysis and Control Techniques (3) Survey of management analysis and control systems through IE techniques. Qualitative and quantitative systems: methods analysis, work measurement, incentive systems, wage and salary development, production and inventory control, linear programming, and applied operations research techniques. Not for credit for students with undergraduate degrees in industrial engineering.

538 Industrial Development (3) Factors other than technology or economic which enter into successful establishment of manufacturing or service enterprise. Organizational and financial planning and evaluation: Cost and capital analysis in complex decision analysis. Prereq: 516.

591-92-93 Special Topics in Industrial Engineering (3,3,3) Individual or group research projects. Prereq: Consent of instructor. May be repeated.

601 Operations Research Models in Engineering Economy (3) Mathematical programming techniques applied to capital budgeting: advanced topics in multiple attribute decision analysis; Bayesian analysis of sequential decision making; Cost and capital analysis in complex decision analysis. Prereq: 518, 523.


604 Advanced Topics in Optimization (3) Multi-stage optimization theory. Sate increment dynamic programming adaptive optimization theory. Prereq: 603.


691-92-93 Advanced Topics in Industrial Engineering (3,3,3) Forum to study individually or in groups. Prereq: Graduate standing and consent of instructor. May be repeated with consent of instructor.

Journalism

(College of Communications)

MAJOR DEGREE

Communications ........................................... M.S.

James A. Crook, Director

Professors:

P. G. Ashdown, Ph.D. Bowling Green; J. A. Crook, Ph.D. Iowa State; G. A. Everett, Ph.D. Iowa; B. K. Leifer, Ph.D. Southern Illinois; M. W. Singletary, Ph.D. Southern Illinois.

Associate Professors:

J. N. Adamson, M.S. Tennessee; M. M. Miller, Ph.D. Michigan State; J. L. Morrow, Ph.D. Toledo; S. L. Puett, M.S. Tennessee.

Assistant Professors:

C. E. Cautilli, Ph.D. North Carolina; M. L. Kern-Foxworth, Ph.D. Wisconsin; R. B. Heller, M.A. Syracuse.

Adjunct Professor:

Alex Haley

The School of Journalism offers a concentration area for the Master's with a major in Communications. See Communications for additional information.

403 International Communications (3) Development and operations of an international communications channels and agencies. Comparative analysis of media, media practices, and flow of news throughout world. Print and broadcast systems in terms of relevant social, political, economic, and cultural factors. Relation of communication practices to international affairs and understanding. Sp

412 Opinion Writing (3) Analysis of editorial positions, practices, and pages. Writing of editorials and columns for newspapers, magazines, and company publications, rhetorical devices and use of logic. Prereq: Communications 200, or consent of instructor. Sp

414 Magazine Article Writing (3) Techniques of writing in-depth articles of mass circulation and specialized magazines. Organizing and presenting material, problems in specialized areas: business, science, agriculture, humanities. Prereq: Communications 200, or consent of instructor. F

416 Issues in Journalism (3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

420 Print Media Management (3) Current business practice among print media, especially newspapers. Problems in management and production and outlook for new technologies. Prereq: 6 hrs mathematics and/or accounting and senior standing. Sp


469 Mass Communications History (3) Development of press and role of mass communications in American history. Newspapers, radio, television, and magazines. F

470 Public Relations Campaigns (3) Preparation of communications materials to implement planned public relations programs. Preparation of news releases—written and video—and broadcasting copy. Research, planning, communication, and evaluation of major public relations projects and campaigns. Prereq: 203, 270, and senior standing. E

480 Journalism in the High School (3) Functions and methods of high school publications. Problems related to layout, layout, photography, printing, advertising, and business. Planning course outlines and curricula for journalism/mass media studies. Su

490 Advanced Photojournalism (3) Advanced principles and methods of black-and-white photography. Introduction to color photography. News and feature photographs and photo essays. Prereq: 290 or consent of instructor.

516 Seminar in Journalism Issues (3) Topics vary. May be repeated. Maximum 6 hrs.


525 Public Opinion (3) Role of press in developing and influencing public consensus. Social theories of public opinion and analysis of mass media's response. F

535 Publications Management (3) Problems in management, production, market analysis, and design. Techniques of writing, editing, and presenting comprehensive articles in other material, regional and specialized magazines. Individual editorial projects. Prereq: 420 or consent of instructor. Su

540 Seminar in Newspaper Operations (3) On-site study of newspaper management operations. Positioning medium for its target audience and how this affects profitability. Prereq: 550 or consent of instructor. Sp

545 Writing and Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, finance, science, technical, general publications. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

571 Seminar in Public Relations (3) Analysis and management of problems in communication between institutions and organizations and their publics. Measurement and evaluation of effectiveness of communication programs. Prereq: 470 or consent of instructor. F

580 Seminar in Visual Communication (3) Behavioral aspects of communication with images. Theories of psychological effect in color, shape, texture, and other design elements. Prereq: 203 or Advertising 350 or Broadcasting 430 or equivalent.

590 Communications and International Development (3) Relationship between mass communications and development of nations. Role of communications media of developed nations in 'Third World' regions of globe. Communications as facilitator of international trade. Sp

597 Independent Study (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

598 Internship (3) Professional work in journalism supervised by editor or manager with faculty approval. No retroactive credit for previous work experience. Prereq: Completion of core curriculum. E

Prereqs: Completion of core curriculum.

Prereq: 360 or consent of instructor. E

Prereq: 420 or consent of instructor. Su

Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Prereq: Completion of core curriculum. E

Prereq: Consent of instructor.
MAJOR DEGREES
Law................................................ J.D., J.D.-MBA

Marilyn Yarbrough, Dean

Professors:
N. P. Cohen, LL.M. Harvard; J. G. Cook, LL.M. Yale; J. J. Cobert, J.D. Duke;
R. M. Gray (Emeritus), LL.M. George Washington; P. H. Hardin, J.D. Chicago;
D. S. Jones, J.D. North Carolina; J. H. King (Alumni Distinguished Service Professor);
J. D. Pennsylvania; C. J. Kirby, LL.M. New York; F. W. Lacey (Emeritus), S.J.D.
Michigan; F. S. Le Clercq, LL.B. Duke;
C. H. Miller (Emeritus), J.D. Duke;
E. E. Overton (Emeritus), S.J.D. Harvard;
J. J. Phillips, J.D. Yale; D. H. Rivkin, J.D.
J. D. Vanderbilt; J. A. Sebert, J.D. Michigan;
T. H. Sewell (Emeritus), LL.M. George Washington; J. L. Sobieski, J.D. Michigan;
W. H. Wicker (Emeritus), LL.D. Newberry;
D. Q. Wickham, LL.M. Harvard.

Associate Professors:
G. L. Anderson, LL.M. Harvard;
J. W. Beamans, J.D. Miami; J. P. Black, Jr.,
J. D. Vanderbilt; J. O. Cochran, J.D. Yale;
T. Y. Davies, J.D. Northwestern;
R. L. Dessem, J.D. Harvard; T. D. Eisler, J.D.
R. L. Hendrick, J.D. Gray, J.D. Vanderbilt;
A. M. Hess, J.D. Virginia; J. D. Jones, J.D.
Wyoming; N. Kofele-Kale, J.D. Northwestern;
S. D. Kovac, J.D. Stanford; R. M. Lloyd, J.D.
Michigan; C. Picquet, M.S.L.S. Tennessee;
C. A. Pierce, J.D. Yale; N. D. Russler, J.D.
Harvard; R. S. Wirtz, J.D. Stanford.

Assistant Professors:
R. Best, M.L.S. Florida; R. J. Hill, J.D.
Tennessee.

Instructor:
M. J. Hoover, J.D. Brooklyn Law School.

DEGREE OF DOCTOR OF JURISPRUDENCE
The degree of Doctor of Jurisprudence will be conferred upon candidates who complete, with the required average, six semesters of resident law study and who have 84 semester hours of credit, including all required courses. The required average is 2.0 and that average must be maintained on the work of all six semesters and also for the combined work of the grading periods in which the last 28 hours of credit were earned. Averages are computed on weighted grades. Grades are on a numerical basis from 0.0 to 4.0. A grade of 0.9 or below is a failure. Eligible law students may receive credit towards the J.D. for acceptable performance in up to three (3) upper-level courses taken in other departments at The University of Tennessee. Courses selection and registration are subject to guidelines approved by the law faculty which include the requirement that any such course be acceptable for credit towards a graduate degree in the department offering the course.

DUAL J.D.-MBA DEGREE PROGRAM
The College of Business Administration and the College of Law offer a coordinated dual degree program leading to the conferral of both the Doctor of Jurisprudence and the Master of Business Administration degrees. A student pursuing the dual program is required to take fewer hours of course work than would be required if both two degrees were to be earned separately.

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 of College of Business Administration for the MBA degree, and by the Dual Degree Committee. Students who have been accepted by both colleges may commence studies in the dual program at the beginning of any term subsequent to matriculation in both colleges provided, however, that dual program studies must be started prior to entry into the last 28 hours required for the J.D. degree and the last 16 hours required for the MBA degree.

Curriculum
A dual degree candidate must satisfy the graduation requirements of each college. Dual degree students withdrawing from the dual degree program before completion of both degrees, credit will not be given towards graduation from either college for courses in the other college, except as such courses qualify for credit without regard to the dual degree program. For students continuing in the dual degree program, the J.D. and MBA degrees will be awarded upon completion of requirements of the dual degree program. The College of Law will award credit toward the J.D. degree for acceptable performance in a maximum of 8 semester hours of approved grade-level courses offered by the College of Business Administration. A student shall receive 2 semester hours of credit for each such course successfully completed, and the college specifies otherwise. Two of the 8 semester hours must be earned in Accounting 501, 503, or a more advanced accounting course. If College of Law credit is given for such accounting course, the dual degree student may not receive College of Law credit for Legal Accounting (Law College Course 865).

The College of Business Administration will award credit toward the MBA for acceptable performance in a maximum of 8 semester hours of approved courses offered by the College of Law. 

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

Awards of Grades

For grade reporting 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 College of Law 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 if required by the college for any appropriate purpose in the college offering the course. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

Non-Law Elective Course Credit
Students enrolled in the J.D.-M.B.A program may elect Satisfactory/No Credit towards the J.D. degree for courses taken in other departments of the University except for those taken in conjunction with the dual program.

Satisfactory/No Credit Option

A student may take a limited number of elective law courses on a Satisfactory/No Credit basis in the following circumstances:
1. The student has completed 34 semester hours of law work toward the Doctor of Jurisprudence degree;
2. The student is not on academic probation;
3. The student is not in a law-related course taken in other parts of the University and applied toward the J.D. Degree. A total of two law courses are applied, then no law electives may be taken on an S/N/C basis.

Students electing an S/N/C basis must meet all requirements imposed on students taking the course on a regular grade basis, e.g., attendance, term paper, recitation, etc. Examinations and other work of students electing an S/N/C basis shall not be graded separately or differently from that of other students. For purposes of S/N/C grading, satisfactory shall mean a grade of at least 2.0. A student electing S/N/C who makes 2.0 or above will receive credit for the course, but the grade shall be recorded as S and will not be used in determining grade average. A student electing Satisfactory/No Credit who makes below 2.0 will receive NC for the course and neither the grade nor the hours of the course will be used in computing grade average or hours credit.

A course taken on an S/N/C basis may be used to satisfy a prerequisite only if a grade of 1.0 is achieved. Required courses may not be taken on an S/N/C basis.

Non-law courses must be taken on an S/N/C basis and, for the purpose of the limitation on the number of S/N/C courses that a
WCAT COURSE REQUIREMENT

One upper-level course in which a substantial legal research paper is written under faculty supervision is required for graduation. This requirement may also be satisfied by a directed research project approved by the Academic Standards Committee, or by a faculty approved comment or perspective written for the Law Review.

No single course may be taken to satisfy both the Perspective Course Requirement and the Writing Requirement. These additional required courses may be taken at any time during the second or third year.

LEGAL CLINIC COURSES

Students are eligible to enroll in clinical courses only after the successful completion of their fourth semester (56 semester hours) in addition to meeting other specified prerequisities. Students must enroll in only one clinical course per semester and are limited to a total of two courses. Clinical courses are numbered 850 through 895.

501 Civil Procedure I (3) Introductory course; binding effect of judgments; selecting proper court—jurisdiction and venue; ascertaining applicable law; federal and state practice.

802 Civil Procedure II (3) Pleading, joinder of claims and parties; discovery, trials, verdicts, judgments and appeals; emphasis on Federal Rules of Civil Procedure.

803 Constitutional Law I (3) Judicial review, limitations on judicial power, national legislative power, regulation of commerce, power to tax and spend; other sources of national power, state power to regulate and tax, interpretation of the Constitution; substantive due process; congressional enforcement of civil rights.

804 Contracts I (3) Basic agreement process and legal protection afforded contracts. Problems of offer and acceptance, interpretation, illegality, and statute of limitations.

805 Contracts II (3) Continuation of Contracts I. Remedies, conditions, impossibility and frustration, third party beneficiaries, assignment and delegation, discharge.

806 Criminal Law (3) Substantive aspects of criminal law. General principles applicable to all criminal conduct, specific analysis of particular crimes, substantive defenses to crimes, including insanity, intoxication, mistake, necessity, legal duty, self-defense, and duress.

807 Income Tax I (4) What is income; whose income is it; when is it income; how is it taxed (capital gains and losses, maximum and minimum tax); deductions and credits; rates (corporate, estate, and trust).

808 Legal Process I (2) Court structure; case analysis, case synthesis, and use of cases to predict and influence judicial decisions; legislative process; statutory interpretation; influence of judge as policy-maker; adversary system and lawyer's role. Use of legal authority in periodic written exercises.

809 Legal Profession I (2) Role of lawyer in society and ethical responsibilities implied in that role; admission to the bar; the organized profession, solicitation, advertising, unauthorized practice, conflicts of interest, decision to represent or withdraw as counsel; fiduciary relationship, advocacy and its limitations, fees, and disciplinary procedures.

810 Legal Bibliography and Research (1) Instruction in legal bibliography, citation form, and research methodology, including computerized research. Identification and location of authorities required to prepare a law office memorandum relating to an identifiable legal problem; S/N/C only.

811 Writing and Advocacy I (2) Legal writing exercises, effective communication of ideas. Preparation of brief and oral argument.

812 Constitutional Law II (3) Freedom of expression, association and religion; Fourteenth Amendment rights; protection of property rights.

813 Property I (3) Freehold estates, future interests, concurrent ownership, leases; real estate contract and deed; principles of personal property.

814 Property II (3) Recording system, title assurance, easements, nuisance, lateral support, water rights, zoning, and eminent domain.

815 Torts I (3) Intended interference with the person, assault and battery, false imprisonment, negligence, affirmative duties, immunities, actual causation, and contributory causes.

816 Torts II (Negligence, right within the risk, or proximate cause. Assumption of risk and contributory fault; interference with property, trespass, conversion, possession; privileges, strict liability, liability of suppliers and contractors; misrepresentation; defamation; unjustifiable litigation; privacy; interference with contractual relations.

820 Administrative Law I (3) Administrative agencies and process; delegation and interpretation of powers; investigatory and rule-making procedures and requirements; adjudicative procedures, evidence, findings, scope of review.

821 Admiralty (3) Admiralty courts and jurisdiction; death and injury to persons, special provisions concerning various maritime workers; carriage of goods by ships; principles governing collisions and liability.

822 American Legal History I (3) Historical development of law, legal institutions, legal profession, and legal education from colonial times to present; historical relationship of legal system to society.

823 Antitrust (3) Federal antitrust laws; monopolization, price-fixing, group boycotts, and anticompetitive practices generally; government enforcement techniques and private treble-damage suits.

824 Bills and Notes (2) Negotiable instruments, negotiability, transfer, holders in due course; equity and defenses; liability of parties; discharge; letters of credit. Arts. 3, 4, and 5 of Uniform Commercial Code.

825 Business Associations (4) Legal forms of cooperative business enterprise; agency, partnership, limited liability, corporation.

828 Criminal Procedure I (3) Pre- and post-trial procedures in a criminal case: bail, preliminary hearing, grand jury, pretrial detention, discovery, speedy trial, plea bargaining, and post-conviction relief.

830 Comparative Law I (3) General introduction to civil law systems of France and Germany, focusing on legal institutions, methodology and aspects of law of obligations and commercial law.

831 Conflict of Laws I (3) Jurisdiction, foreign judgments, choice of law, constitutional limitations, reversion, and classification.

832 Constitutional Law II (3) Freedom of expression, association and religion; Fourteenth Amendment rights excluding rights of criminally accused, including discrimination in criminal law; cases, conditions, impossibility and frustration, third party beneficiaries, assignment and delegation, discharge.

836 Criminal Procedure II (3) Police practices and rights of persons charged with crimes: arrest, search and seizure, identification, interrogation, entrapment, electronic eavesdropping, right to counsel, and jury trial.

840 Debtor-Creditor Law I (3) Enforcement of judgments; bankruptcy and its alternatives for the business and consumer; emphasis on federal bankruptcy statutes.
915 Environmental Protection Seminar (2) Problems of initiating in defense of environment and mobilizing public and private efforts in defense of environment. Problems of proving environmental impact of selected projects, interpretation and evaluation of scientific data, use of expert witnesses. Special environmental concerns of region, e.g., TVA operations, strip mining, forest management, wildlife preserves. Team-teaching and selected experts. Prereq: 844.

917 Estate Planning Seminar (2) Problems of estate planning both inter vivos and testamentary; advantages and disadvantages of various types of ownership; law and practice of fiduciary administration, insurance, wills, future interests, trusts, corporations, partnerships, and gifts as related to estate planning; research on assigned topics; drafting of estate plan for hypothetical fact situations. Prereq: 841 and 885.

919 International Law Seminar (2) Current international law problems; paper required. Prereq: 854.

921 Juvenile Law Seminar (2) Unique history and philosophy of juvenile justice system; jurisdiction, judicial and extrajudicial functions of juvenile court, and research on assigned topics; drafting of estate plan for hypothetical fact situations. Prereq: 841 and 885.

923 Labor Relations Law Seminar (2) Selected labor relations law problems.

925 Land Acquisition & Development Seminar (2) Alternative business forms and major documents (notes, deeds, contracts) necessary to accomplish acquisition or development of large pieces of raw land prepared and presented for seminar discussion. Prereq: 861.

927 Law and Current Problems Seminar (2-3)

929 Law and Medicine Seminar (2) Medical professionals; involvement in judicial process; medical malpractice and alternatives to fault-based liability; responsibilities for disposition and care of dead bodies and organ transplantation; expert medical proof and testimony; medicolegal aspects of euthanasia; legal import of medical profession's various canons of ethics.

931 Law and Mental Health Seminar (2) Psychiatric principles, roles of psychiatrist, and relationship to role of legal counsel; assigned readings; field work in mental health clinic; jointly taught by law professor and psychiatrist.

933 Office Practice Seminar (2) Techniques of law office management, methods and practice: techniques in preparation of various legal instruments, official documents, interviewing and counseling, management of personnel.

935 Seminar in the Professional Competence of the Lawyer (2) Typical situations in which malpractice claims arise: third party claims, conflicts of interest, breach of fiduciary duties; examination of difficult problems of proof including use of expert testimony.

937 Trade Regulation Seminar (2) Antitrust laws and practice of fiduciary administration, insurance, wills, future interests, trusts, corporations, partnerships, and gifts as related to estate planning; research on assigned topics; drafting of estate plan for hypothetical fact situations. Prereq: 841 and 885.

997 Law and Current Problems Seminar (2-3)

520 Information Sources and Services (3) Information sources in social sciences: political science, sociology, psychology, geography, history, anthropology; sources and services in business, education, and law. Prereq: 520. Sp

521 Technical Services I (3) Technical services principles and techniques: acquisitions, basic manual and automated cataloging, structure and use of library catalogs, basic subject organization and indexing. E,Su,A

522 Technical Services II (3) Library of Congress subject organization and description, automated cataloging and catalog, cataloging of serials and more difficult materials. Prereq: 520. Sp

530 Information Sources and Services (3) Basic bibliographic and information sources, online databases, interview and search techniques, selection and evaluation of information collections and development and evaluation of services. E,Su,A

531 Sources and Services for the Social Sciences (3) Information sources in social sciences: political science, sociology, psychology, geography, history, anthropology; sources and services in business, education, and law. Prereq: 530. Sp

532 Sources and Services in Science and Technology (3) Information sources in engineering, physical and life sciences. Prereq: 530. Sp

533 Sources and Services for the Humanities (3) Information sources in literature, philosophy, religion, fine arts, performing arts, literature and language, and history. Organization of collections for optimum use. Prereq: 530. Su
580 Foundations of Information Science (3) Identifies and viewing guidance to meet adult interests; developing categories, popular and standard; reading, listening, and viewing guidance for individuals and groups. Services for children and young adults. Reading, listening, and viewing of useful materials. This will be achieved by excellent teachers. Prereq: 571 or 572 or consent of instructor. E, Su, A

580 Information Retrieval System Design (3) Characteristics of information retrieval system design, and a survey of the current state of the art. Prereq: 580 or consent of instructor. F, Sp

581 Information in Society (3) Characteristics of an information society, including its social and political implications. Prereq: Consent of instructor. F, Sp

582 Automation (3) Computer concepts and their applications to library and information center operations. Prereq: 581 or consent of instructor. E, Su

583 Information Systems Analysis and Design (3) Tools and methodologies in library/information agency systems planning and implementation. Role and training of systems analyst, systems study from planning through implementation and evaluation, and related topics. Sp

584 Bibliographic Database Design (3) Design and construction of bibliographic databases, record and database structure, document representation, indexing, abstracting, thesaurus construction and maintenance, and information retrieval. Sp

585 Information Technologies (3) Computer-based and non-computer related media and methods for information retrieval, and transfer within and external to library/information center environment; existing and prototype systems and interfacing of technologies. Prereq: 582 or consent of instructor. Sp

589 Problems in Library and Information Science (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

591 Supervised Readings in Library and Information Science (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

592 Independent Study (3-6) Prereq: Consent of advisor. Maximum 6 hrs.

599 Practicum (3) Opportunity to translate theory into practice under guidance of qualified information professional. Prereq: Completion of courses relevant to student's practicum design. Written consent of advisor and approval of practicum coordinator. May be repeated with consent of advisor and practicum coordinator.

Life Sciences (Office of the Provost)

MAJOR DEGREES

Life Sciences ................................ M.S., Ph.D.

Coordinating Council:
H. I. Adler (Chair); Physiology: R. Bagby; Biotechnology: D. K. Dougall; Cellular, Molecular and Developmental Biology: J. M. Becker; Environmental Toxicology: W. R. Forkas; Ethology: G. B. Burghardt; Plant Physiology and Genetics: O. J. Schwarz.

The programs leading to the M.S. and Ph.D. degrees in Life Sciences are interdepartmental and intercollegiate programs which supplement the programs of individual departments.

The Life Sciences Council supports studies and research in the following concentrations: physiology, biotechnology (M. S. only); cellular, molecular and developmental biology; environmental toxicology; and plant physiology and genetics. Students interested in any of these areas should contact either the chair of Life Sciences or the director of the area of interest. Each program is overseen by a committee and may have unique admission and graduation requirements.

ADMISSION REQUIREMENTS

1. A Bachelor's degree with a major in a biological, behavioral, or physical science.
2. GRE (general) scores.
3. Three letters of recommendation.
4. Course work including a year of calculus (differential and integral), one year of chemistry, and a year of physics. Specific course deficiencies may be corrected during the first year.

DEGREE REQUIREMENTS

The Master's degree requires a minimum of 30 semester hours of study approved by the student's committee, a thesis, and an oral examination. Within the biotechnology program only, a non-thesis M.S. option is available. Students choosing this option are expected to complete: (1) two summers' co-op experience in an appropriate industry. An evaluation by supervisor and a written report are required (529, Biotechnology Practicum Cooperative Experience, maximum 4 hrs.); (2) A written report in the form of a scientific paper in an area of specialization chosen by the student and advisor. The minimum requirements for the doctoral degree include at least 6 hours above the 600 level, 24 semester hours of course 660, a pattern of courses approved by the student's committee, a comprehensive examination, a doctoral dissertation, and a defense of dissertation. Individual programs may have additional requirements.

CONCENTRATIONS

Biotechnology

The biotechnology program will prepare students to participate in the wide variety of opportunities presented by the use of living cells and their components for the production of useful materials. This will be achieved at the M.S. level by a prescribed course of study for the biology and biochemistry of cells and molecules in the first year; by further formal study in areas of specialization in the second year; and by the development of special expertise in areas such as animal embryo manipulation, automated chemical synthesis of macromolecules, bioprocess engineering, bioproducts and biotransformations, liposomes, microscopy and image processing, monoclonal antibodies and hybridoma technology, plant tissue culture, recombinant DNA technology and risk assessment, and modeling. The production of a research thesis or an industrial co-op experience plus an area of specialization will also be an integral part of the training experience. Required courses are Life Sciences 509, 511, 512, 531, 532: Biochemistry 511; Microbiology 410; Botany 451; Chemical Engineering 475; and Zoology 507.

Cellular, Molecular and Developmental Biology

The interdepartmental program in cellular, molecular, and developmental biology includes research in structural or functional aspects of cells or subcellular components, or the interactions between cells. Required courses are Life Sciences 511, 512, 531, and 532.
Environmental Toxicology

The toxicology program provides intensive training in basic toxicological principles and techniques. Courses and research expose trainees to mechanisms of intended and unintended interactions between living systems and potentially toxic agents from the point of view of biochemistry, physiology, ecology, public health, environmental law and regulation, pest management, pollution control and repair, and testing and residue analysis of toxicants.

Required courses are Biochemistry 561, 562, 604; and Life Sciences 510.

Ethology

Ethology is the naturalist study of normally occurring animal and human behavior. The program provides intensive training in basic ethology with specialized studies available in the development, evolution, and physiology of behavior; human ethology; and behavioral ecology and sociobiology.

Required courses for the Master's are Psychology/Zoology 450, 459; Zoology 524, 583; Statistics 531-32; and Zoology/Psychology 516.

The Ph.D. requirements are the same as for the Master's with the additional requirement of one additional statistics course and six semester hours of courses numbered above 600 approved by student's committee.

Physiology

The inter-departmental program in physiology includes research in the areas of cellular, comparative, developmental, exercise, muscle, neuro-physiology, regulatory, or reproductive.

Required courses are Zoology 520, 521, 240, 350, 420; Biochemistry 410; four 600-level semesters; and a statistics sequence.

Plant Physiology and Genetics

This program provides the opportunity for intensive training and research experience in areas transcending the usual boundaries of botany, biochemistry, and agricultural plant sciences. It devotes itself to seeking solutions to problems concerning the interactions of physiology and genetics in applied and fundamental aspects of plant science.

Required courses are Life Sciences 510; Botany 521, 522; Biochemistry 511, 512; Plant and Soil Science 551, 571; Microbiology 410.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

509 Biotechnology Seminar (1-2) Topics of importance to biotechnology. May be repeated. Maximum 9 hrs.

510 Special Topics in Life Sciences (1-3) Specializations in biotechnology; cellular, molecular, and developmental biology; environmental toxicology; ethology; plant, physiology and genetics; and physiology. May be repeated. Maximum 9 hrs.

511 Advanced Cellular Biology (3) Cell structures and functions at molecular and supramolecular level. Membrane structure, function, and biogenesis; cellular communication: receptors and membrane flow; growth regulation and oncogenes; plant cell structure and function; contractility and motility; mastosis and mastocytes; blood and immune cells.

512 Advanced Molecular Biology (3) (Same as Biochemistry 512.)

525 Research Practicum in Life Sciences (1-3) Individual sections for each of biotechnology: cellular, molecular, and developmental biology; environmental toxicology; ethology; plant physiology and genetics; and physiology. May be repeated. Maximum 9 hrs.

529 Biotechnology Practicum Co-operative Experience (2) Work experience in commercial or organizational organization for students undertaking non-thesis option of biotechnology concentration. Evaluation by supervisor and written report by student. May be repeated. Maximum 4 hrs.

531 Biotechnology Laboratory (3) Growth of microorganisms, analysis of extracellular and intracellular components.

532 Biotechnology Laboratory (3) Pilot scale yeast cultivation, enzyme isolation, purification and characterization. Application of purified enzymes to food production fermentations and fermentation process control.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

610 Advanced Topics in Life Sciences (1-3) Topics vary. May be repeated. Maximum 6 hrs.

Logistics

See Marketing, Logistics and Transportation

Management

(Office of Business Administration)

MAJOR DEGREES

Business Administration

Ronald W. Boling, Acting Chair

Professors:

R. W. Boling, Ph.D. Stanford; H. D. Dewhurst, Ph.D. Texas; M. E. Gordon (Alumni Distinguished Service Professor), Ph.D. California; A. H. Keally (Emeritus), MBA Pennsylvania; E. M. Larson, Jr., Ph.D. Purdue; C. R. Neel, Ph.D. Alabama; S. K. Reed, Ph.D. Edinburgh; D. Reese (Emeritus), Ph.D. Iowa; E. R. Smith, Ph.D. Ohio; S. C. Vance (Emeritus) (William B. Stokely Professor of Strategic Management), Ph.D. Pennsylvania; G. A. Wagener (Emeritus), Ph.D. Indiana; G. H. Whitlock (Emeritus) (Alumni Distinguished Service Professor), Ph.D. Tennessee; M. S. Worman, Jr., (William B. Stokely Professor of Strategic Management), Ph.D. Minnesota.

Associate Professors:

O. S. Fowler, Ph.D. Georgia; K. C. Gilbert, Ph.D. Tennessee; R. T. Ladd, Ph.D. Georgia; R. C. Maddox, Ph.D. Texas; M. C. Rush, Ph.D. Akron.

Assistant Professors:


BUSINESS ADMINISTRATION CONCENTRATIONS

For complete listing of MBA and Ph.D. program requirements, see Business Administration.

MBA Concentrations

Management

Forest Industries Management

Minimum Course Requirements for MBA

Concentrations: Management—Three courses from the following: 511, 513, 521, 541, 542, 551, 571, 593. Selection must be approved by the Management Department MBA advisor. Forest Industries Management — 511, 513, Forestry 560, 565.

Ph.D. in Business Administration

Concentration

Management (Operations Management and Strategic Management)

Minimum Course Requirements for Ph.D.

Concentration: Operations Management — 541 and 542; two semesters of 640 (may be repeated for credit); one additional semester of approved doctoral seminar work; Strategic Management — 513, 610, 611, 612.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

504 Management of Organizational Behavior (3) Integration of individual and group differences, organizational theory and design, motivation, leadership, human resources planning, and career implications with strategy, planning, and decision making.

505 Operations and Logistics Management (3) Concepts and techniques for managing operations and distribution systems. (Same as Transportation 505.)

511 Organizational Theory: Integrated Structure and Behavior (3) Cases, group projects, discussion; organizational theories, organizational effectiveness; contextual factors of organizations; environment, size, technology; organizational structure configurations, organization design; social influences on organization effectiveness; management of group behavior, intergroup relations, organization change and development.

513 Strategic Planning (3) Theoretical and applied literature, successful strategic positioning of business in a variety of environments. Analysis of industry notes and case histories. Coreq: Business Administration 509.

521 Personnel Administration (3) Personnel functions and human resources management. Community relations, recruiting, selection, training, performance evaluation, wage and salary administration, legal framework as it affects personnel.

522 Labor Relations and Collective Bargaining (3) American labor history, labor law, philosophy of bargaining, dispute settlement, and contract administration. (Same as Economics 582.)

525-26 Industrial and Organizational Psychology (1-3, 3-3) Readings in industrial and organizational psychology. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 6 hrs. S/NC or letter grade.

531 Management of Technology-Based Organizations (3) Role of technology and innovation in formulation and implementation of strategy, Management of research and development function and coordination with other functions. Management of scientists and engineers.

541 Operations Management (1) Techniques applicable to decision of systems in operations function.
and organizational psychology. 1 hr per chology (1-12) Supervised field practice in industrial
690 Field Work in Industrial and Organizational Psychology (1-12) Supervised field practice in industrial
and organizational psychology, 1 hr per 30 hrs of practice. May be repeated. Maximum 12 hrs. (Same as Psychology 690.)
computer science, a high degree of
mathematical maturity to enhance a potential
career in management, research, or teaching.

Admission and Degree Requirements
The doctoral program requires three
Graduate School Rating Forms and the GRE
or GMAT. General University requirements
for the doctoral degree are stated on page
22.

Course Work
A minimum of 48 semester hours of
course work taken for graduate credit (exclu-
sive of thesis or dissertation) is required. Some
of this may be the course work from a
Master's program although a Master's is not
a prerequisite for the doctorate. The can-
didate must complete a minimum of 24
semester hours at The University of Tennes-
see, Knoxville, at least 6 of which must be at
the 600 level. Both of these requirements
are also exclusive of thesis or dissertation
credits. Entering students who have completed
course work in applicable fields will be
granted course credits for work which is
equivalent to required courses in the pro-
gram.

The program includes approximately 16 to
20 semester hours of course work in the
applied area.

Qualifying Examinations
The student must demonstrate mastery of
probability theory and statistical inference, Statistics 563, 564, by passing a written
qualifying examination. Mastery of 12 to 14 semester hours in
mathematics course work must be demon-
strated by passing a written qualifying examination. Topics normally include
numerical analysis, either Mathematics 471, 472, 453, and 571, or 571-572, and real analysis,
Mathematics 445-446. Other options may be
approved. In exceptional circumstances, the
faculty will consider waiving the mathematics
and/or statistics qualifying examinations.

These requirements generally are com-
pleted by the end of the first year of the
program. There is no foreign language requirement.

Comprehensive 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 comprehensive exami-
nation 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 integrat-
ing ability that goes beyond simple mastery of
course content.

Research and Dissertation
The student must complete 24 semester
hours of Management Science 600. 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 disserta-
tion and such other segments of the
program that the faculty committee deems
appropriate. This effort, which is beyond
the minimum 48 hours of course work, normally
is completed in the third year of the pro-
gram.

PREREQUISITES FOR MANAGEMENT
SCIENCE COURSES
The Management Science Program is
interdisciplinary and students in other degree
programs are encouraged to enroll in man-
gagement 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.

BUSINESS ADMINISTRATION
CONCENTRATION
For complete listing of MBA program
requirements, see Business Administration.

MBA Concentration
For students whose MBA concentration is
area Management Science, the MBA Core
is revised as follows: substitute Management
Science 531 for 501, Statistics 563 for 501,
and with approval of student's advisor, sub-
stitute Statistics 564 for 501. The
concentration area must include Manage-
ment Science 532 and 534.

500 Thesis (1-15) P/NP only. E
501 Quantitative Analysis for Management Decisions
(3) Assignment, transportation and general linear pro-
gramming problems; decision theory, Markov chains
and queuing. Prereq or coreq: Statistics 501. Not avail-
able for students with credit for 531.
502 Registration for Use of Facilities (3-15) Required
for the student not otherwise registered during any
semester when student uses University facilities and/or
teaching faculty time before degree is completed. May not
be used toward degree requirements. May be repeated.
S/NC only. E
531 Mathematical Programming (3) Linear programming
procedures, duality and sensitivity analysis. Network
flows, integer, and nonlinear programming. Prereq:
Fundamentals of matrix algebra and differential cal-
culus, proficiency in computer language.
532 Stochastic Models in Management Science (3)
Dynamic programming, Markov chains, Markov deci-
sion processes and applications to queuing, inventory and reliability. Prereq: Statistics
511 and proficiency in computer language.
533 Computational Mathematical Programming (3)
Advanced modeling, computational and reporting tech-
niques in practical mathematical programming. Prereq:
531 and proficiency in PASCAL.
534 Application of Management Science Methods
(3) Application of methods from 531 and 532 to real
world problems. Exposure to existing problem in indus-
try or elsewhere.
541 Modeling of Production Systems (3) Models for
production planning based on linear and dynamic pro-
grammation, network and stochastic models. Static and
dynamic models, Multi-product, multi-stage and multi-
period planning. Models for material handling, flow,
and machine selection. Prereq: 531, 532.
561 Special Topics in Management Science (3) Prereq:
Consent of instructor. May be repeated. Maximum 9 hrs.
593 Management Science Problems (1-6) Directed
study on subject of mutual interest.
600 Doctoral Research and Dissertation (3-15) P/NP
only. E
621 Network Flows (3) Treatment of network optimization
algorithms, transportation and transshipment models
and primal-dual and primal-basis tree methods. Prereq:
531 or equivalent.
631 Integer Programming (3) Theoretical and com-
putational aspects of linear programming with integer
variables, branch and bound, cutting plane, and group
theoretic algorithms. Prereq: 531 or equivalent.
641 Large Scale Mathematical Programming (3) Micro
and macro structure in large scale systems. Decom-
position, factorization and parameteric methods. Model
validation and management. Prereq: 531, 533.
651 Nonlinear Optimization (3) Solution of con-
strained and unconstrained nonlinear programming
problems. Practical algorithms that perform well in
recent practice. Prereq: 531 or equivalent.
661 Queueing and Inventory Models (3) Single queue
systems, birth-death processes and more general serv-
ice and arrival patterns. Single and multiple customer
types. Networks of queues, just-in-time production.
Reorder point and periodic review inventory models.
Optimal control of inventory and queueing systems.
Hierarchical control. Prereq: 532.
683 Modeling and Simulation (3) Simulation model-
ing perspectives. Data collection and analysis. Random
variate generation and validation. Network modeling.
Discrete event and continuous models. Model valida-
691-92 Management Science Seminar (1,1) Sub-
jects selected from current literature.

Marketing, Logistics and
Transportation
( College of Business Administration)

MAJOR
DEGREES
Business Administration........... MBA, Ph.D.
David J. Barnaby, Chair

Marketing

Professors:
D. J. Barnaby, Ph.D. Purdue; E. R. Cadotte,
Ph.D. Ohio State; R. L. Jenkins, Ph.D. Ohio
State; W. B. Locander, Ph.D. Illinois; R. B.
Woodruff, DBA Indiana.

Associate Professors:
J. R. McMillan, Ph.D. Ohio State; R. C. Reizenstein, Ph.D. Cornell; J. O. Rentz,
Ph.D. Georgia.

Assistant Professors:
D. J. Faulds, Ph.D. Iowa; S. F. Garcia, Ph.D.
Houston; D. W. Schumann, Ph.D. Missouri
(Columbia); P. S. Speck, Ph.D. Texas Tech.

BUSINESS ADMINISTRATION
CONCENTRATIONS
For complete listing of MBA and Ph.D.
program requirements, see Business Admin-
istration.

MBA Concentration
Marketing
Minimum Course Requirements for MBA
Concentration: Three courses from the fol-
lowing: 503, 504, 505, 506, 550, 593, 599,
Transportation 507, Business Administration 599.
501 Marketing Management (3) Marketing viewed as total system designed to plan, promote, and distribute goods and services to household consumers and industrial users. Demand analysis as basis for marketing decisions. Prereq: 501.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used to fulfill degree requirements. May be repeat ed. S/NC only. E

503 Buyer Behavior—Analysis for Marketing (3) Consumer behavior concepts and processes developed and applied to marketing analysis and design, and control of marketing programs. Social psychology and demographic factors that affect consumer product, brand and patronage decisions. Prereq: 501.

504 Analyzing Market Opportunity for Marketing Decisions (3) Major determinants of opportunity in markets, framework for finding and analyzing these opportunities for opportunity, application of market opportunity analyses to marketing strategy decisions. Prereq: 501.

505 Marketing Research and Information Planning (3) Design of a rigorous marketing study from inception to implementation of results by recognizing key decision points and critically evaluating merit of research project. Prereq: 501.

506 Marketing Strategy (3) Integration of concepts and analytical skills from each component area of marketing to formulate cohesive, well-organized marketing program. Prereq: 501.

550 Market Opportunity Analysis for New Ventures (3) Concepts for understanding coverage of new ventures, new markets, and various information sources and procedures; identify and analyze sales opportunities in markets for new product or service. Prereq: Consent of instructor.

593 Independent Study (3) Directed research and study. Prereq: MBA Core and consent of instructor. May be repeated. Maximum 6 hrs.

599 Special Topics Seminar (3) Topics vary: business marketing applications, macroenvironmental issues, market segmentation, international marketing, marketing campaigns, marketing channels, and related issues. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Marketing Theory (3) Nature and scope of marketing, role of theory development and theory testing important to marketing research. Prereq: 502.

602 Research Methods I (3) Research process: problem formulation, research and experimental design, measurement and implementation of results. Design: experimental design, survey research, and measurement. Prereq: 503.

603 Marketing Thought (3) Marketing literature across number of research areas. Evaluate individual works, determine state of research in each area, and identify areas that merit further study.

604 Seminar in Buyer Behavior Research (3) Behavioral study of people in their roles as buyers and users of goods and services both individual and group processes.

605 Research Methods II (3) Analytical approach to marketing decisions and role of quantitative methods. Models and model building in marketing: consideration of decision theory, linear programming, simulation and other mathematical representations of marketing phenomena.

606 Special Topics (3) Topics vary: marketing strategy, advanced consumer behavior, influence and persuasion theory and strategy, pricing issues, international marketing issues, and nonprofit organization marketing issues.

Transportation and Logistics


Associate Professor: J. H. Foggin, DBA Indiana.

BUSINESS ADMINISTRATION CONCENTRATIONS

For complete listing of MBA and Ph.D. program requirements, see Business Administration.

MBA Concentration

Transportation and Logistics Minimum Course Requirements for MBA Concentration: 501, 508, and one course from the following: 503, 504, 506, 507, 593, and 599.

Ph.D. in Business Administration Concentration

Transportation and Logistics Minimum Course Requirements for Ph.D. Concentration: 12 hours to include 601, 602, 603.

501 Survey of Logistics and Transportation (3) U.S. logistics and transportation: physical, economic, social, and political environment; financing, managing, maintaining, and enhancing U.S. transport infrastructure.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used to fulfill degree requirements. May be repeated. S/NC only. E

503 Logistics and Transportation Economics and Policy (3) Economics and legal principles which shape formation and administration of logistics and transportation policy in U.S.

504 Freight Carrier Systems and Management (3) Analysis of freight carrier management's efforts to provide services demanded by consumers in logistics and transportation marketplace.

505 Operations and Logistics Management (3) (Same as Management 505.)

506 Logistics Systems Management (3) Development of strategy for management of logistics systems. Executive level integration of logistics operations with marketing, production, and other decision areas. Practical applications through case approach and simulation game.

507 International Logistics and Transportation (3) Logistics strategy in the multi-national firm: materials management, international sources and distribution, and importing/exporting. Issues: international carrier management and operations and comparative national transport systems analysis.

508 Executive-In-Room Seminar in Logistics and Transportation Strategy (3) Capstone, integrative case course in logistics and transportation strategy; participation in Executive-In-Residence program that provides student interaction with top-level logistics and transportation executives.

593 Independent Study (3-6) Directed research and study. Prereq: Consent of instructor. May be repeated.

599 Special Topics Seminar (3) Fundamental research process in areas of logistics and transportation, history and development of body of knowledge, and contemporary research methodology to develop student dissertation topics.

Materials Science and Engineering

(PhD only)

DEGREES

MAJORS

DEGREES

Metallurgical Engineering..............M.S., Ph.D.
Polymer Engineering................M.S., Ph.D.

Joseph E. Spruill, Head

Professors: K. H. G. Ashbee, Ph.D. Birmingham (England); D. C. Bogue, Ph.D. Delaware; B. S. Borie, Ph.D. Massachusetts Institute of Technology; C. R. Brooks, Ph.D. Tennessee; R. A. Buchanan, Ph.D. Vanderbilt; E. S. Clark, Ph.D. California (Berkeley); D. A. Canonic, Ph.D. Lehigh; F. Fellers, Ph.D. Akron; J. S. Lin, Ph.D. Kansas; C. D. Lundin, Ph.D. Rensselaer Polytechnic Institute; C. J. McAuliffe, Ph.D. Kentucky; B. F. Oliver, Ph.D. Pennsylvania State; J. P. Phillips, Ph.D. Liverpool (England); J. E. Spruill, Ph.D. Tennessee; E. E. Stansbury (Emeritus), Ph.D. Cincinnati.

Associate Professors: W. T. Becker, Ph.D. Illinois; J. Bentley, Ph.D. University of Salford (England); D. M. Krogser, Ph.D. Vanderbilt; C. T. Liu, Ph.D. Brown University; T. T. Meek, Ph.D. Ohio State; A. J. Pedraza, Ph.D. National University (Argentina); C. L. White, Ph.D. Michigan Tech. University.

Assistant Professor: R. S. Benson, Ph.D. Florida State.

Lecturer: George D. Wignall, Ph.D. Sheffield (England).

Graduate programs are offered leading to the degrees of Master of Science and Doctor of Philosophy in Metallurgical Engineering or Polymer Engineering. Both the metallurgical
and polymer programs are flexible and interdisciplinary in nature. Students may be admitted from a wide range of disciplines; these include physics, chemistry, chemical engineering, mechanical engineering, electrical engineering, materials engineering, and engineering science programs. Prospective students should consult materials science and engineering faculty concerning development of individual concentrations or special programs compatible with their backgrounds and goals.

Areas of concentration within the metallurgical engineering program include rheology and physical behavior of materials; failure analysis; and mechanical and physical behavior of materials. Specializations in electronic and ceramic materials are available.

Areas of concentration within the polymer engineering program include rheology and polymer processing; polymer morphology; mechanical, physical and chemical behavior of polymers; and composite materials.

THE MASTER’S PROGRAM

Departmental requirements include the satisfactory completion of:
1. A major consisting of 12 to 18 semester hours of graduate courses in metallurgical engineering, polymer engineering. The Polymer Engineering major must include Polymer Engineering 511, 512, 541, 551-2. (Substitutions may be acceptable for students with significant experience in polymer research.)
2. One or two minors or cognate work, 6 to 12 hours total in engineering, chemistry, mathematics, physics, or other related fields.
4. Active participation in graduate seminars in the department. Resident students must register for the appropriate 501 every semester offered.

THE DOCTORAL PROGRAM

Students applying for entrance into the doctoral program must display 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.

Departmental requirements consist of the satisfactory completion of:
1. Graduate courses in materials science and engineering, metallurgical engineering, or polymer engineering amounting to approximately 24 semester hours, at least 8 of which must be in 600 series courses.
2. Supporting courses in related scientific and engineering fields amounting to approximately 24 semester hours, subject to approval by the student’s faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.
3. The comprehensive examination, usually given in two parts, and covering such topics as materials science and engineering, metallurgical or polymer engineering operations and processes, thermodynamics, technology, materials, and engineering, chemistry, and other related fields.
4. Active participation in graduate seminars conducted by the department. Resident students must register for the appropriate 501 every semester offered.

Materials Science and Engineering

414 Corrosion Science and Engineering (3) Mechanisms and control of corrosion and degradation processes; thermodynamics and electrode kinetics of corrosion reactions; electrochemical measurement techniques; applications to design. Prereq: 201 or equivalent.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when the student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

505 Engineering Analysis (3) (Same as Chemical Engineering 565.)
521 Chemical Thermodynamics (3) Enthalpy and entropy of mixing, Gibb’s function and chemical potential methods of measuring activity; solution theories; phase rule; heat capacity of gases, liquids and solids; calculation of phase diagrams. Prereq: Metallurgical Engineering 303 or equivalent.

541 Electron Microscopy (3) Operation of electron microscope; kinematical and dynamical diffraction theories; structure determination; analysis of lattice defects. Prereq: 331 or equivalent.

551 X-Ray Diffraction (3) Symmetry of crystals, space group theory, reciprocal lattice and application to definition of structures; powder and single crystal x-ray techniques; introduction to crystal structure determination; characterization of orientation; application to inorganic, metallic and polymer structures.

552 Biomaterials Analysis and Development (3) Physical-property limitations of current surgical implant materials and methods of improvement; resistance to corrosion and mechanical damage; detrimental effects of specific metal ions; development of new biomaterials and new materials processing techniques. Prereq: 315, 414 or consent of instructor.

562 Formability of Materials (3) Modeling and analysis of finite plastic strain with application to primary and secondary forming operations; crystalline and noncrystalline materials; flow localization, instability, predictive testing. Prereq: Consent of instructor.

Metallurgical Engineering

411 Materials Process Design (3) Property control through composition, thermal and mechanical processing of materials. 6 credit hours: casting and nonferrous alloys. Prereq: Materials Science and Engineering 201 or equivalent: F

421 Fabrication (3) Principles and processes of welding, casting and powdery metallurgy; solidification, segregation, heat flow, microstructure, residual stresses, thermal treatments, sintering; non-destructive testing. Prereq: 301, 302. 3 hrs or 2 hrs and 1 lab. F

422 Chemical Process Metallurgy (3) Application of chemical thermodynamics to metallic processing. Ferrus and nonferrous pyrometallurgical refining, slagmetal equilibria, solidification, gas-metal processing. Prereq: 303, Sp

431 Mechanical Metallurgy I (3) Mechanical properties from tensile to elastic behavior, description of stress, strain, and stress-strain relations; plane stress and plane strain loading; failure by yield; stress concentration; brittle fracture due to loading rate and to plastic and flaw geometry. Prereq: Materials Science and Engineering 201, and Engineering Science and Mechanics 321. F

432 Mechanical Metallurgy II (3) Brittle fracture due to metallurgical and environmental factors; stress-life and strain-life fatigue analysis; residual stresses; creep and stress-rupture; finite plastic strain, ductile fracture; fracture by fatigue, necking, cracking, stretch forming, formability testing. Prereq: 431; or Mechanical Engineering 489, Materials Science and Engineering 201 or equivalent. Sp

501 Graduate Seminar (1) Prereq: Admission to graduate program. May be repeated. S/NC only. E

511 Defects in Crystals (3) Analytical and experimental analysis of defect interactions in solids. Prereq: 431 or consent of instructor.

521 Plastic Deformation (3) Geometry and mechanics of single crystal plastic deformation; slip, twinning, and cleavage, work hardening, effect of temperature, loading rate effects; effect of ordering and solid solution alloying; polycrystalline behavior in terms of single crystal deformation mechanisms; texture formation. Prereq: 301, 302 or consent of instructor.

522 Metallurgical Thermodynamics (3) Applications of chemical thermodynamics to metallurgical problems: refining, oxidation, surface treatments, alloy systems. Prereq: Materials Science and Engineering 521 or equivalent.

531-32 Welding Metallurgy (3,3) Welding processes; physical metallurgy of welding; phase transformation; heat flow; residual stresses; theories of hot cracking, cold cracking and porosity formation; applications to process utilization.

541 Diffusion in Solids (3) Phenomenology and atomic mechanisms of diffusion in solid state. Solution and applications of diffusion equations; random walk problem and mechanisms of diffusion; diffusion in dilute and concentrated alloys; Kirkendall effect; high diffusivity paths.

542 Phase Transformations (3) Thermodynamics of phase equilibrium, theory of nucleation in solids; kinetics and morphology of diffusion controlled growth; kinetics of interface controlled phase transformations; crystallography and kinetics of martensitic transformations.

551 Advanced Corrosion (3) Analyses of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors contributing to pitting, crevice, fretting, wear, fatigue and stress corrosion. Prereq: Materials Science and Engineering 414 or consent of instructor.


591-92 Special Topics in Metallurgical Engineering (3,3) Recent advances in metallurgical engineering. Prereq: Consent of instructor. May be repeated.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

611-12 Theoretical Metallurgy (3,3) Topics in solid state physics as applied to metallurgy; introduction to quantum theory, specific heats, electron theory of solids, electrical and thermal conductivity, magnetic properties, theories of alloy formation. Prereq: Consent of instructor.

621-22 Solidification and Crystal Growth (3,3) Theories of solidification, fluid flow effects, magneto-hydrodynamic instabilities of immiscible fluids, growth stability theory, thermodynamic applications, rapid solidification theory, metastability, 622-sameni seminar. Prereq: Consent of instructor.

631 Advanced X-Ray Diffraction (3) Kinematical and dynamical theory; crystal structure determination; thermal motion; lattice faults, diffuse scattering. Prereq: Materials Science and Engineering 551.

641 Seminar in Recent Advances in Metallurgical Engineering (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Polymer Engineering

494 Introduction to Polymer Science and Engineering (3) Basic course on polymers. Methods of synthesis;
molecular characterization; crystalline and glass transitions; crystallization kinetics; introduction to mechanical properties; introduction to rheology and processing. Pr. F.

496 Polymers Processing (3) Rheological measurements; flow through tubes and slits, and effects and extrudate swell; selected application, screw extrusion, injection molding; polymer fibers, spinning methods, structure development, properties. Pr. F.

500 Thesis (1-15) P/NP only. E

501 Graduate Seminar (1) Prereq. Admission to graduate program. May be repeated. S/NC only. E

511 Mechanical Properties of Solid Polymers (3) Types of mechanical behavior; Hookean and rubber elasticity; plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; loss tangent, experimental methods, introduction to mechanical properties of polymeric composites. Prereq: M. S. Bradley, Head

512 Polymer Solution Thermodynamics and Characterization (3) Theories of solutions, statistical thermodynamics, characterization, transition, crystallization, ordering, swelling, measurement of properties; viscosity, light scattering and osmotic pressure. Prereq: Undergraduate physical chemistry.

513 Physical Characterization of Polymers (3) Birefringence theory; small angle x-ray and light scattering; spherical and fibrous structures; introduction to electron microscopy. Prereq: E.

541 Fluid Mechanics and Polymer Processing (3) Navier-Stokes equations and illustrative problems; applications in chemical engineering and polymer engineering, packed and fluidized beds, multiphase systems, basic concepts in rheology; applications in polymer processing; screw extrusion, fiber spinning, injection molding. (Same as Chemical Engineering 541.)

542 Further Topics in Polymer Processing (3) Descriptions and analysis of selected polymer processing operations. Prereq: 541.

551-52 Laboratory Methods in Polymer Engineering (1,1) Basic experimental techniques and instrumentation associated with characterization, x-ray and light scattering, rheometry, mechanical properties of solid polymers, polymer processing operations. Coreq: 494 or consent of instructor.

571 Phase Transformations in Polymers (3) Glass transition and glassy state; annealing of polymeric glasses; crystallization of polymers; nucleation, growth and morphology; secondary nucleation theory; solution of copolymers; crystallization under stress. Prereq: 494.

591-92 Special Topics in Polymer Science and Engineering (3) Applications; operation of plastics fabrication; classification; selection criteria, processing techniques; characterization laboratory. Prereq: 511.

621 Advanced Rheology and Viscoelastic Theory (3) Continuum mechanics, formulation of viscoelastic theories for describing deformation and flow of polymeric materials. Application to polymer processing problems. Recommended for MS candidates working in rheological areas. Prereq: 541.

622 Advanced Topics in Polymer Processing (3) Application of theories of rheological behavior and structure development to analysis of polymer processing operations. Prereq: 511.

641-42 Recent Advances in Polymer Science and Engineering (3,3) Treatment of latest developments in science and technology of polymers. Prereq: Consent of instructor. May be repeated.

Mathematics

(College of Liberal Arts)

MAJOR

DEGREES

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

John S. Bradley, Head

Professors:

G. E. Albert (Emeritus), Ph.D. Wisconsin;
J. S. Bradley, Ph.D. Iowa; J. H. Carruth, Ph.D. Louisiana State; C. E. Clark, Ph.D. Louisiana State; R. E. Cline, Ph.D. Purdue;
R. J. Daverman, Ph.D. Wisconsin;
D. J. Dessert, Ph.D. Maryland; D. E. Dobbs, Ph.D. Cornell; E. D. Eaves (Emeritus), Ph.D. Texas; H. Franzens, Ph.D. Illinois;
J. A. George (Distinguished Scientist), Ph.D. Stanford; T. G. Hallam, Ph.D Missouri;
D. B. Hinton, Ph.D. Tennessee;
A. S. Householder (Emeritus), Ph.D. Chicago;
L. S. Husch, Ph.D. Florida State;
G. S. Jordan, Ph.D. Wisconsin;
R. M. McConnel, Ph.D. Duke; H. T. Mathews, Ph.D. Tulane; D. D. Miller (Emeritus), Ph.D. Michigan;
B. S. Raupat, Ph.D. Illinois;
K. C. Reddy (UTSI), Ph.D. Indian Institute of Technology;
D. J. Rosinski, Ph.D. Wisconsin;
S. Serbin, Ph.D. Cornell; K. Soni, Ph.D. Oregon State; F. W. Stallmann (Emeritus), Ph.D. Giessen (Germany);
E. Wachspres, Ph.D. Rensselaer Polytechnic Institute;
W. R. Wade, Ph.D. California (Riverside); C. G. Wagner, Ph.D. Duke;
J. J. Walsh, Ph.D. SUNY (Binghamton).

Associate Professors:

L. Alexides, Ph.D. Delaware; N. Alikakos, Ph.D. Brown; D. F. Anderson, Ph.D. Chicago;
J. Dydak, Ph.D. Warsaw; L. J. Gross, Ph.D. Cornell;
O. Karakashian, Ph.D. Harvard;
K. R. Kimble (UTSI), Ph.D. Ohio State;
Y. Kuo, Ph.D. Cincinnati; B. A. Kuperschmidt (UTSI), Ph.D. Massachusetts Institute of Technology;
S. Lenhart, Ph.D. Kentucky;
J. Rosinski, Ph.D. Wroclan (Poland);
W. H. Row, Jr., Ph.D. Wisconsin; R. Rowlett, Ph.D. Virginia; H. Simpson, Ph.D. California Institute of Technology;
J. Smith, Ph.D. California (Berkeley);
R. P. Soni, Ph.D. Oregon State;
K. R. Stephenson, Ph.D. Wisconsin;
C. Sundberg, Ph.D. Wisconsin.

Assistant Professors:

L. Bales, Ph.D. Cornell; J. Haefner, Ph.D. Wisconsin; S. Hariharan (UTSI), Ph.D. Carnegie Mellon; S. Mulay, Ph.D. Purdue;
R. Svinsky, Ph.D. Johns Hopkins.

The Mathematics Department has three graduate degrees: (1) The Master of Mathematics degree, intended primarily for teachers of high school mathematics, (2) the Master of science degree, designed to prepare students for industrial employment and for teaching at the high school and junior college level, and (3) the Doctor of Philosophy degree, designed to prepare students for industrial employment and for college and university teaching and research. Contact the department office for additional information.

THE MASTER'S PROGRAM

The Master of Mathematics is intended primarily for teachers of high school mathematics.

Before admission to this program, the applicant must have either (a) certification for teaching secondary mathematics in at least one state, or (b) three years of elementary or secondary school teaching experience. Applicants must have successfully completed one year of calculus (141-42 or equivalent) and a course in matrix algebra (251 or equivalent).

The following requirements must be met:
1. Complete 30 hours of course work of which 21 must be at the 500 level. The course work must include 504, 505, 506, 507, and 6 hours in 500. At most, 6 hours may be taken outside the Department of Mathematics (selected in consultation with the advisor).
2. Pass a final examination upon completion of all course work.

In exceptional circumstances, part of admission requirement (b) might be satisfied concurrently with course work. Normally Master of Mathematics degree students will start the program by taking 504 during the summer.

The Master of Science program is designed to prepare students for industrial employment and for teaching at the high school and junior college level. The department offers two options for this degree. The first option requires a thesis for which 6 hours must be earned along with 24 additional hours of work in acceptable courses numbered above 400. Of the additional hours, 6 may be in an area outside the department and 15 must be in courses in mathematics numbered above 500.

After one semester of graduate study, a student whose supervisory committee gives its approval may choose the non-thesis option, for which 30 hours in courses numbered above 400 are required. Of these, 21 hours (at least 15 of which must be in mathematics) must be in courses numbered above 500. Of the 30 hours, 9 in courses approved by the supervisory committee may be taken in fields other than mathematics. For this option it is also required that a written final examination be given, and that credit be received for a reading course (598) in which a term paper or project is required. A student offering mathematics as a minor for the Master's degree is required to obtain at least 6 hours of resident graduate credit in courses numbered above 400 and approved by both the major department and the Department of Mathematics.

THE DOCTORAL PROGRAM

For the Ph.D. in Mathematics, the student must meet the following four requirements:
1. Satisfy either of the following: A, the standard program or B, the mathematical ecology concentration. A student intending to work in mathematical ecology may complete either but he/she is encouraged to complete the mathematical ecology concentration. A student may also choose one from the other provided that the constraints of the latter option have not been violated. A student's status after electing such a transfer is determined by the complete history of his/her earlier examinations from the standard program and part 1 of the interdisciplinary mathematical ecology concentration.

A. Standard program: Pass written exam-
Inclusions covering four subjects, at least three of which must be from the following list:

1. Modern Algebra 551-52
2. Complex Analysis 543-44
3. Topology 561-62
4. Real Analysis 541-42
5. Applied Linear Analysis 547-48
7. Ordinary Differential Equations 531-32
8. Numerical Mathematics 571-72
9. Statistics 525-26
10. Probability 523-24

Students may not count passes of examinations in both 4. and 5., in both 6. and 7., in both 9. and 10., nor in both 8. and 9., nor in both 8. and 10. toward the required four passes. Those students who choose four from this list must choose two from 1. through 5., and the students who choose only three from this list must choose one from 1. through 5.

A student selecting only three from the above list will also be required to pass a written exam on an area of mathematics (e.g., fluids, elasticity, mathematical ecology) approved as an examination topic for that student by the Graduate Committee and the Applied Mathematics Committee. For a given student and a given area, the Graduate Committee will appoint a section of the student's supervisory committee. Members of the mathematical ecology section, before submitting materials to the Graduate Committee and the Applied Mathematics Committee for approval, will meet to determine the specific area of concentration.

A student may take as many of the written examinations as desired at any time these exams are given subject to the following conditions:

1. The exams to be taken must be approved in advance by the student's supervisory committee.
2. At most, 4-n exams may be taken at any one time, where n denotes the number of exams previously passed by the student.
3. A student may take a collection of written examinations a maximum of four times, but no one failing five exams, counting possible repetitions, will be permitted to take another round of exams.

II. Demonstrate proficiency in one foreign language, normally from among French, German, or Russian; this requirement is to be met prior to the examination in the area of specialization. The student's doctoral committee may require that the student pass a second language exam.

IV. Take an examination in the field of specialization. This examination will be given by a committee appointed by the department head at some time after the requirements in I. have been met. A student may take this exam only twice.

V. Take a one-year, 600-level sequence in mathematics and an area of concentration. The use of the course selected to fulfill this requirement must be approved by the department head and the student's doctoral committee. (Such approval may occur after completion of the course.)

400 History of Mathematics (3) Survey of development of mathematics from ancient to modern times. Does not satisfy major requirements for B.S. or M.S. in mathematics. Term paper required. Prereq: 1 yr calculus, 141-42, or equivalent.

401 Mathematics and Microcomputers (3) Primarily for students seeking certification as mathematics teachers at secondary level. Use of microcomputers to study concepts and problems in mathematics. Prereq: 141 plus 1 semester of discrete mathematics, 221 or 504.

404 Applied Vector Calculus (3) Topics from multivariable and vector calculus; line and surface integrals, divergence theorem, and Gauss and Stokes. Prereq: 241.

405 Models in Biology (3) Difference and differential equation models of biological systems. Prereq: 141-42 or 151-52.


421 Combinatorics (3) Introduction to problems of combinatorial analysis and enumeration for discrete structures: sequences, partitions, graphs, finite fields and geometries, or experimental designs. Prereq: 353 or consent of instructor.

423 Probability II (3) Law of large numbers and central limit theorems for discrete and continuous random variables; Poisson processes; discrete and continuous parameter Markov chains and their applications, Kolmogorov differential equations; Brownian motion process as limit of random walks. Prereq: 323.

425 Statistics (3) Derivation of standard statistical distributions; t, F, and X²; independence of sample mean and variance; basic limit theorems; point and interval estimation; Bayesian estimates; statistical hypothesis tests; Neyman-Pearson theorem; likelihood ratio and other parametric and non-parametric tests; sufficient statistics. Prereq: 323.


444 Complex Variables II (3) Applications of complex variables to steady-state temperatures, electrostatics, and fluid flow. Prereq: 443.

445-46 Advanced Calculus II (3,3) Theory of sequences, series, differentiation, and Riemann integration of functions of one or more variables. Prereq: 302 or consent of instructor.

447-48 Honors: Advanced Calculus II (3,3) Honors version of 445-46. Prereq: 341 or consent of instructor.

451 Topics in Algebra (3) Number theory and theory of polynomials including equations, quadratic theory, and Riemann surfaces. Prereq: 351.


456-56 Abstract Algebra I (3,3) Algebraic structures: groups, rings, fields, vector spaces and linear transformations. Prereq: 351 or consent of instructor.

457-58 Honors: Abstract Algebra II (3,3) Honors version of 455-56. Prereq: 351 or consent of instructor.

460 Geometry (3) Axiomatic and historical development of Euclidean, non-Euclidean, and hyperbolic geometry stressing proof technique and critical reasoning. Models of Non-Euclidean geometries. Term paper. Prereq: 141-42, or consent of instructor.

461 Topology (3) Topology of line and plane, separation properties, compactness, connectedness, continuous functions, homeomorphisms, continua and topological invariants. Prereq: 341 or consent of instructor.


490 Readings in Mathematics (1-3) Open to superior students with consent of department head. Independent study with faculty guidance. Prereq: Consent of faculty mentor to supervise independent work. May be repeated. Maximum 9 hrs.

499 Seminar in Mathematics (1-3) Students must register for number of credit hours announced for particular seminar. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

500 Thesis (1-6) PMP only. F

502 Registration for Use of Facilities (3-15) Required
for the student not otherwise registered during any semester in which the student uses University facilities for personal study or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

503 MBA Calculus (3) Review of derivatives and antiderivatives, elementary functions, functions of two variables, introductory matrix algebra. Credit available only to satisfy MBA core requirements. Prereq: 121.

504 Discrete Mathematics for Teachers (3) Mathematical reasoning, sets, functions and relations, combinatorics. Normally first graduate course for students seeking M.S. degree. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus, 141-42, or equivalent.

505 Analysis for Teachers (3) Development of differential and integral calculus, proofs of basic theorems. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus, 141-42, or equivalent, and 504.

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to algebra of integers and polynomials. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus, 141-42, or equivalent, and 504.


508 Seminar for Teachers (3) For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: Consent of instructor or 504.

513-14 Mathematical Principles of Fluid Mechanics (3) Equations of motion, incompressible and compressible potential flow, shock waves, viscous flows, Navier-Stokes equations. Prereq: 431, 435, and 445-46 or 404, or consent of instructor.

517-18 Mathematical Methods in Physics (3.3) (Same as Physics 571-72.)

519 Seminar in Applied Mathematics (1-3) May be repeated. Maximum 12 hrs.

521-22 Applied Combinatorics (3.3) Application of finite differences, generating functions, and permutation groups to enumeration problems. Coding theory, experimental design, graph theory, or decision theory.

523-24 Probability (3.3) Pertinent facts from measure theory, definition of abstract probability spaces; Kolmogorov's existence theorem; series of independent random variables and laws of large numbers; general theory of distributions of random vectors and their characteristic functions; weak convergence concept; weak compactness and Levy's continuity theorem, inequalities of Holder and Minkowski, Fubini's theorem, Reisz representation theorem, and Banach-Steinhaus theorem. Prereq: 445-46.


549 Seminar in Analysis (1-3) May be repeated. Maximum 12 hrs.

550 Matrix Algebra (3) Advanced topics in matrix theory: decomposition theorems and applications to matrices with special structure. Prereq: 453 or consent of instructor.

551-52 Modern Algebra (3.3) Groups, rings, modules and linear algebra, fields and Galois theory. Must be taken in sequence. Prereq: 455-56 or consent of instructor.

553 Linear Programming (3) Theory and applications. Prereq: Consent of instructor or 453 and programming ability.


555-56 Number Theory (3.3) Introduction to algebraic number theory. Prereq: 456-56 or consent of instructor.

559 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

561-62 Topology (3.3) Topological spaces; metrization; homeomorphic invariants of point sets. Mappings and homotopy. Covering spaces and fundamental group.

569 Seminar in Topology (1-3) May be repeated. Maximum 12 hrs.


575 Matrix Theory and Techniques in Numerical Analysis (3) Advanced topics in study of iterative and direct methods for large systems of linear equations: sparse matrix analysis, relationship to modern computer architectures. Prereq: 453, 471-72, or consent of instructor. May be repeated. Maximum 9 hrs. (Same as Computer Science 575.)

579 Seminar in Numerical Mathematics (1-3) May be repeated. Maximum 12 hrs.

581-82 Mathematical Ecology (3.3) Deterministic and stochastic models of populations, communities, and ecosystems. Prereq: 431, 453 or consent of instructor.

583 Mathematical Evolutionary Theory (3) Population genetics and evolutionary ecology. Prereq: 431, 453 or consent of instructor.

584 Mathematical Systems Theory (3) Analytic approach to discrete and continuous dynamical systems; optimal control. Applications to ecology. Prereq: 431, 453, 445-46 or consent of instructor.

585 Optimal Control Theory (3) Deterministic optimal control. Examples involving calculus of variations, optimal trajectories, and engineering control problems. Introduction to stochastic control. Prereq: 431, 445-46 or consent of instructor.

589 Seminar in Mathematical Ecology (1-3) May be repeated. Maximum 12 hrs.

593 Independent Study (1-15) See page 31.

598 Graduate Reading in Mathematics (1-3) Independent study with faculty guidance. Prereq: Graduate standing and consent of instructor. May be repeated. Maximum 6 hrs.

600 Doctoral Research and Dissertation (5-15) P/NP only. E

617-18 Lie Algebras in Mechanics and Physics (3.3) An introduction to the historical and logical development from differentiable manifolds, tensors, Lie derivatives, Lie groups, differential forms, Lie algebras, applications to Hamiltonian mechanics, analytic and algebraic equations, flows, vector fields, and plasmas, numerical methods in continuum mechanics. Prereq: 431, 435, 547, 571-72. (Same as Physics 617-18.)

619 Seminar in Applied Mathematics (1-3) May be repeated. Maximum 12 hrs.

623-24 Advanced Probability (3.3) Selected topics in modern probability theory and stochastic processes: Ito's calculus and stochastic differential equations, integration prediction theory, ergodic theory, probability on algebraic structures, limit theorems, geometry and probability in Banach spaces, probability methods in analysis. Prereq: 523-24 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

631-32 Advanced Ordinary Differential Equations (3.3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature. Subject matter varies according to interests and preparations of students. Prereq: 521-32 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

635-36 Advanced Partial Differential Equations (3.3) Selected topics in classical and modern theoretical partial differential equations. Prereq: 541-42 or 547-48 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.
Mechanical and Aerospace Engineering

(Engine of Engineering)

MAJORS

Aerospace Engineering M.S., Ph.D.
Mechanical Engineering M.S., Ph.D.

Don R. Pitts, Head
A. J. Fournier, Associate Head

Professors:
J. F. Bailey (Emeritus), Ph.D. Lehig, P.E.
G. W. Braun* (Emeritus), Ph.D. Gottingen;
F. G. Collins*, Ph.D. California (Berkeley),
A. J. Edmondson, Ph.D. Texas A. & M.,
P. E.; to Foucher*, Ph.D. Washington (Seattle);
G. W. Garrison*, Ph.D. North Carolina State;
B. H. Goethert* (Emeritus), Ph.D. Berlin
(Chalmers); K. E. Harwell*, Ph.D. California
Institute of Technology; W. H. Heiser*, Ph.D.
Massachusetts Institute of Technology;
J. W. Hodgson, Ph.D. Georgia Institute of
Technology, P.E.; R. W. Holland, M.S.
Tennessee, P.E.; W. S. Johnson, Ph.D.
Clemson, P.E.; E. G. Keshock, Ph.D.
Oklahoma State, P.E.; J. R. Kan, Ph.D.
Oklahoma; M. Kurosaka*, Ph.D. California
Institute of Technology; H. Liston, Jr. (Vice
Provost); M. E. A. George Washington;
T. L. Maxwell, U.S. Air Force Reserve,
P.E.; M. W. Milligan, Ph.D. Tennessee, P.E.;
M. K. Newman* (Emeritus), Ph.D. Columbia,
P.E.; C. Peters*, D. Applied Science
Brussels; D. R. Pitts, Ph.D. Georgia Institute
of Technology; F. Shahrokh*; Ph.D.
Oklahoma; G. V. Smith, Ph.D. Pennsylvania
State, P.E.; F. H. Speckhtr (IBM Professor),
Ph.D. Georgia Institute of Technology, P.E.;
W. K. Stair (Emeritus), M.S. Tennessee;
J. M. Tucker (Emeritus), M.S. Illinois;
J. W. White, Ph.D. Stanford; H. J. Wilkerson,
Ph.D. Tennessee, P.E.; J. M. Wu* (B.H.
Goethert Professor), Ph.D. California
Institute of Technology; Y. L. C. Wu*, Ph.D. California
Institute of Technology; R. L. Young*, Ph.D.
Northwestern, P.E.

Associate Professors:
R. V. Arimilli, Ph.D. Virginia Polytechnic
Institute; S. E. Becker, Ph.D. North Carolina
State, P.E.; R. A. Crawford*, Ph.D.
Tennessee; J. A. Euler, Ph.D. Purdue, P.E.;
T. H. Moulden*, Ph.D. Tennessee; M. Parang,
Ph.D. Oklahoma; J. R. Parsons, Ph.D. North
Carolina State, P.E.; R. J. Schutz*, Ph.D.
Tennessee; A. D. Varol*, Ph.D. Tennessee.

Assistant Professors:
M. Keyhani, Ph.D. Ohio State; K. Nguyen,
Ph.D. Colorado (Boulder).

Space Institute, Tullahoma.

Graduate programs in Mechanical Engineering or Aerospace Engineering are available that lead to the Master of Science and Doctor of Philosophy with concentrations in energy conversion and utilization, propulsion, heat transfer and fluid mechanics, and thermodynamics. In addition, Mechanical Engineering offers concentrations in gasdynamics, machine design and dynamics, power generation, and stress analysis; Aerospace Engineering offers structures and stress analysis, aerodynamics and gasdynamics, flight mechanics, and aeroacoustics. Each student must satisfactorily complete a program of study that has been approved by the student's committee. Specific program requirements are given below.

THE MASTER'S PROGRAM

Entrance into the Master of Science program 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 are available.

Thesis Option

The requirements of this option are that the student must satisfactorily complete a program of study that includes:

1. A minimum of 24 semester hours of course work that includes at least 12 semester hours of graduate (500-level or above) courses in mechanical and/or aerospace engineering and normally 6 semester hours of course work (400-level or above) in mathematics. No more than 3 semester hours of course work may be below the 500 level.

2. Participation in the departmental seminar program.

3. Passing a comprehensive written and oral final examination on all course work submitted for the degree. The student's committee will be of sufficient size to include all of the study areas reflected in the course program.

Problems Option

The requirements of this option are that the student must satisfactorily complete a program of study that includes:

1. A minimum of 24 semester hours of course work that includes at least 12 semester hours of graduate (500-level or above) courses in mechanical and/or aerospace engineering and normally 6 semester hours of course work (400-level or above) in mathematics.

2. A minimum of 6 semester hours in 590 Selected Engineering Problems. 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).

THE DOCTORAL PROGRAM

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

The student must satisfactorily complete an approved program of study that includes a minimum of 72 semester hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or problems, including:

1. A minimum of 24 semester hours in doctoral dissertation.

2. A minimum of 12 semester hours in...
mathematics in courses numbered 400 or above. 3. A minimum of 24 semester hours in mechanical and/or aerospace engineering courses numbered 500 and above, with at least 9 semester hours of 600-level courses. These are exclusive of thesis, problems, or dissertation credit. 4. Participation in the departmental semi-

GRADUATE CREDIT FOR UNDERGRADUATE COURSES Senior (400-level) mechanical and aero-

space engineering courses may be taken for graduate credit by non-mechanical or non-
aerospace engineering majors, if approved by the student's major department. Mechani-
cal or aerospace engineering majors may not normally use more than one 400-level engi-

teering course to meet their advanced degree requirements. Non-mechanical or non-
aerospace engineering graduate stu-

dents should consult with instructors regarding prerequisites for undergraduate courses.

Mechanical Engineering

186 Turbo-Machinery (3) Basic principles of turbomo-


machinery; systematic methods of analysis, design, performance evaluation. Prereq: Aerospace Engineer-

ing 351.
422 Environmental Noise (3) Basic principles of acoustics: measurements and control of noise in industrial and community environments. Prereq: Senior standing in engineering or consent of instructor.
445 Lubrication (3) Hydrodynamic theory of lubrica-
tion of sliding bearings; application of Navier-Stokes equations to infinite and finite bearings; analytical and numerical solutions; applications to design. Prereq: 344, Aerospace Engineering 351.
455 Introduction to Design (3) Engineering economy, optimization, design for automation, reliability, pa-


ents and product liability; design of mechanical engineering solid mechanics systems. Participation in team design effort; design report. Prereq: 353 and 465. F.
456 Introduction to Thermal Design (2) Engineering economy, optimization, design for automation, reli-
bility, economics, design of mechanical engineering thermal-fluid system. Participation in team design effort; design report. Prereq: 332, 344. F.
482 Tool Design (3) Principles underlying tool and die design; design for high volume production; work hold-


ing fixtures; comparison of material removal methods; selection of tool material; plastics production. Prereq: 366 or Industrial Engineering 404, Engineering Science and Mechanics 321.
464 Energy Methods in Mechanical Design (3) Applica-
466 Machine Design II (3) Application of strength and properties of materials, design factors, theories of failure to design elements. Mini design experiences. Prereq: Materials Science and Engineer-


469 Machine Design (4) Design of complete machine; documentation, complete specifications, design cal-


471 Refrigeration and Air Conditioning (3) Vapor compression and absorption cycles; heat pump sys-
tems; psychrometric processes; air washers; cooling towers; solar radiation; building heat transmission. Prereq: 332, 344.
474 Solar Energy Utilization (3) Nature and availabil-


ity of solar radiation for heat transfer; topics pertinent to solar energy collection and use; design analysis of solar energy collectors and method of storage; solar hybrid systems. Prereq: 392, 344, or consent of instructor.
475 Thermal Engineering (3) Thermal systems, tur-
bomachinery, heat exchangers, combustion and system analysis and design, second law and economic analy-
532 Phase Change Heat Transfer (3) Thermal analysis of solid phase change processes; moving phase fronts; melting and solidification processes; nucleation; dropwise and spraywise condensation; condensation heat transfer modes. Prereq: 344.
535 Select Topics in Mechanical Engineering (1, 1-


4) Problems and topics related to develop-
ments and practice in mechanical engineering. Prereq: Consent of instructor. E.
500 Thesis (1-15) P/NP only. E.
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeat-
ed. S/N only. E.
511 Conduction Heat Transfer (3) Analysis of steady-


tate and time dependent heat conduction by analytical and numerical methods. Modeling of thermal systems. Prereq: 344.
512 Convection Heat Transfer (3) Analysis of laminar and turbulent convection heat transfer in internal and external flows, effects of variable surface temperature or heat flux and variable fluid properties. Prereq: 531.
513 Radiation Heat Transfer (3) Properties of radiat-


ing surfaces, diffuse, specular and directional interchange for grey and nongrey surfaces. Interaction with other heat transfer modes. Prereq: 344.
521-22 Thermodynamics I and II (3, 3) Macroscopic thermodynamics, including First and Second Law analy-


ses, availability, phase change, molecular criteria, combustion, gas mixtures, and property relations, deter-
mination of thermodynamic properties from molecular structure; spectroscopic data, kinetic theory, statisti-
cal mechanics, quantum physics, Schroedinger equation. Prereq: 332.
523 Special Topics in Thermodynamics (3) Application of thermodynamics to topics of current interest in mechanical engineering. Prereq: Consent of instruc-
tor.
531 Fluid Mechanics (3) Derivation of equations governing flow of viscous fluid (conservation of mass, Newton's second law, conservation of energy using vector and Cartesian tensor notation. Equations of state and constitutive relations. Specialization of governing equations to those for Newtonian fluid. Applic-


ation and boundary conditions. Exact solutions. Introduction to boundary layer flows, potential flows, low Reynold's number flows. Prereq: 341, Aerospace Engineering 351.
ing systems. Prereq: 531.
541-42 Research in Mechanical Engineering I and II (3, 3) Design of experiments; data analysis; experi-


mental investigation. Prereq: Consent of instructor.
551-52 Mechanical Engineering Design (3, 3) Design of mechanical systems and devices. Prereq: Consent of instruc-
tor.
554-55 Advanced Strength of Materials (3, 3) Ele-


560 Computer Aided Mechanical Design (3) Applica-
tions of matrices and computational techniques in static and dynamic analysis and re-design of compi-
lus, three-dimensional, statically indeterminate structures. Prereq: 569 and 464 or consent of instruc-
tor.
561 Experimental Stress Analysis (3) Experimental stress analysis, photoelasticity, strain gauges. Prereq: Consent of instructor.
567-68 Dynamics of Machinery (3, 3) Kinematics and kinetics; fixed, moving and rotating co-ordinate sys-
tem; linear and angular momentum; energy methods; computational techniques derived from Lagrangian mechanics, variable mass; rigid body dynamics. Prereq: 363, 391.
569 Vibrations (3) Free and forced vibration of single and multiple degree of freedom systems linear and non-linear. Prereq: Undergraduate vibrations course.
571 Metal Machining and Forming (3) Mechanics of cutting and behavior of cutters. Mechanisms of friction and tool wear and effects of temperature. Selection of cutting fluids and tool mate-


581 Rocket Propulsion I (3) Rocket propulsion funda-


amentals; thermodynamics of nonreacting and chemically reacting gases; rocket nozzle design; ideal rocket performance parameters; rocket heat transfer; chemistry of propellants; liquid rocket engine systems; ground testing; introduction to solid propel-


lant rockets. Prereq: Consent of instructor.
582 Rocket Propulsion II (3) Solid propellant rocket performance, homogeneous and heterogeneous prop-


ellant chemistry and combustion system performance, thermal decomposition and gas phase reaction models; effect of chamber pressure and additives on solid propellant burning; analysis of two-phase solid rocket exhaust flow. Introduction to nuclear and electric propulsion; electrical resistance and electromagnetic field phenomena; rocket nozzle; rocket reaction; magnetohydrodynamic thrusters, traveling wave thrusters; exotic propulsion systems. Prereq: Consent of instruc-
tor.
584-85 Turbomachinery Systems I, II (3,3) Ideal cycle analysis of turbine engines, real cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines), flowthrough theory, turbine engine component matching, transient operation, surge protection, and rotating stall, engine control systems, structural considerations. Prereq: First year graduate standing and consent of instructor.


588 Measurement Science I (3) (Same as Nuclear Engineering 588, Chemical Engineering 588, Civil Engineering 588, Electrical and Computer Engineering 588, Engineering Science and Mechanics 588, and Aerospace Engineering 586.)

589 Measurement Science II (3) (Same as Nuclear Engineering 588, Chemical Engineering 588, Civil Engineering 588, Electrical and Computer Engineering 588, Engineering Science and Mechanics 588, and Aerospace Engineering 586.)

590 Selected Engineering Problems (2-5) Enrollment limited to students in problems program. Prereq. Consent of advisor. May be repeated. S/NC only.

595 Seminar (1) All phases of mechanical engineering, reports on current research at UT. May be repeated. S/NC only.

596 Special Topics in Mechanical Engineering (1-3) Prereq. Consent of instructor. May be repeated. Maximum 5 hrs.

600 Doctoral Research and Dissertation (3-15) P/NC only. E

610 Advanced Topics in Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer; natural convection, multiple phase flow, high speed reacting and nonreacting flows, advanced boundary layer techniques, combustion, perturbation and variational methods of analysis, heat exchanger theory and design. May be repeated. Maximum 9 hrs. Prereq. Consent of instructor.

611 Advanced Convection Heat Transfer, Fluid Mechanics and Mass Transfer (3) Stagnation point and high speed flow; viscous boundary layer flows; problems in heat transfer at high supersonic and hypersonic speeds; laminar and turbulent boundary layer heat transfer with surface melting, ablation, sublimation; effects of gas species recombination; stagnation point heat transfer. Led's integral solution for high speed boundary layers; heat flux scaling rules; mass transfer and radiation cooling techniques. Prereq: 512 and consent of instructor.


613 Advanced Radiation Heat Transfer (3) Radiation heat transfer in absorbing, emitting and scattering media; interaction of thermal radiation with convection and conduction heat transfer. Prereq: 511, 512, 513.


622 Advanced Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium and non-equilibrium. Prereq. Consent of instructor. May be repeated. Maximum 9 hrs.


Aerospace Engineering


423 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow, compressibility effects; numerical solution methods. Prereq: 351, Mechanical Engineering 391. Sp

424 Astronautics (3) Propulsion, trajectories, guidance, control, and atmospheric reentry of space vehicle systems. Prereq: 362, Mechanical Engineering 332. Sp

425 Propulsion (3) Principles of propulsion devices; turbojet, ram jet and rocket engines. Prereq: 351. F

426 Introduction to Aerospace Design (2) Design process, synthesis, safety, reliability, products, product liability, economic analysis, optimization, design standards, design studies. Individual design reports. Prereq: 351, 370, 363 Coreq: Mechanical Engineering 344. F

429 Aerospace System Design (4) Synthesis and design of complete aerospace system, economic and technical aspects. Participation in team design effort, formal presentations and design report. Prereq: 425, 426. Sp

449 Aerospace Engineering Laboratory (3) Designing, conducting, and reporting results of experimental exercises. Test standards and specifications. Analysis of data and formation of conclusions. Prereq: 345, 351. 3 labs. F

454-55 Selected Topics in Aerospace Science (1-4) Current problems and topics in aerospace science. Prereq: Consent of instructor.

500 Thesis (1-15) P/NC only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

511 Inviscid Flow (3) Kinematics and dynamics of inviscid fluids; potential flow about body, conformal mapping. Prereq: 422 or Mechanical Engineering 531. Mathematics 425 or equivalent.

512 Viscous Flow (3) Equations of viscous fluid flow; laminar and turbulent flow; transition; separation; boundary layer theories; exact and approximate solutions. Prereq: Mechanical Engineering 531 or equivalent.


515-16 Air Vehicle Aerodynamics and Performance (3,3) Application of aerodynamic principles to air vehicles to provide estimates of performance, stability, and control characteristics for subsonic to hypersonic speeds. Relations among thrust, drag, lift and altitude, propulsion systems, vehicle performance characteristics, and trajectory optimization. Prereq: 422; 515 or 516.

521-22 Aerodynamics of Compressible Fluids (3,3) One dimensional internal and external flows; waves; small perturbation theory; slender body theory; similarity rules; method of characteristics. Prereq: 422 for 521; 521 for 522.

525 Hypersonic Flow (3) slender body flow; similarity; Navierton theory; blunt body flow; viscous interactions; free molecule and rarefied gas flow. Prereq. 512.

527-28 Aerospace Ground Test Facilities (3) Atmosphere, models and similarity considerations; aerodynamic test facilities; continuous and intermittent wind tunnels and ballistic ranges; propulsion test facilities or air breathing and rocket engines; space environment and space vehicle test facilities. Prereq: 512 and 521, Mechanical Engineering 513 and 522.

531 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics; thermodynamic and thermophysical properties of gas plasmas; governing equations and applications. Prereq: 422 and Mathematics 471.

532 Introduction to Turbulence (3) Macroscopic effects, analogies, statistical treatment, correlation functions, energy spectra, diffusion; application of turbulent jets and pipe flow. Prereq: 512.

534 Atmospheric Entry (3) Reentry trajectories; lift and drag during reentry; vehicle motion and stability during reentry; aerodynamic heating and heat protection systems. Prereq: 522. Recommended prereq: 512.

544 Transonic Flow (3) Nature of flow at transonic speeds; small disturbance theory; shock wave properties; shock-vortex interaction phenomena; solution techniques. Prereq: 522.


554-55 Aerospace Vehicle Stability and Control (3,3) Static and dynamic longitudinal directional and lateral stability and control. Control and modes. Motion with free and fixed flight control surfaces. Automatic control systems. Prereq: 423, 551.

556 Vertical or Short Take Off and Landing Aircraft (3) Stability, control, control of rotary wing, tilt wing, vectored lift and jet vertical riser type aircraft. Vertical and transition flight modes. High lift aerodynamics. Automatic controls. Simulation type and flight testing. Prereq: 555.


561 Fundamentals of Aeronautics (3) Generation, propagation and absorption of sound in static and moving media. Prereq: Consent of instructor.

568 Measurement Science I (3) (Same as Nuclear Engineering 588, Chemical Engineering 588, Civil Engineering 588, Electrical and Computer Engineering 588, Engineering Science and Mechanics 588, and Mechanical Engineering 586.)

569 Measurement Science II (3) (Same as Nuclear Engineering 588, Chemical Engineering 588, Civil Engineering 588, Electrical and Computer Engineering 588, Engineering Science and Mechanics 588, and Mechanical Engineering 586.)

590 Selected Engineering Problems (2-5) Enrollment limited to students in problems problem. Prereq. Consent of advisor.

595 Seminar (1) All phases of aerospace engineering, reports on current research at UT. May be repeated. S/NC only.

599 Special Topics in Aerospace Engineering (1-3) May be repeated. Maximum 6 hrs.

600 Doctoral Research and Dissertation (3-15) P/NC only. E

631 Magnetohydrodynamics (3) Electromagnetic field equations, equations of motion, solutions, similarity considerations, statistical description of plasma, Boltzmann equation, conduction and diffusion in ionized gases, continuum magnetohydrodynamic equations. Prereq. or coreq. 512. Prereq: Mathematics 561 or equivalent.

632 Magnetohydrodynamics II (3) Alfven and shock waves, exact solution for magnetohydrodynamic channel flow, one-dimensional model of channel flow, engineering applications of magnetohydrodynamics.
propulsion and power generation. Prereq: 631 and Mathematics 562.


645 Theory of Turbulence (3) (Same as Engineering Science and Mechanics 645.)

651-52 Advanced Aerodynamics (3,3) Subsonic, transonic, supersonic, and hypersonic flows treated in generalized and unified manner with combined viscous/viscous effects. Relationships among various regimes of fluid flows. Fundamental assumptions, limitations of approximations and consequences. Foundations of gas dynamics, applications to airplane, rocket, ground testing and jet propulsion. Discussion of special topics according to interest of students. Prereq: 511, 522.


690 Advanced Topics in Aerospace Engineering (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

**Medical Biology**

(College of Medicine-Knoxville Unit)

**Carmen B. Lozzio, Acting Chair**

**Professors:**
J. P. Chen, Ph.D. Pennsylvania State; W. Farkas, Ph.D. Duke; J. E. Fuhr, Ph.D. St. John's (New York); C. C. Congdon (Emirratus); M. D. Michigan; J. B. Jones, D.V.M. Illinois; R. D. Lange (Emirratus), M.D. Washington (St. Louis); C. B. Lozado, M.D. Buenos Aires (Argentina); T. P. McDonald, Ph.D. Pennsylvania; P. W. Wigler, Ph.D. California (Berkeley); C. J. Wust, Ph.D. Indiana (Bloomington).

**Associate Professors:**
R. Carroll, Ph.D. Cornell; W. T. Hanna, M.D. Ain-Shams (Egypt); A. T. Ichiki, Ph.D. Rockefeller; J. M. Woodward (Emeritus), Ph.D. Pennsylvania; K. M. Sirotkin, Ph.D. Michigan State; G. Stacey, Ph.D. Texas (Austin).

**Assistant Professors:**
K. Matteson, Ph.D. Wisconsin (Milwaukee); R. C. Switzer, III, Ph.D. Michigan State; J. Tyler, Ph.D. Suny-Buffalo; R. E. Worthington, Ph.D. Washington (St. Louis).

The Department of Medical Biology of The University of Tennessee College of Medicine-Knoxville Unit was formed from the faculty of The University Memorial Research Center and Hospital in 1978. The Research Center was established in 1956. The faculty has research, education, and service interests in cancer, cardiovascular, metabolic, toxicology, neuroscience, birth defects, cytogenetics, and clinical genetics. Courses in these areas are offered to students at the graduate and undergraduate levels. Elective courses are also available to students in the College of Medicine.

The faculty with the College of Veterinary Medicine participates in the graduate program leading to M.S. and Ph.D. in Comparative and Experimental Medicine. Other advanced degree students can do thesis research in the department by arrangement with other life science departments at the University.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. Prereq: Consent of instructor. May be repeated. S/N/C only. E

508 Graduate Research Participation (3) Advanced research techniques while conducting individual biomedicine program. Prerequisite: Division of faculty. Open to all graduate students. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 9 hrs. S/N/C only. E

521 Principles of Oncology (3) Lectures, classroom discussion, and case reports surveying major topics of oncology. Prereq: Biology 220-30 or consent of instructor.

522 Special Topics in Cancer (1-3) Prereq: 521 and consent of instructor. May be repeated. Maximum 9 hrs. F/S/P.

531 Principles of Hematology (3) Pathophysiology of blood and blood forming systems. Lectures, class discussions and demonstrations. Prereq: Upper division histology and/or cell biology, Zoology 410 and 420.

532 Special Topics in Hematology (1-3) Prereq: 531 and consent of instructor. May be repeated. Maximum 9 hrs. F/S/P.


541 Molecular Basis for Metabolic Disease (4) Metabolic disorders of humans and animals. Molecular mechanisms in inborn errors of metabolism, toxic reactions and deficiency states. Clinical and pathologic correlations. Prereq: Biochemistry 410-19 or equivalent. Sp, A

542 Special Topics in Metabolic Disease (1-3) Biochemical and physiological basis of selected diseases of humans and animals. Clinical-pathologic correlations. Prereq: 541 and consent of instructor. May be repeated. Maximum 9 hrs. F/S/P.


545 Clinical Genetics (3) Human genetic disorders: new developments in cytogenetics, molecular genetics, clinical diagnosis and prevention. Prereq: Biology and genetics background or consent of instructor.

600 Doctoral Research and Dissertation (3-19) P/NP only. E

611 Advanced Topics in Medical Biology (1-3) New developments in biological research applicable to clinical medicine. Prerequisite: for doctoral candidates in Comparative and Experimental Medicine. Prereq: Consent of instructor. Maximum 6 hrs. F/S/P.

652 Special Topics in Pathology (1-3) Pathologic anatomy, biochemical pathology, and related areas. Prerequisite for doctoral candidates in Comparative and Experimental Medicine. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. F/S/P.
concepts, and to facilitate the selection of a research professor. Usually the student selects a research professor toward the end of the laboratory rotation period. The major professor assists in the selection of and carrying out of a suitable research program and in the naming of a thesis or dissertation committee.

THE MASTER'S PROGRAM

The program leading to the M.S. is designed to provide the student with broad basic knowledge in microbiology, to permit the acquisition of technical competence in the fundamentals of research, and to encourage creative and independent thinking. Two to three calendar years are usually needed for the course of study that has the following requirements: (1) 30 hours including thesis credits; (2) a 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F system; (3) a 3.0 GPA in courses taken in the department; (4) a complete course sequence in biochemistry; (5) course work in at least five of the sub-disciplines recognized by the department: microbial physiology, pathogenic bacteriology, virology, mycology, immunology, microbial genetics, microbial ecology, molecular biology, and applied microbiology; and (6) presentation of a research proposal and its oral defense.

THE DOCTORAL PROGRAM

The program leading to the Ph.D. is designed to develop the student's ability to pursue independent and original research in microbiology and allied fields, to teach both oral and written communication of the results of research to the scientific community, and to train effective teachers. Students may enter the program after receiving either a Bachelor's or Master's degree. Students who enter with a Bachelor's degree usually receive the Ph.D. after four or five years; those with the Master's degree usually take three or four years to complete the degree. Departmental requirements are: (1) a 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F scale; (2) a 3.0 GPA in courses taken in the department; (3) satisfactory performance in at least one semester as a teaching assistant; (4) one semester of physical chemistry; (5) one course in statistics; (6) courses in at least five of the sub-disciplines listed in the Master's program; (7) satisfactory performance in a comprehensive examination that must be passed before admission to candidacy; and (8) the presentation of a written research proposal and its oral defense.

430 Immunology (2) Principles of inflammation and immunity; immune soluble factors and factors that control the development and distribution of inflammatory responses; the theory of cell and tissue damage; cell cooperation and recognition in immune mechanisms; and immune tolerance. Prereq: Biology 220.

439 Immunology Laboratory (1) Laboratory exercises designed to accompany 430. Coreq: 430. (Same as Zoology 439.)


480 Mycology (3) Morphology, physiology, genetics, and taxonomy of yeasts and molds; pathogenesis of disease causing fungi. Prereq: 310. Coreq: 489.

489 Mycology Laboratory (1) Laboratory exercises designed to accompany 480. Coreq: 480.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when 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.

510 Microbial Physiology (3) Topics in microbial physiology and metabolism. Prereq: 410, Biochemistry 410, or consent of instructor. May be repeated. Maximum 12 hrs.

520 Pathogenesis of Infectious Disease (3) Topics in pathogenesis: microbial factors and host responses. Prereq: 420, 430, or consent of instructor. May be repeated. Maximum 12 hrs.

530 Immunology and Immunochemistry (3) Topics in molecular and genetic aspects of immune response, immunobiology, and immunopathology. Prereq: 420, 430, or consent of instructor. May be repeated. Maximum 12 hrs.

540 Molecular Virology (3) Topics in replication, assembly, and expression of viruses. Prereq: 440 or consent of instructor. May be repeated. Maximum 12 hrs.

550 Microbial and Molecular Genetics (3) Topics in transmission and expression of genetic information at the molecular level. Prereq: 410, Biochemistry 410, or consent of instructor. May be repeated. Maximum 12 hrs.

560 Recombinant DNA (3) Plasmid and bacteriophage molecular biology applied to development of recombinant DNA techniques. Prereq: 410 or consent of instructor.

569 Recombinant DNA Laboratory (3) Practical details and procedures applicable to recombinant DNA methods and techniques. Prereq or coreq: 560 or consent of instructor.

570 Applied and Environmental Microbiology (3) Topics in applied and environmental microbiology that treat physiology, metabolism, and genetics of microorganisms: fermentations and natural and simulated ecosystems. Prereq: 470 or consent of instructor.

580 Laboratory Problems (2-6) Laboratory methods for development and interpretation of microbiological research. Prereq: Graduate standing. May be repeated. Maximum 6 hrs. S/NC only.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Selected Topics in Microbiological Research (2-4) Literature surveys and discussions of selected topics. Prereq: Graduate standing. May be repeated. Maximum 8 hrs. S/NC only.

595 General Seminar (1) Lectures and seminars by invited speakers, faculty, and graduate students. May be repeated. Maximum 16 hrs. S/NC only. E

596 Laboratory Rotation (1) Familiarization with research areas in department through series of rotations in laboratories of individual faculty members. May be repeated. Maximum 3 hrs. S/NC only.

600 Doctoral Research and Dissertation (2-4) P/NP only. E

601 Journal Club in Microbial Physiology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

602 Journal Club in Microbial Pathogenesis (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

603 Journal Club in Immunology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

604 Journal Club in Virology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

605 Journal Club in Microbial Genetics (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

606 Current Topics in Biological Membrane Research (1) (Same as Biochemistry 606.)

610 Advanced Topics in Microbial Physiology (3) Prereq: 510 or consent of instructor. May be repeated. Maximum 12 hrs.

620 Advanced Topics in Microbial Pathogenesis (3) Prereq: 520, 530 or consent of instructor. May be repeated. Maximum 12 hrs.

630 Advanced Topics in Immunology (3) Prereq: 530 or consent of instructor. May be repeated. Maximum 12 hrs.

640 Advanced Topics in Virology (3) Prereq: 440, 540, or consent of instructor. Maximum 12 hrs.

650 Advanced Topics in Microbial and Molecular Genetics (3) Prereq: 550 or consent of instructor. May be repeated. Maximum 12 hrs.

670 Advanced Topics in Environmental Microbiology (3) Prereq: 570 or consent of instructor. May be repeated. Maximum 12 hrs.

Microbiology - Veterinary Medicine

See Veterinary Medicine for program description.

PROFESSIONAL COURSES

811-12 Microbiology UI (5.4) Pathogenesis of bacterial, fungal and viral diseases. Study relating microbial structure, metabolism and genetics to patterns of disease and mode of action of antimicrobials, antibodies and vaccines. Immunobiology, study of mechanisms of immune reaction, diagnostic immunology, and role of immune response.

817 Special Problems in Microbiology (1-8) Extramural and specially designed study for students interested in select topics in bacteriology, mycology, virology and immunology.
Music
(College of Liberal Arts)

MAJOR DEGREES
Music ............................................. M.M., M.A.

John J. Meacham, Head

Professors:
G. C. Bitzas, M.M. Converse; J. P. Brock, M.M. Alabama; J. Coker, M.A. Sam Houston; F. M. Combs, M.A. Missouri; G. F. DeVine (Emeritus) Diploma, Schurz (Chicago); W. Dorn, M.A. Columbia; H. W. Fred, Ph.D. North Carolina; C. R. Huber, Ph.D. North Carolina; J. J. Meacham, M.M. Northwestern; D. M. Pederson, Ph.D. Iowa.

Associate Professors:

Assistant Professors:
W. Hawthorne, Ph.D. Cincinnati; D.M.A. Yale; D. Ogden, M.M. Texas; E. Schroeder, Ph.D. Stanford; G. M. Sper1, M.M. Indiana.

The Department of Music offers the Master of Music with concentrations in accompanying, choral conducting, composition, instrumental conducting, performance (organ, piano, strings, voice, wind, and percussion), piano pedagogy and literature, sacred music, string pedagogy, and theory, and the Master of Arts in Music with concentrations in musicology and theory.

Applicants for these degree programs must have completed an undergraduate degree approximately equivalent in music requirements to those required in degrees conferred by UTK, appropriate to the applicant's prospective area of concentration on the Master's level.

Applicants who plan to pursue the concentration in performance are required to audition before the appropriate area faculty committee. Applicants for admission to the program in composition must submit scores and tape recordings of representative works. Other applicants are required to have an interview with members of the faculty of the prospective area of concentration.

All applicants are required to take the Diagnostic Examinations in music theory and music history/literature. These examinations are given by the Department of Music at the beginning of each semester.

All concentrations require a written and oral final examination.

THE MASTER OF MUSIC PROGRAM
A minimum of 30-33 semester hours of course work is required for the Master of Music. These hours are specifically distributed according to the area of concentration. All concentrations require course work in music history/literature and music theory and allow for elective courses. Specific curricula are available from the Department of Music.

The graduate recital is given in lieu of thesis by Master of Music degree students with concentrations in performance, pedagogy, and accompanying. A performance project is given in lieu of thesis by students with concentrations in choral conducting, instrumental conducting, and sacred music.

A thesis is required of students in composition and theory.

THE MASTER OF ARTS PROGRAM
A minimum of 33 semester hours, including 18 hours of course work above the 500 level and 6 hours of thesis, is required for the Master of Arts. Specific curricula are available from the Department of Music. A reading knowledge of French or German must be demonstrated by applicants before being admitted to candidacy.

Music General
500 Thesis (1-15) P/np only. E

501 Graduate Recital (2)

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

511 Lecture Recital (2)

521 Special Topics in Performance (1-3) Prereq: Consent of department head.

561 Church Music Performance Project (1-2) May be repeated. Maximum 3 hrs.

Music History
410 Music History Genre (3) Topics vary. May be repeated. Maximum 6 hrs.

420 History of Opera (3) Dramatic, vocal, and orchestral elements in opera of Italian, French, and German schools, 1600-present.

430 Symphonic Literature (3) Literature for orchestra from Baroque to present, evolution of symphony.

440 Music of North America (3) Folk and art music of U.S. and Canada from colonial times to present.

450 Composer Seminar (3) Life and works of single composer. Subjects vary.

460 Music Aesthetics (3) Nature of music and musical experience, sense perception and emotions, music, and role of artist in society. Aesthetic viewpoint of individuals and historical eras through selected writings.


490 Church Music Methods and Administration (3)

510 Music Bibliography (2) Bibliographic methodology in music.

520 Music Research (1) Principles of research methodology applied to writing of research proposal and project.

530 Music in the Middle Ages (3) Gregorian and medieval chant, secular monophony, and rise of polyphony.

540 Music in the Renaissance (3) From 1400 to 1600. Mass, motet, chant, polyphony, and other vocal and instrumental forms and genres.

550 Music in the Baroque Period (3) From c. 1600 to 1750; rise of opera and oratorio, sacred and secular cantatas, instrumental forms, performance practice.

560 Music in the Classic Period (3) Evolution of classical style from pre-classic music to music of Haydn, Mozart, and early Beethoven.

570 Music in the Romantic Period (3) Nineteenth-century musical styles from Beethoven to post-romanticists.

580 Music in the Twentieth Century (3) From 1880, Debussy, to present, Stockhausen and others.

590 World Music (3) Attitudes and techniques of ethnomusicology. Survey of world music cultures. Interview and transcription projects.

593 Independent Study (1-15) See page 31. Prereq: Consent of department head.

Music Instrumental
410 Band Arranging (3) Study and application of techniques employed in scoring for marching and concert bands. Prereq: Music Theory 320.

490 Instrumental Conducting (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and relationship of different styles to conductor's art; musical analysis and practice in conducting. Prereq: Music Education 320 or equivalent.

570 Advanced Suzuki Pedagogy (2) Study of psychology, procedures and literature utilized by Shinichi Suzuki in Japan. Prereq: 495 or consent of instructor. May be repeated. Maximum 4 hrs.

580 Band Literature (3) Band literature and origins of band, its important expanded cultivation during past century in United States and Europe.

582 Instrumental Conducting Performance (1) Jury performance; conducting bands or orchestra in public.

583 Practicum for Instrumental Conductors (1) Intern experience in choral music. S/NC only.

584 Practicum for Instrumental Conductors (1) Intern experience in field other than area of major interest. S/NC only.

595 Instrumental Conducting Seminar (3) Rehearsal and performance problems and techniques allied to score reading and preparation. Particular attention to individual problems. Prereq: 490 or equivalent.

Music Jazz
410 Advanced Improvisation (3) Further development of individual skills and solving individual problems in jazz improvisation. Prereq: 210 and 220.

420 Jazz Pedagogy (1) Methods and materials relating to teaching of jazz, designing and administering jazz programs, and rehearsal techniques for jazz ensembles. Prereq: Studio music and jazz major or consent of instructor.

Music Keyboard

420-30 Piano Literature I, II (2, 2) 420—From 1750 to middle 19th century; 430—Middle 19th century to present.

460-70 The Organ and Its Literature I, II (3, 3) Development of organ and organ literature from Middle Ages to present; problems of style and interpretation;
pedagogical literature and methods; organ design.
Prereq. or coreq: Music History 220 and consent of instructor.
520 Piano Literature Seminar (2) Topics vary. May be repeated. Maximum 6 hrs.
531 Recital Project (2,2) Preparation and accompaniment of full recital for accompanying concentrations only. 531-Vocal recital, 541-Instrumental recital. Prereq: Consent of instructor.
540-550 Advanced Piano Pedagogy I, II (2,2) 540-Evaluation and study of methods and materials for teaching piano at all levels. Supervised teaching; Prereq. 440, 450, or consent of instructor. 550-Introduction and principles of Kodaly, Orff, Suzuki, Dalcroze Eurhythmics, and class piano teaching. Prereq. 440, 450 or consent of instructor.
560 Organ Literature Seminar (3) Topics vary. May be repeated. Maximum 6 hrs.

Music Theory
430-440 Counterpoint I, II (3,3) 430-Study of species counterpoint in modal and tonal styles; works of Palestrina and J.S. Bach. Prereq. 220, 440-Writing of contrapuntal forms of 18th century and fugue; analysis of works from 18th through 20th centuries. Prereq: 430.
510 Musical Styles (3) Elements of design and their role in definition of musical styles. Prereq. Consent of instructor.
530 Music Theory Pedagogy (3) Techniques, methods, and materials involved in college-level theory programs. Prereq. Consent of instructor.
540 Computer Projects (1-3) Programming languages, design and implementation of projects in computer-managed instruction. Prereq. Consent of instructor.
550 Music Theory Seminar (1-3) Topics vary.

Music Voice
430 Styles in Opera Acting (2) Study and practice of styles in opera acting based on historical and national characteristics. Prereq. 230.
440 Projects in Opera Theatre (1-3) Prereq. Consent of instructor. May be repeated. Maximum 9 hrs.
510 Vocal Literature Seminar (3) Topics vary. May be repeated. Maximum 6 hrs.
530 Opera Performance (2) Prereq. Consent of instructor. May be repeated. Maximum 4 hrs.
540 Opera Production (1-3) Prereq. Consent of instructor. May be repeated. Maximum 6 hrs.
550-60 Advanced Vocal Pedagogy I, II (2,2) 550-Study of vocal production; examination of different methods. 560-Study of teaching materials, observation of studio teaching, analysis of vocal problems in selected students, and supervised teaching.
570 Vocal Chamber Music Performance (2) Prereq. Consent of instructor.
580-85 Choral Literature I, II (2,2) Choral music from middle ages to present with consideration of historical development of major choral genres.
590 Advanced Choral Conducting (3) Expansions and continued refinement of conducting techniques; development of choral rehearsal skills. Prereq. Consent of instructor.
585 Choral Conducting Seminar (3) Score reading and preparation; problems of interpretation, performance practices, and conducting techniques. Prereq: 590 or consent of instructor. May be repeated.

Music Performance
All performance courses require an audition and consent of instructor. May be repeated. Maximum 8 hrs toward M.M. degree.

Music Ensemble
501 Wind Ensemble (1) May be repeated.
503 Small Jazz Ensemble (1) May be repeated. Maximum 12 hrs.
504 Jazz Ensemble (1) May be repeated. Maximum 12 hrs.
506 Trombone Choir (1) May be repeated.
509 Tubas Ensemble (1) May be repeated. Maximum 6 hrs.
510 Percussion Ensemble (1) May be repeated.
511 Baroque Ensemble (1) May be repeated.
512 Baroque Ensemble (1) May be repeated.
513 Synthesizer Ensemble (1) May be repeated.
514 Brass Choir (1) May be repeated.
515 Chamber Music Ensemble (1) May be repeated. Maximum 12 hrs.
520 UT Singers (1) May be repeated.
530 Chamber Singers (1) May be repeated.
532 Collegium (1) May be repeated.
534 Saxophone Choir (1) May be repeated.
540 Opera Theatre (1) May be repeated.
542 Opera Workshop (1) May be repeated.
550 Concert Band (1) May be repeated.
552 Campus Band (1) May be repeated.
554 Varsity Band (1) May be repeated.
556 Laboratory Band (1) May be repeated.
559 Marching Band (1) May be repeated.
570 Symphony Orchestra (1) May be repeated.
580 Concert Choir (1) May be repeated.
582 University Chorus (1) May be repeated.
583 Men's Chorale (1) May be repeated.
589 Women's Chorale (1) May be repeated.
599 Accompanying (1) May be repeated.

Nuclear Engineering
(College of Engineering)

MAJOR DEGREES
Nuclear Engineering .....................M.S., Ph.D.

Pietro F. Pasqua, Head

Professors:

H. L. Dodds, Ph.D. Tennessee, P.E.;

Associate Professors:

*Part-Time.

The Department of Nuclear Engineering offers degrees leading to the Master of Science and Doctor of Philosophy with concentrations in nuclear dynamics, nuclear reliability and risk, radiation transport, thermal hydraulics, core analysis, fuel and waste management, artificial intelligence, fusion technology, and high temperature plasma physics.

The Nuclear Engineering Department has developed programs with other components of the University that provide expanded opportunities. A joint fusion energy program has been developed between the Nuclear Engineering and the Electrical and Computer Engineering Departments. Cross-listed courses from each department are used to satisfy degree requirements. Students may have the opportunity to do their Master’s thesis at the Fusion Energy Division of the Oak Ridge National Laboratory or at the Plasma Science Laboratory, affiliated with the Electrical and Computer Engineering Department. A limited number of Graduate Research Assistantships are available at each location. Further information about this program is available from the department.

Students in the Nuclear Engineering Department have an opportunity to participate in the Measurement and Control Engineering Center and the Waste Management Research and Education Institute. These organizations provide unique research opportunities.

THE MASTER’S PROGRAM
A graduate program leading to the Master of Science is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary prerequisite courses before he/she enters the program.

The student must complete 30 semester hours of course work approved by the student’s advisory committee that includes the following:
1. A major consisting of a minimum of 12 semester hours of graduate courses in nuclear engineering.
2. A minor of 6 semester hours in mathematics, statistics or computer science.
3. Six semester hours from either nuclear engineering or a related field.
4. A six-hour thesis that demonstrates independent research or design capabilities. The student must pass a final oral examination covering the thesis and graduate course work.

An alternate program is available that involves satisfying the research component through an internship or practice problems rather than a thesis. The engineering practice option provides the student with the opportunity to perform research in two, three, or four different areas as opposed to the traditional thesis, which involves in-depth research in one area. Engineering practice problems are usually smaller in scope than a thesis and must have prior approval of a member of the faculty. The student must complete a program of study that includes the following:
1. Twenty-four semester hours of course work similar to the requirements for the usual Master of Science program (see above).
2. Sixteen hours of NE 598 Nuclear Engineering Practice. Students register for NE 598 each semester. At the end of each semester, the student makes an oral presentation of the work. Upon completion of each credit for the M.S., the student submits a formal written report of the work.
3. Final oral examination covering graduate course work and practice school problems.

THE DOCTORAL PROGRAM
Students in the field of nuclear engineering desiring to study for the Doctor of Philosophy must have a Bachelor of Science or Master of Science from a recognized university, with a major in engineering or physics, and present at least a B average. All candidates will be required to demonstrate general competence in a comprehensive examination in the areas of engineering science, mathematics, and physics. At the same time, all candidates will be required to demonstrate special competence in nuclear design.

Specific course requirements for the Ph.D. in Nuclear Engineering include:
1. A minimum of 48 semester hours beyond the Bachelor’s degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.
2. A minimum of 24 semester hours in doctoral research.
3. A minimum of 30 semester hours in nuclear engineering courses numbered 500 and above (or the equivalent), with at least 9 semester hours of 600-level courses. These are exclusive of thesis or dissertation credit.
4. A minimum of 12 semester hours in mathematics, computer science, or statistics courses beyond nuclear engineering undergraduate requirements numbered 400 or above.
5. A minimum of 6 semester hours in courses numbered 500 or above from a department other than nuclear engineering. The choice depends on the student’s overall program and should expand his/her knowledge in a given field.
6. A reading knowledge of one foreign language may be specified by the student’s doctoral committee.

The comprehensive examination is prepared by the Nuclear Engineering faculty and consists of 12 hours of written examinations. All past examinations are filed in the library, and students are encouraged to review them. Students are invited to take the comprehensive examination after completing approximately 30 semester hours of course work. A student who fails the written part of the examination must take and pass the examination the next time it is offered before remaining in the Ph.D. program. Registration for NE 600 Dissertation is not permitted until the written examination is passed. The comprehensive examination is completed with a successful oral defense of the dissertation proposal.

A candidate must successfully defend, in an oral examination, all work presented for the degree—all course work and dissertation.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

400-level courses in nuclear engineering may be used for graduate credit. However, students must recognize that at least two-thirds of the minimum required hours (30) in a Master’s degree program must be taken in courses numbered 500 or above.

401 Nuclear Reactor Theory (3) Thermal and fast spectrum computational methods, homogeneous and heterogeneous methods. Equations that relate thermal and neutronic variables, power distribution calculations, and reactivity control methods. Prereq: 302.

403 Nuclear Engineering Laboratory (3) Cross-section measurement, diffusion properties of neutrons, critical loading experiment, control rod calibration, statistical weight, shielding, xenon poisoning, dynamics and controls experiments. Prereq: 304 or equivalent. Coreq: 401 or 405 or equivalent.


406 Radiation Shielding (3) Types of radiation sources, fundamentals of gamma ray and neutron attenuation, biological effects, approximate methods of shield design, discrete ordinates, and Monte Carlo. Prereq: Physics 232.

409 Introduction to Fusion Energy I (3) (Same as Electrical and Computer Engineering 463.)

414 Introduction to Fusion Energy II (3) (Same as Electrical and Computer Engineering 464.)

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the present not to exceed 5 semester weeks when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

511-12 Transport Processes in Nuclear Engineering (3,3) Rheology of neutron-rich and non-neutron-rich fluids; integral and system conservation equations for single and multi-component fluids; in-depth development of differential conservation equations for mass, energy, momentum: exact and approximate solutions of equations of motion; boundary layer analysis; numerical analysis of fluid flow and heat transfer.

521 Nuclear Systems Dynamics and Control (3) Introduction to state variable methods for system dynamics and control analysis and design of these methods to nuclear plant dynamics, simulation and control problems.

531 Nuclear Systems Reliability (3) Qualitative and quantitative techniques for assessing and improving nuclear systems reliability and safety. Fault tree analysis and associated dependent failure analysis.

541 Reactor Fuel Management (3) Topics relative to in-core fuel management. Applicable topics in reactor physics, fuel depletion, isotopic inventories, reactivity control and numerical methods. Prereq: 401.


551 Plasma Diagnostics I (3) (Same as Electrical and Computer Engineering 561.)

552 Plasma Diagnostics II (3) (Same as Electrical and Computer Engineering 562.)

553 Plasma Engineering (3) Integration of plasma physics models, fusion engineering design criteria, and fusion technology into design of future plasma experiments and reactors. Particle, momentum, and energy balance equations. Simulation of various fusion reactor plasma. Prereq: 464 or consent of instructor. (Same as Electrical and Computer Engineering 563.)

554 Fusion Technology (3) Engineering problems associated with fusion reactor design; vacuum and magnetic systems, materials and irradiation; plasma heating, fuelling and impurity control; review of major design studies. Prereq: 553. (Same as Electrical and Computer Engineering 564.)


572 Reactor Theory and Design (3) Analytical and numerical techniques for neutronics modeling of nuclear systems. Multigroup cross section theory for homogeneous and heterogeneous systems. Selected topics from literature. Class project: solution of nuclear design problem. Prereq: 571 or equivalent.


588 Measurement Science I (3) Principles of measurement, introduction to measuring devices. Prereq: Consent of instructor. (Same as Chemical Engineering 588, Civil Engineering 588, Electrical and Computer Engineering 588, Engineering Science and Mechanics 588, Mechanical Engineering 588 and Aerospace Engineering 588.)

599 Measurement Science II (3) Modern industrial measurement systems, advanced topics in measurement. Prereq: 588. (Same as Chemical Engineering 589, Civil Engineering 589, Electrical and Computer Engineering 589, Engineering Science and Mechanics 589, Mechanical Engineering 589, and Aerospace Engineering 589.)

597 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.

598 Nuclear Engineering Practice (3-9) Experience in research and reporting on engineering problems. Prereq: Approval of department. May be repeated, enrollment limited to alternative plan students. S/NC only.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

611-12 Selected Topics in Reactor Theory (3,3) Transport theory, control rod theory, stochastic methods. Selected topics from literature. Prereq: 572.

651 Plasma Engineering II (3) Detailed modeling of plasma breakdown, start up, burn dynamics. Prereq: 564.

652 Special Topics in Fusion Engineering (3) Selected advanced topics in plasma engineering and fusion reactor engineering and technology. Prereq: 651.

653 Theory of Information Processing (3) Modern system theoretical methods for evaluating system performance from dynamic measurements. Prereq: 522 or equivalent.

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**Nursing**

(College of Nursing)

**MAJOR**

**DEGREE**

**Nursing**

Sylvia E. Hart, Dean

Professors:
- D. H. Goodfellow, Ph.D. Peabody
- M. E. Groer, Ph.D. Illinois
- S. E. Hart, Ph.D. New York
- J. N. Mozart, Ph.D. Walden

Associate Professors:
- M. M. Davis, Ph.D. Tennessee
- P. G. Droppleman, Ph.D. Tennessee
- M. L. Jolly, Ed.D. Kentucky
- B. M. Reid, Ph.D. Texas
- T. G. Sharp, Ed.D. Tennessee

Assistant Professors:
- M. Fenske, Ph.D. Vanderbilt
- D. Shoffner M.S.N. Tennessee
- S. M. Thomas, Ph.D. Tennessee

The College of Nursing offers the Master of Science in Nursing with concentrations in adult health nursing, parent-child nursing, mental health nursing, and primary care nursing. See college description for additional information.

**ADMISSION REQUIREMENTS**

1. Meet requirements for admission to The Graduate School.
2. Hold a Bachelor's degree in Nursing or complete the equivalent of an upper division undergraduate major in nursing in addition to meeting all MSN degree requirements.
3. Have an undergraduate GPA of 3.0 or higher or a GPA of 3.0 for courses in the undergraduate major.
4. Complete the General Aptitude portion of the Graduate Record Examination. NOTE: A strong performance on this examination may compensate for a GPA lower than 3.0.
5. Complete Graduate Program Data Form.
6. Submit three letters of reference to Graduate Program Data Form.

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**THESIS AND NON-THESIS OPTIONS**

The thesis option is available for interested students and is especially encouraged for those who are considering pursuit of doctoral degrees sometime in the future. Students who choose the non-thesis option must complete a research-oriented project while registered for 580 Nursing Project. Specific guidelines for the project are available from the student's major advisor.

**PROGRAM REQUIREMENTS**

All students must complete a minimum of 40 semester hours distributed as follows:

- **Core (12 credits)**
  - 503-4 Holistic Nursing I,II
  - 510 Theoretical Foundations of Nursing
  - 520 Nursing Resource Management

- **Research (9-12 credits)**
  - Graduate level statistics course
  - 501 Nursing Research: Methods, Design, and Analysis
  - 500 Thesis
  - 580 Nursing Project

**Clinical Concentration (11 credits)—choose one**

- 530-31 Adult Health Nursing I,II
- 540-41 Family Nurse Practitioner I,II
- 550-51 Parent-Child Nursing I,II
- 560-61 Mental Health Nursing I,II

- **Role Preparation (5 credits)—choose one**
  - 562 Specialty Field Work and Seminar
  - 563 Teaching Strategies and Practicum (Not an option for non-nursing students)

- **Nursing Management: Strategies and Practicum (Not an option for non-nurse students)**
  - 564

- **Elective (3 credits)—waived for those who choose thesis option**
  - 301 Pharmacology
  - 302 Introduction to Professional Nursing
  - 304 Nursing Assessment and Health Promotion
  - 311 Acute Care Nursing
  - 313 Nursing Research
  - 401 Family Health Nursing
  - 403 Community Health Nursing
  - 406 Nursing Leadership
  - 411 Psychosocial Long Term Nursing

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*All students must complete a minimum of 40 semester hours distributed as follows:*
Registered nurses whose undergraduate degrees are not in nursing must complete 304, 305, 313, 315 Clinical Nursing Practicum, and 403. They must also complete or successfully challenge the following:

301 Pharmacology 3
312 Acute Care Nursing Theory 6
402 Family Health Nursing Theory 3
412 Psychosocial Long Term Nursing Theory 3

Students whose science backgrounds are deficient may also need to take 214 Integrated Biomedical and Health Sciences and/or 450 Physiological Principles.

FINAL EXAMINATION REQUIREMENTS
All students must successfully complete a final examination as required by The Graduate School. For thesis students, the examination will consist of an oral defense of the thesis as well as written or oral questions designed to measure student mastery of the entire program of study. For non-thesis students, the written examination will cover the entire program of study and may, at the discretion of the student’s committee, be followed by an oral examination.

SPECIAL POLICIES
1. Students must maintain a 3.0 GPA throughout the program. If the GPA for all graduate level courses is less than 3.0 after 20 credit hours are completed, the student will be required to withdraw from the program.
2. If the clinical performance of any student for any course is found to be unsatisfactory, the student will receive a grade of “F” for the course.
3. If a student achieves a final grade of ‘D’ or ‘F’ for any required undergraduate nursing course, he or she will not be permitted to repeat the course and will be required to withdraw from the program.
4. If the clinical performance of any student is characterized by unethical, unprofessional or unsafe behavior, or behavior that places the client in jeopardy, the student will be required to withdraw from the program.

REQUIREMENTS FOR SECOND MASTER’S DEGREE:
1. Students must complete 40 semester hours at the graduate level with a cumulative GPA of 3.0 unless they already have Master’s or doctoral degrees. Those who already hold a Master’s or doctoral degree may apply up to 9 semester hours from that degree to meeting MSN program requirements. In order to apply these hours to the MSN degree, the following criteria must be met:
   a. The courses utilized must be relevant to the MSN.
   b. The credits must have been earned within the time limits established for the MSN degree.
   c. The utilization of these courses must be approved by the student’s committee, by the Dean of the College, and by the Dean of The Graduate School.
2. Regardless of the specific courses transferred in order to reduce degree requirements, the following distribution of required nursing courses must be completed:
   Core 12
   Clinical Concentration 11
   Role Preparation 5
   Research 3

500 Thesis (1-15) F/P only  F
501 Nursing Research: Methods, Design, and Analysis (3) Methods, design, and data analysis issues and their interrelationships in planning, implementation, and evaluation of nursing and health-related research; research application of computer applications to data analysis. Prereq: 313. Prereq or coreq: Graduate level statistics course. F
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. SYNC only. F
503 Holistic Nursing I (3) Examination of philosophy of holistic nursing and new paradigms for nursing assessment, diagnosis, and intervention. Exploration and application of principles of health promotion, education, and innovative strategies for achievement of wellness. Prereq: 501. Graduate degree, MSN student, or consent of instructor. F,Sp
504 Holistic Nursing II (6) Continuation of 503. Holistic nursing modalities utilized to provide nursing care to clients, families, and community groups. Clinical practice experience with clients experiencing deviations from wellness. Prereq: 503, 4 hrs and 1 lab. F,Sp
505 Advanced Pharmacology (3) Pharmacological agents utilized to treat common, recurrent health problems; indications, contraindications, side and interactive effects of commonly prescribed drugs. Prereq: 501 or equivalent or consent of instructor. F
509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Social Work 509, Physical Education 509, Nutrition and Food Sciences 509.)
510 Theoretical Foundations of Nursing (2) Historical evolution of nursing science; examination and critical analysis of nursing’s metaparadigm and selected conceptual models, philosophies, and theories; contemporary ethical theories and application to nursing practice dilemmas. Prereq: MSN student or consent of instructor. F,Sp
520 Nursing Resource Management (2) Selected organizational, conflict-management, decision-making, leadership, professional, technological, and other theories, principles, and concepts to advanced clinical nursing practice. Prereq or coreq: 504. F,Sp
530 Adult Health Nursing I (6) Exploration and application of advanced nursing, physiological, developmental, and psychosocial theories to nursing care and management of clients and their families who are experiencing episodes of acute and chronic illnesses and related crises; role of clinical nurse specialist in helping clients and families achieve optimal health. Prereq: 501, 504, 510. 2 hrs and 4 labs. F
531 Adult Health Nursing II (5) Continuation of 530. Role of clinical specialist in providing and managing nursing care for acutely and chronically ill adults across life span; analysis and utilization of nursing and health-related research in practice settings. Prereq: 530. 2 hrs and 3 labs. Sp
540 Family Nurse Practitioner I (6) Exploration and application of holistic nursing theories to nursing management of common health problems of individuals and their families in the acute and chronic phases of clinical practice in role of nurse practitioner in variety of settings. Prereq: 501, 504, 510. 2 hrs and 4 labs. F
541 Family Nurse Practitioner II (5) Continuation of 540. Management of chronic health problems; clinical experiences in variety of settings. Prereq: 540, 510, 512. 1 lab and 3 labs. Sp
550 Parent Child Nursing I (6) Exploration and application of selected advanced nursing, physiological, psychological, developmental, and other theories, principles, and concepts to child-bearing and child-rearing families in acute care or community settings; family health promotion and interventions designed to recognize and respond to threats to health of mothers and children. Prereq: 501, 504, 510. 2 hrs and 4 labs. F
551 Parent Child Nursing II (Continuation of 550. Role of clinical nurse specialist in provision and management of nursing care for child-bearing and child-rearing families in community, hospital, or other health care settings. Prereq: 550. 2 hrs and 3 labs. Sp
560 Mental Health Nursing (6) Exploration and application of advanced theories of therapeutic intervention to clients experiencing mental health problems. Options for clinical practice with clients of various age groups in acute care or community facilities. Prereq: 501. 504, 510. 2 hrs and 4 labs. F
561 Mental Health Nursing II (Continuation of 560. Families and groups with mental health problems. Prereq: 560. 2 hrs and 3 labs. Sp
562 Specialty Field Work and Seminar (5) Seminar suitable for a clinical or practicum designed to facilitate further development of specialized knowledge and skills utilized for advanced clinical practice; required for all students who select role preparation in advanced clinical practice. Prereq: 530, 540, 550, or 550. Prereq or coreq: 531, 541, 551, or 561. 1 hr and 4 labs. Sp
563 Teaching Strategies and Practicum (5) Exploration, analysis, and application of selected educational, curriculum, teaching-learning, measurement, and evaluation principles and theories to instruction of undergraduate nursing students; teaching practicum in collegiate nursing program. Prereq or coreq: 531, 541, 551, or 561. 3 hrs and 2 labs. Sp
564 Nursing Management: Strategies and Practicum (5) Exploration, analysis, and application of selected advanced management, supervisory, organizational, leadership, and other theories and principles to nursing management practicum in nursing service facility. Prereq or coreq: 531, 541, 551, 561. 3 hrs and 2 labs. Sp
577 Special Topics (3) Topic is determined by faculty and student interest. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F,Sp
580 Nursing Project (3) Research-oriented, student-initiated endeavor that culminates in scholarly paper and/or presentation; initiative that culminates in scholarly paper and/or presentation; project may take form of development of innovative nursing intervention program, comprehensive literature review that reflects synthesis or comprehensive analysis, or other formats approved by nursing faculty member. Required for all MSN candidates who select non-thesis option. Prereq 501, 510. May be repeated. Maximum 6 hrs. Sp
593 Independent Study (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F,Sp

NUTRITION AND FOOD SCIENCES
(College of Human Ecology)

MAJORS

DEGREES

Food Science ............................................ M.S.
Nutrition ............................................. M.S.
Food Science and Human Nutrition ....... M.S.
Human Ecology ...................................... Ph.D.

Betty Ruth Carruth, Head

Professors:

Associate Professors:
W. C. Morris, Ph.D. Iowa; D. S. Sachan, Ph.D. Illinois; M. N. Traylor, M.P.H. California (Berkeley).
Assistant Professors:
J. B. Bittle (Memphis), Ph.D. Tennessee;
M. D. Brooks (Memphis), M.S. Alabama;
B. Haughton, Ed.D. Columbia; P. Redlinger,
Ph.D. Kansas State; J. D. Biohinner, Ph.D.
Oregon State; J. P. Sneed, Ph.D. Ohio State.

Instructor:
M. McGrath, M.S. Purdue.

Master of Science programs are available in Nutrition, Food Science, and Food Systems Administration. Within the Nutrition program, a student may choose a concentration in nutrition science or public health nutrition.

ADMISSION REQUIREMENTS
Admission into any of the graduate programs in the department is dependent on completion of undergraduate courses that give the necessary background for success in the graduate program. For all programs in Nutrition Science and Food Science, courses in general organic chemistry, physiological chemistry, food and clinical analysis, microbiology, mathematics, physiology, economics, science of food, and nutrition are essential. For the Master's program in food systems administration, undergraduate courses in food service systems administration, quantity food production, cost control, and personnel development are essential. In addition, students with work experience will be given preference.

THE MASTER'S PROGRAM
Nutrition
In Nutrition, students may choose a thesis or non-thesis option. Students emphasizing public health nutrition must choose the non-thesis option. Nutrition students who choose the non-thesis option must take 515 or 541 and 2 hours from 542-544, which are designed as courses in which the student will integrate knowledge from course work and write a major paper upon completion of an individual project.

Thesis Option: The program consists of a minimum of 33 hours with at least 16 hours of course work in the department. NFS 503 or 504, 511, 512, and 541, or 544 or 545 are required. Six hours in one area outside the department are required. A minimum of 22 hours at the 500 and 600 level is required.

An oral comprehensive examination is required upon completion of the thesis.

Non-Thesis Option: The program consists of a minimum of 33 hours with at least 20 hours of course work in the department. NFS 503, 504, 511, 512, 541, and 544 or 545 are required. Six hours outside the department are required. A minimum of 24 hours at the 500 and 600 level is required.

A written comprehensive examination is given at the end of the program.

Food Systems Administration
In Food Systems Administration, students may choose a thesis or non-thesis option. Food Systems Administration students who choose the non-thesis option must take 541, 546 and 3 hours from 548, which are designed as courses in which the student will integrate knowledge from course work and write a major paper upon completion of an independent project.

Thesis Option: The program consists of a minimum of 33 hours with at least 16 hours of course work in the department. NFS 540, 541, and 546 are required. Six hours of thesis 500 are required and may be applied toward the 33 hours. Six hours outside the department are recommended. A minimum of 22 hours at the 500 and 600 level is required.

An oral comprehensive examination is required upon completion of the thesis.

Non-Thesis Option: The program consists of a minimum of 36 hours with at least 20 hours of course work in the department. NFS 540, 541, 546, and 3 hours from 548 (non-thesis research project) are required. Six hours in one area outside the department are required. Six hours outside the department are recommended. A minimum of 24 hours at the 500 and 600 level is required.

A written comprehensive examination is given at the end of the program.

THE PH.D. CONCENTRATION
Students enrolled in the food science concentration specialize in either the physicochemical or socio-cultural aspects of food in relation to people and their environment. Students are expected to develop strength in nutrition and other fields by taking courses in a cognate area. Food systems administration, food technology, education, and the natural and behavioral sciences are among the potential cognate areas.

The nutrition science concentration enables students to study the science of nutrition from the cellular level to the application of nutritional principles by people in a changing environment.

In either concentration, students may specialize in nutrition education, using nutrition and food science as foundation areas, and incorporating the study of food habits and factors that influence dietary change. Cognate areas could include sociology, education, anthropology, and/or statistics. Students are expected to acquire advanced training in food science, chemistry, biology, and other natural and behavioral sciences. The doctoral program emphasizes human nutrition, experimental nutrition (nutrition of small animals), and intermediary metabolism.

Requirements for both concentrations:
1. Sixteen hours with a concentration in food science or nutrition including 9 hours at the 600 level (exclusive of dissertation);
2. NFS 511, and 512, 503 or 504 (nutrition science concentration) or 503 and 504 (food science concentration);
3. Minimum 4 hours of NFS 540;
4. Minimum 9 hours of statistics, computer science and research methods;
5. Minimum 6 hours in a cognate area;
6. Students without college teaching experience are required to take the fall semester seminar for GTAs and NFS 548 comprising a faculty-supervised problem in college teaching.

413 Experimental Food Science (3) Individual and group laboratory experience in food science; microcomputer applications. Prereq: 312, Plant and Soil Science 471. 1 hr and 2 labs. F, A

414 Nutrient-Drug Interactions (2) Nutrient effects on efficacy and toxicity of drugs; drug effects on absorption and metabolism of nutrients. Prereq: 300 or equivalent. Sp, A

423 Foodservice Systems Design and Equipment (3) System facility design; production and delivery systems analysis; equipment selection and purchase. Prereq: 351 or consent of instructor. A

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (1-15) Required. May not be used toward degree requirements. May be repeated. S/NC only. E

503 Physicochemical Properties of Foods I (3) Proteins and lipids: physical and chemical characteristics; behavior in foods. Prereq: 201 or equivalent. 413. F, A

504 Physicochemical Properties of Foods II (3) Sugars, starches, starch-branching agents, hydrocolloids, and pigments: physical and chemical characteristics; behavior in foods. Prereq: 201 or equivalent. 413, F, A

505 Food Texture (2) Classification of foods according to textural parameters; instrumental and sensory methods of evaluation of food texture. Prereq: 413 or Food Technology and Science 411, statistics or consent of instructor. 1 hr and 1 lab. Su

506 Sensory Analysis (3) Principles and methodology for sensory evaluation of food; application to laboratory and consumer panels; interpretation of data. Prereq: 413 or consent of instructor. 2 hrs and 1 lab. F

508 Culture, Food, and Nutrition (3) Food-related behaviors of individuals and groups in the United States, Sociocultural, economic, and technological influences. Nutrition and food surveys, public policy. Prereq: 301 or 313 or consent of instructor. F, A

509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nutrition 509, Physical Education 509 and Social Work 509.)

511 Advanced Physiological Chemistry (4) Bioenergetics, flux control and hormonal interrelationships. Prereq: 513 or equivalent. F

513 Community Nutrition (3) Orientation to community; assessment of needs and trends; functional roles of public health nutritionist. Concurrent field experiences. Prereq: 313 or consent of instructor. F

514 Community Nutrition (3) Planning, implementation, and evaluation of public health nutrition programs. Concurrent field experiences. Prereq: 513 or consent of instructor. Sp

515 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of in-depth study to be selected in consultation with instructor. Prereq: 514 and consent of instructor. Su

516 Maternal and Child Nutrition (3) Nutrition principles related to growth and development during pregnancy, infancy, and childhood to age 5, high risk conditions. Prereq: 313 or consent of instructor. F

517 Childhood and Adolescent Nutrition (3) Application of nutrition principles to school age children; effects of diseases on growth and health maintenance; nutritional assessment and counseling for nutrition. Prereq: 313 or consent of instructor. Sp

518 Nutrition and Aging (3) Nutritional problems of adults; nutritional requirements, dietary intakes; affects of nutrition on biological aging. Prereq: 313 or consent of instructor. Su

519 International Nutrition (3) World food supply, demographic, sociocultural, economic, and technological relationships; food and nutrition; international and intervention and assistance programs. Prereq: Consent of instructor. F,A

520 Nutritional Ecology (2) Examination of issues in natural, political, physical, and social environments that impact availability of food and nutrients in U.S. food supply. F,A

521 Physiological Basis for Diet and Disease (2) Altered nutrient needs as result of metabolic changes that occur in selected disease states. Prereq: 411 or consent of instructor. F,A

522 Nutrition Counseling (2) Individual eating habits and disorders, evaluation strategies for effectiveness of helping process. Prereq: 313 or consent of instructor. F,A

523 Nutrition and Behavior (2) Influence of nutrients on intracerebral metabolic processes, electrophysiological indicators of brain function and behavior of individuals: sensory, motor, intellectual, and personality aspects. Prereq: Consent of instructor. Su

524 Nutrition Education: Principles, Implementation, and Evaluation (3) Conceptual models, principles, application, and evaluation models in nutrition education and research. Prereq: 508 or consent of instructor. Su,A

525 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students in training at Child Development Center, UT, Memphis. Supervised project in selected area. Prereq: Consent of department head. E

527 Nutrition in Mental Retardation and Developmental Disabilities (1-9) Interdisciplinary diagnosis and treatment of developmentally-handicapped child; role of nutritionist; clinical experiences and lectures at Child Development Center, UT, Memphis. Prereq: Consent of department head. E

529 Management in Nutritional Care (2) Administrative roles and management functions of dietitians in clinical settings: program development, planning, and evaluation. Prereq: 220, 422, or consent of instructor. Su

530 Computer-Assisted Foodservice Systems Management (3) Application of computer technology to foodservice systems management. Course work includes budgeting, production, and nutrient analysis. Prereq: 320 or consent of instructor. Su,A

531 Financial and Marketing Administration in Foodservice (3) Marketing and financial techniques used in foodservice operations; developing foodservice marketing plan, budgeting, foodservice accounting and information services. Prereq: 326 or consent of instructor. Sp

532 Human Resource Management in Foodservice (3) Identifying labor needs; development and maintenance of work force. Prereq: 422 or consent of instructor. F

533 Advanced Food Production and Delivery Systems Management (3) Analysis of food production and delivery systems; application of quantitative methods and models to optimize decisions. Prereq: 320 or consent of instructor. F

534 Special Topics in Foodservice Systems Administration (1-3) Lecture/discussion format. Contemporary developments and trends in industry. Prereq: Consent of instructor. May be repeated. E

535 Directed Study in Foodservice Systems Administration (1-3) Problems selected for study by student with guidance of faculty member. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

537 Seminar in Foodservice Systems Administration (1) May be repeated. S/NC only. Sp

540 Seminar in Nutrition and Food Sciences (1) May be repeated. S/NC only. E

541 Research Methods (1) Basic principles of planning, conducting, and interpreting nutrition, food sciences, and foodservice systems administration research. Prereq: 6 graduate hours in nutrition and food sciences and statistics. Sp

542 Advanced Experimental Nutrition (2) Application of research principles to individual project using experimental animals. Prereq or coreq: 541. Sp

543 Human Metabolic Research Methods (2) Application of research principles to conducting and interpreting metabolic study. Prereq or coreq: 541. Sp

544 Food and Nutrition Survey (2) Project for assessment of food consumption, nutrient intake, nutritional status, and sociocultural economic parameters in populations. Prereq or coreq: 541. Sp

545 Advanced Experimental Food Science (2) Application of research principles to individual food science study. Prereq or coreq: 541. 2 labs. Sp

546 Foodservice Systems Administration Research Methods (2) Application of research methods to development of proposals for individual foodservice-industry related research project to be completed in 548. Prereq or coreq: 541. Sp

547 Field Experience (3-9) Experience in food-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. S/NC only. E

548 Directed Study in Nutrition and Food Sciences (1-3) Advanced study in nutrition and food sciences. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

549 Special Topics (1-3) Recent advances in nutrition, food science, food systems administration and hospitality industry; implications for professionals. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Advanced Topics in Food Science (1-3) Comprehensive individual study and group discussion of topics related to current problems in food science. Prereq: 503 or 504, consent of instructor. May be repeated. F

602 Advanced Topics in Nutrition Science (1-3) Comprehensive individual study and group discussion of topics related to current problems in nutrition. Prereq: 512 or consent of instructor. May be repeated. F

603 Current Trends in Food and Sociocultural Change (2) Critical evaluation of research. Prereq: 508, 541, 544, graduate-level statistics. Su,A

Ornamental Horticulture and Landscape Design (College of Agriculture)

MAJOR DEGREE
Ornamental Horticulture and Landscape Design M.S.

G. Douglas Cramer, Head

Professors: L. M. Callahan, Ph.D. Rutgers; G. D. Crater, Ph.D. Ohio State; E. T. Graham, Ph.D. Pennsylvania State; G. L. McDaniel, Ph.D. Iowa State; H. v. der. Werken, GAUST; Horticulture College, Frederiksoord, (Holland); B. D. Williams, Ph.D. Pennsylvania State.

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

Assistant Professors: S. M. Rogers, M.L.A. Georgia; R. Trigiano, Ph.D. North Carolina State.

The Department of Ornamental Horticulture and Landscape Design offers the Master of Science with concentrations in floricultural science and technology, nursery science and technology, turfgrass science and technology. Various science and technology interests such as micropropagation, innovative ornamental plant production systems, and computer aided maintenance and production management systems can be emphasized in any of the areas of concentration by judicious selection of courses and research objectives for the thesis. For admission, the student must have a B.S. in ornamental horticulture, horticulture, plant science, or a closely related agricultural or basic science discipline and must have the undergraduate transcript evaluated by the department for prerequisite requirements. If any deficiencies, research assistantships are available on a competitive basis. For further information, contact the department head.

THE MASTER'S PROGRAM

Thesis Option

1. A thesis is required. A Master's committee of no fewer than 3 faculty members will be selected. Prior to research for the thesis, a proposal must be approved by the Master's committee. Registration for a minimum of 6 hours of Thesis 500 is required.

2. In addition to the thesis requirement, a minimum of 24 hours of graduate credit is required. Not more than 10 hours of the minimum 30 hours can be below the 500 level. The academic program must be approved by the Master's committee which may require additional course work if the student's progress or background indicates such need.

3. All students are required to include 2 hours of 590 Seminar in their program and are expected to attend this course and par-
to participate in discussions each semester and course work is required.

Non-Thesis Option
1. A Master's committee of no fewer than 3 faculty members will be selected.
2. Thirty-four hours of graduate course work of which 22 hours must be at the 500 level or above is required.
3. All students are required to include 2 hours of 590 Seminar in their program and are expected to attend this course and participate in discussions each semester enrolled.
4. Twelve hours of course work in the department must be at the 500 level or above exclusive of Thesis 500.
5. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 32 hours of approved graduate work.

Pathobiology

MAJOR DEGREE
Veterinary Medicine D.V.M.

R. L. Michel, Head

Professors:
M. D. McGavin, Ph.D. Michigan State; R. L. Michel, V.M.D. Pennsylvania; Ph.D. Michigan State; L. N. D. Potgieter, Ph.D. Iowa State; H. M. Schuller, D.V.M. Justus Leibig (Germany); Ph.D. Hansvnepper (Germany).

Associate Professors:

Assistant Professor:
M. A. Breider, D.V.M. Oklahoma State; Ph.D. Texas A & M.

Instructor:
G. M. del Fierro, D.V.M. Philippines.

Residents:
R. B. Dunc&m, D.V.M. Ohio State; S. L. Vanhuusen, D.V.M. Texas A & M.

See Veterinary Medicine for Program Description.

PROFESSIONAL COURSES

871 General Pathology (4) Principles of pathobiology and the relationship of disturbances of cell growth, inflammation, and neoplasia.

873 Parasitology (3) Principles of parasitology: protozoology, helminthology, and entomology and relationships to diseases in animals.
Philosophy

(College of Liberal Arts)

MAJOR DEGREES

Philosophy ........................................... M.A., Ph.D.

Joan W. Davis, Head

Professors:
R. E. Aquila, Ph.D. Northwestern;
G. G. Brenkent, Ph.D. Michigan; L. B. Cebik, Ph.D. Nebraska; J. W. Davis, Ph.D. Emory;
R. B. Edwards, Ph.D. Emory; G. C. Graber, Ph.D. Michigan; B. C. Postow, Ph.D. Yale;
D. Van de Vate, Jr., Ph.D. Yale.

Associate Professors:
J. O. Bennett, Ph.D. Tulane; S. M. Cohen, Ph.D. Northwestern; K. A. Emmett, Ph.D. Ohio State; J. E. Noit, Ph.D. Ohio State;
M. L. Osborne, Ph.D. Tennessee.

Assistant Professors:
H. P. Hamlin, Ph.D. Georgia; E. R. Jones, Ph.D. Chicago; M. Lavin, Ph.D. Stanford.

The Department of Philosophy offers graduate study leading to the Master of Arts and Doctor of Philosophy. The M.A. program includes thesis and non-thesis options and offers concentrations in medical ethics and in religious studies. The Ph.D. program also has a concentration in medical ethics. Detailed information may be obtained from the Director of Graduate Studies in Philosophy.

THE MASTER'S PROGRAM

The department offers both a thesis and a non-thesis option. The course requirements for an M.A. with thesis are 30 hours, including a maximum of 6 hours in Philosophy 500. Of non-thesis courses, at least two-thirds must be in courses at or above the 500 level. No philosophy course numbered under 400 may be taken for graduate credit. There are no particular courses that M.A. students are required to take. The nature of the student's course work should be determined in consultation with the student's faculty committee. The non-thesis M.A. requires 30 hours of course work of which at least two-thirds must be in courses at or above the 500 level. Students seeking the non-thesis option must also pass a final written examination on all work offered for the degree. An additional oral examination may be required.

THE DOCTORAL PROGRAM

Specific requirements for doctoral students in Philosophy include a minimum of three academic years of graduate study involving at least 48 semester hours in course work (normally 16 semester courses or their equivalent, exclusive of credit for thesis and dissertation) of which no fewer than 30 hours shall be in courses numbered over 500 and no fewer than 6 hours shall be in courses numbered over 600. The specific number and distribution of courses will be determined by the student's faculty committee.

Doctoral students must demonstrate competency in one foreign language, normally French or German. This may be done by passing the doctoral language examination administered by the Romance Language or German Departments, or by passing French 302 or German 332 with a B or better. In special circumstances and upon petition by the student, the department's graduate committee may approve a substitute language for French or German.

SPECIAL CONCENTRATIONS

Medical Ethics

The department has an M.A. and Ph.D. program of graduate study with a concentration in medical ethics. Detailed information concerning the program can be obtained from either the Director of Graduate Studies in Philosophy or the Director of the Medical Ethics Program.

Religious Studies

The department has an M.A. program of graduate study with a concentration in religious studies. Details concerning the program may be obtained from either the Director of Graduate Studies in Philosophy or the Department of Religious Studies.

400 Special Topics (3) May be repeated when topic varies. Maximum 6 hrs.

411 Modern Religious Philosophies (3) (Same as Religious Studies 411.)

412 Classical Indian Systems of Philosophy: The Moksha Tradition (3) (Same as Religious Studies 412.)

420 Topics in History of Philosophy (3) Figures or movements in the history of philosophy. Prereq: 6 hrs of philosophy or consent of instructor. May be repeated when topic varies. Maximum 9 hrs.

425 American Philosophy (3) Colonial to early 20th Century. Prereq: 6 hrs of philosophy or consent of instructor.

430 Topics in Logic (3) Prereq: 6 hrs of logic or consent of instructor. May be repeated when topic varies. Maximum 6 hrs.

440 Contemporary Ethical Theory (3) Topics in metaethics or ethics. Prereq: 8 hrs of philosophy or consent of instructor.

446 Theoretical Issues in Medical Ethics (3) Prereq: 240 or 345 or consent of instructor. (Same as Religious Studies 446.)

460 Philosophy of Science (3) Methodological and conceptual issues in natural and social sciences: patterns of theory modification and replacement, nature of explanation and causation, status of theoretical entities. Prereq: 380 and 1 yr of natural or social science, or consent of instructor.

465 Philosophy of History (3) Speculative and critical aspects of philosophy of history. Prereq: 6 hrs of philosophy or consent of instructor.

473 Philosophy of Mind (3) Problems of mind and body in relation to consciousness and personal identity. Prereq: 6 hrs of philosophy or consent of instructor.

475 Analytic Metaphysics and Epistemology (3) Topics in metaphysics and epistemology in recent Anglo-American tradition. Prereq: 6 hrs of philosophy or consent of instructor.

476 Philosophy of Language (3) Survey of issues such as meaning, reference, and truth. Prereq: 6 hrs of philosophy or consent of instructor.

479 Studies in Recent Continental Philosophy (3) Selected thinker or topics: existentialism, phenomenology, hermeneutics, structuralism, poststructuralism. Prereq: 6 hrs of philosophy or consent of instructor. May be repeated when topic varies. Maximum 6 hrs.

500 Thesis (1-15) P/NP only. E

503 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or of faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E

520 Topics in the History of Ancient and Medieval Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

522 Topics in the History of Modern Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

524 Topics in the History of Twentieth-Century European Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

527 Topics in the History of American Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

530 Topics in Logic and Philosophy of Mathematics (3) May be repeated. Maximum 9 hrs.

540 Topics in Value Theory (3) May be repeated. Maximum 9 hrs.

542 Ethics (3) Dominant movements in history of ethics. May be repeated. Maximum 9 hrs.

544 Applied Ethical Theory (3) Single author, tradition, or topic in ethical theory, application to issues in health, business, technology, ecology, and other practical fields. May be repeated. Maximum 9 hrs. (Same as Religious Studies 544.)

546 Orientation to Medical Ethics (3) Survey of ethical theories in application to issues in medical ethics. Prereq: Consent of Medical Ethics Committee.

547 Clinical Medical Ethics (2) Medical terminology, history of medical ethics, case study discussion, clinical observation. Open only to students concentrating in medical ethics. May be repeated. Maximum 4 hrs.

548 Clinical Residency in Medical Ethics (3-9) Open only to students concentrating in medical ethics. Prereq: Consent of Medical Ethics Committee, S/N/C only.

553 Philosophical Topics in Literature and the Arts (3) Aesthetics, criticism, art and society. May be repeated. Maximum 9 hrs.

560 Philosophy of Natural Sciences (3) Nature of subject matter and method of science. May be repeated. Maximum 9 hrs.


570 Philosophy of Religion (3) Examination of central problems. (Same as Religious Studies 570.)

575 Topics in Metaphysics and Epistemology (3) May be repeated. Maximum 9 hrs.

577 Philosophy of Mind (3) Relation of mental to physical and of role of words in discourse for mental activities, thinking and feeling. May be repeated. Maximum 9 hrs.

590 Social and Political Philosophy (3) Philosophical problems concerning social and political life: family, state, freedom, justice; major theoretical responses: anarchism, social contract, Marxism. May be repeated. Maximum 9 hrs.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

600 Doctoral Research and Dissertation (3-15) P/NP only. E
Physical Education and Dance

(College of Education)

MAJORS

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<th>DEGREES</th>
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<tr>
<td>Physical Education</td>
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<tr>
<td>Education</td>
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</table>

Professors:


Associate Professors:

- P. A. Beitel, Ed.D. North Carolina (Greensboro); R. J. Croskey, M.A. Southern Methodist; R. E. Jones, Ph.D. Toledo; B. J. Mead, Ph.D. Purdue; W. J. Morgan, Ph.D. Minnesota.

Assistant Professors:


Adjunct Faculty


THE MASTER’S PROGRAM

The Department of Physical Education and Dance offers the Master of Science with a major in Physical Education with the following concentrations:

- Adapted Physical Education
- Exercise Physiology and Fitness
- Motor Behavior
- Pedagogy in Physical Education
- Philosophical and Sociological Foundations of Sport
- Sport Administration/Management

The Master of Science program permits the student to select a thesis or non-thesis option. The thesis option requires a minimum of 30 hours. The non-thesis option requires 32 hours, including a project. All students must complete a course in research design or statistics and register for two credits of Physical Education 601.

THE DOCTORAL PROGRAM

The Doctor of Education with a major in Physical Education is available with concentrations in the following areas:

- Adapted Physical Education
- Exercise Physiology and Fitness
- Motor Behavior
- Philosophical and Sociological Foundations of Sport

The Doctor of Philosophy with a major in Education includes the concentrations and specializations listed under Education.

ADMISSION REQUIREMENTS

Applicants are required to complete the departmental application which will be sent to all persons upon their initial inquiry about the program. Specific questions about these programs should be directed to the head of the Department of Physical Education and Dance.

The following retention policy applies to all graduate students seeking a degree in the Department of Physical Education and Dance:

1. Graduate students are required to maintain an overall GPA of 3.0.
2. Any student who falls below this standard will be advised in writing by the department head of the need to discuss the matter with his/her advisor.
3. If a student's overall GPA remains below 3.0 for a second semester, the student will have his/her degree status revoked.

GRADUATE ASSISTANTSHIPS

A limited number of graduate assistantships are available for qualified women and men who are graduates of accredited colleges or universities. These assistantships are open to students in the Master's and doctoral programs. Students interested in these opportunities should file their applications before February. Letters should be addressed to:

Graduate Assistantships Coordinator
Department of Physical Education and Dance
The University of Tennessee
Knoxville, TN 37996-2700

Physical Education

405 Sociology of Sport (3) (Same as Sociology 405.)

414 Physical Activity and Fitness (2) Relationship of exercise to cardio-respiratory function, body composition, healthy low back, and stress. Prereq: 200, 292. (Same as Health 414.)

423 Readings in Physical Education (2) Review of current and classic literature in physical education.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

509 Graduate Seminar in Public Health (1) (Same as Public health 509, Nursing 509, Nutrition and Food Science 509 and Social Work 509.)

511 Administrative/Supervisory Processes in Physical Education (3) Organizational concepts, management strategies, and supervisory techniques related to physical education programs at all levels.

512 Application of Theory to Curricular/Methodological Decision in Physical Education (3) Application of curricular principles and theories to educational situations for development of curricula and lessons in physical education. Various methodological approaches.

514 Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptual, moral, aesthetic, and social-political issues.

515 Social Theories of Sport (3) Liberal, democratic and Marxist social theories of sport. (Same as Sociology 594.)

528 Motor Behavior: A Theoretical Perspective (3) Motor behavior from information processing perspective; overview of current research that supports theoretical bases. Prereq: Undergraduate course in general psychology or consent of instructor.

531 Biomechanics of Human Performance (3) Human movement, biomechanics, and sports medicine. Prereq: 492 or equivalent.

532 Seminar in Research Techniques in Physical Education (3) Evaluate, compare, and contrast research techniques in physical education with consideration for and implications of various theoretical perspectives, design, and analysis procedures, and proposal development.

533 Psychology of Sport (3) Social psychological factors influencing human behavior in sport context; discussion of contemporary theory, research, and methodology. Prereq: General psychology course or consent of instructor.

534 Motor Behavior and Skill Acquisition (3) Topical explanation and application of principles of human movement behavior to acquisition and performance of skills; discussion of current research and methodology.

541 Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport. May be repeated.

542 Sociological Aspects of Sport and Physical Education (3) Social and cultural factors influencing sport and physical education; pertinent issues and research applications. Prereq: Consent of instructor. (Same as Sociology 542.)

543 Human Motor Development (3) Changes in selected motor performance and related attribute areas during critical developmental periods within context of perceptual-motor development. Prereq: Consent of instructor.

544 Theories of Physical/Movement Education (3) Integration of various theoretical approaches to physical education/movement education within cultural context; research and field work.

553 Advanced Adapted Physical Education (2) Curriculum development and teaching methodologies in programming for children with special education needs. Prereq: 411 or consent of instructor. Coreq: 554.

554 Advanced Adapted Physical Education Practice (1) Curricular and methodologies represented in lab in school for handicapped. Coreq: 553.

555 Motor Assessment and Programming for the Child with Special Education Needs (3) Criterion and norm-referenced tests used in development of individualized education programs for children with physical education/motor development needs. Testing protocols which purport to get at basis of dysfunction; those which just measure symptoms of dysfunction; efficacy of remediation theories based or related to testing protocols. Evaluation of motor skill in exceptional children and development of remedial programs for children assessed appropriate for school/parent implementation.

560 Physiology of Fitness (3) Adaptations that take place with training and detraining, and influence of environmental and hereditary factors. Prereq: Under-
481 History of Dance II (3) Development of dance in theatre, recreation and education during 20th century.

490 Philosophy of Dance and Related Arts (3) Aesthetic principles and current trends in dance; relationship with other art forms.


495 Dance Pedagogy (3) Principles and methods of teaching of dance with practical application in in-service teaching experience. Prereq: Upperclass or graduate standing and consent of instructor.

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**Physics and Astronomy**

*(College of Liberal Arts)*

### MAJOR DEGREES

<table>
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<tr>
<th>Physics</th>
<th>M.S., Ph.D</th>
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<td>William M. Bugg, Head</td>
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**Professors:**

- C. R. Bingham, Ph.D. Tennessee
- W. E. Blass, Ph.D. Michigan State
- M. A. Breazeale, Ph.D. Michigan State
- W. M. Bugg, Ph.D. Tennessee
- T. A. Calcott, Ph.D.
- L. G. Christophorou, Ph.D.
- University of Manchester (England)
- E. W. Coligazer, Ph.D. California Institute of Technology
- T. C. Collins, Ph.D. Florida
- G. T. Condo, Ph.D. Illinois
- W. E. Deeds, Ph.D.
- Ohio State
- J. B. Dicks (Alumni Distinguished Professor), Ph.D.
- D. Vanderbilt
- K. Fox, Ph.D. Michigan
- N. M. Giarla (Emeritus), Ph.D.
- Ohio State
- S. Georgiou, Ph.D.
- Manchester (England)
- M. W. Guidry, Ph.D.
- Tennessee
- E. G. Harris (Alumni Distinguished Professor), Ph.D.
- Tennessee
- E. L. Hart, Ph.D. Cornell
- P. G. Huray, Ph.D.
- Tennessee
- H. C. Jacobson, Ph.D.
- Yale
- D. T. King, Ph.D. Bristol (England)
- R. J. Lovell, Ph.D. Vanderbilt
- G. D. Milan (Distinguished Scientist), Ph.D. California
- Berkeley
- A. A. Mason, Ph.D. Tennessee
- A. H. Nielsen (Emeritus), Ph.D.
- Michigan
- F. E. Obenshain, Jr., Ph.D.
- Pittsburgh
- L. R. Painter, Ph.D. Tennessee
- J. P. Pegg, Ph.D.
- New Hampshire
- L. L. Fiedinger, Ph.D.
- Vanderbilt
- R. H. Ritchie, Ph.D.
- Tennessee
- H. C. Schweiner (Emeritus), Ph.D.
- Massachusetts Institute of Technology
- I. A. Selli (Chancellor’s Research Scholar), Ph.D.
- Chicago
- C. C. Shih, Ph.D.
- Cornell
- P. J. Siemons (Distinguished Scientist), Ph.D.
- Cornell
- P. H. Stelson, Ph.D.
- Massachusetts Institute of Technology
- J. R. Thompson, Ph.D.
- Duke
- J. O. Thomson, Ph.D.
- Illinois
- G. W. Wheeler, Ph.D.
- Yale
- J. W. White (Emeritus), Ph.D.
- North Carolina

**Associate Professors:**

- J. Brau, Ph.D.
- Massachusetts Institute of Technology
- M. Brenig, Ph.D.
- Oregon
- R. W. Childers, Ph.D.
- Vanderbilt
- J. Connel, Ph.D.
- Colorado State
- H. W. Crater, Ph.D.
- Yale
- K. E. Duckett, Ph.D.
- Tennessee
- W. A. Dunnill, Ph.D.
- Florida
- S. B. Elston, Ph.D.
- Massachusetts
- T. Ferrell, Ph.D.
- Clemens
- T. H. Handler, Ph.D.
- Rutgers
- R. H. Kohl, Ph.D.
- Ohio State
- J. W. Lewis,

**Physics and Astronomy/FIELDS OF INSTRUCTION**

- Astronomy
- Physics and Molecular Spectroscopy
- Physics, Chemical Physics
- Physics, Elementary Particle Physics
- Physics, Health Physics
- Physics, Heavy Ion Physics
- Physics, Molecular Spectroscopy
- Physics, Nuclear Physics
- Physics, Plasma Physics
- Physics, Solid State Physics
- Physics, Theoretical Physics
- Physics, Ultrasonics

**Graduate Programs**

Graduate programs leading to the Ph.D. degree are available in condensed matter physics, atomic and low temperature physics, biophysics, chemical physics, elementary particle physics, health physics, heavy ion atomic physics, molecular spectroscopy, nuclear physics, plasma physics, condensed matter physics, computational physics, and theoretical physics.

**ADMISSION REQUIREMENTS**

A student who enrolls in the Graduate School with the intention of obtaining an advanced degree in Physics will have completed an undergraduate major in Physics or its equivalent. Physics 311-12, 321, 341-32, and 461-62-63 or 411-12 constitute the minimum courses prerequisite to graduate study.

A student who intends to present Physics as a graduate minor will have completed an undergraduate minor in Physics or its equivalent. Physics 311 and 431-32 constitute the minimum course work prerequisite to a minor in Physics.

All first-year graduate students are required, for advising purposes only, to take a qualifying examination in undergraduate physics during the fall semester registration period.

**THE MASTER’S PROGRAM**

**Thesis Option**

This program is designed primarily for students intending to go into industrial or governmental laboratories as physicists. The course requirements include 24 semester hours of physics courses, of which at least 12 semester hours are taken from Physics 511-12, 521-22, 531-32, 541-42, or 571-72. Each candidate must present an acceptable thesis, 6 hours of 500, and pass an oral examination on course material and thesis.

**Non-Thesis Option**

This program is designed primarily 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 the non-thesis option must apply to the department’s graduate committee for permission to enroll under this program. The requirements are the satisfactory completion of 30 hours of course work composed of 18 semester hours from Physics 511-12, 521-22, 531-32, 541-42, and 571-72; 6 semester hours in a declared minor.
hours in a minor field; and 6 semester hours must be taken at the 500 level or above. In addition, the candidate must pass a written examination administered by the committee.

**THE DOCTORAL PROGRAM**

All students are expected to take Physics 521-22, 531, 541-42, 551, 561, 571-72, and 611. Physics 601-02 are normally required of students specializing in atomic physics. Physics 521-22 when used in partial fulfillment of the major field of study, constitutes the core curriculum and are the basis for graduate credit in physics with consent of department. Must be taken in sequence. Prereq: 232 or equivalent, Mathematics 438.

421 Modern Optics (4) Transmission of light in uniform, isotropic media; reflection and transmission at interfaces; wavefronts of wave motion and interference effects. Prereq: Mathematics 438. Coreq: 431 or 432 and consent of instructor. 3 hrs and 3 labs.

425 Principles of Nondestructive Testing (3) (Same as Engineering Science and Mechanics 425.)


461-62 Modern Physics Laboratory (3,3) Experimental techniques; spectroscopy, electric measurements, computer interfacing, resonance, detectors, and statistical analysis, applied to experiments in nuclear, atomic, molecular, and solid state systems. Must be taken in sequence. Prereq: 401 or consent of research director. 3 hrs and 3 labs.

471-72 Health Physics (3,3) Radiobiology, interaction of electromagnetic radiation with matter, radiation quotients and units, x-rays, neutron and gamma rays, and neutron activation, interaction of charged particles with matter, stopping power, range-energy relations, counting statistics, shielding, dosimetry, waste disposal, criticality prevention, radiation biology and ecology. Prereq: 340 or 341.

490 Senior Seminar (1-3) Topic of current interest. May be repeated with consent of department. Maximum 6 hrs.

500 Thesis (1-18) P/NC only. E

501 Graduate Research Participation (3) Advanced research participation for graduate students appointed as research assistant or research director whose research area coincides with interests of student. Open to all graduate students in good standing. Prereq: Consent of department and research director. May be repeated with consent of department. Maximum 18 hrs. S/NC only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses facility. S/NC only. E

505 Physics of Fluids (3) Fluid physics, overview of fluid mechanics and associated computational techniques; general description of laminar and turbulent flows; subsonic, supersonic and hypersonic flows; continuum, transitional and free-molecular flows; pipe flow, nozzle flow and sonic orifice expansion flows; reacting and nonreacting flowfields; shock-tube physics; and an introduction to the method of characteristics and Monte Carlo computational techniques.

506 Experimental Methods (3) Principles, real operational behavior, and hazards of laser types, radiation detectors, and detectors of other forms, light pipes, image converters, image disectors, streak cameras, and fast-facing cameras; high-vacuum systems including cryogenic-based devices, data acquisition techniques including synchronous detection, digital electronics methods and micro-computer data acquisition and registration methods.

507 Contemporary Optics (3) Topics in geometrical, physical, and nonlinear optics and introductory laser physics. Extensive use of computer calculations and design of practical and sophisticated optical systems.

508 Laser Physics (3) Mode analysis, stable and unstable resonators, rate equations and population inversion, saturation, relaxation oscillations, fluctuations and noise, laser stability; quantum theory of laser, photon coherence, mode-locking, Q-switching and frequency stabilization; specific laser types: semiconductor and solid-state, excimer, copper vapor and dye lasers.


532 Advanced Classical Mechanics (3) Variational principles, canonical transformations, Hamilton-Jacobi theory, normal modes, elasticity, fluid mechanics. Prereq: 531.


561 The Theory of Relativity (3,3) Geometry of space-time, relativistic electrodynamics, particle mechanics and gauge fields, Lorentz transformations, Schwarzschild solutions, the classical test of general relativity. Prereq or coreq: 531 and 542.

571-72 Mathematical Methods in Physics (3,3) Linear vector and matrix analysis, tensors, curvilinear coordinates, functions of a complex variable, partial differential equations and boundary value problems, Green's functions, integral transforms, integral equations, spherical harmonics, Bessel functions, calculus of variations. Prereq: Advanced calculus and differential equations. Must be taken in sequence. (Same as Mathematics 517-18.)

574-75 Group Theory for Physicists (3,3) Introduction to group theory, group representation, Noether's theorem, symmetries and degeneracies, application of group-theoretical methods to atomic physics, solid-state physics, and particle physics. Prereq: 571-72.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Special Problems (3) Especially assigned theoretical or experimental work on problems not covered in other courses. May be repeated. Maximum 9 hrs. E


600 Doctoral Research and Dissertation (3-15) N/P only. E


605 Laser Spectroscopy (3) Application of lasers to spectroscopy of atomic and molecular systems; review of classical multiple-pole radiation, atomic L-S and J-J coupling, and Stark-Zeeman effects, spontaneous emission of atomic systems and oscillator strengths, selection rules of dipole and quadrupole transitions, radiative transfer and formation of spectral lines. Study of saturated absorption spectroscopy, resonance fluorescence and strong field effects, Hanle effect, optical double resonance, optical pumping and hyperfine spectroscopy. Prereq: 521, 541, 508.

606-07 Nonlinear Optics (3,3) Nonlinear optical susceptibilities, wave propagation in nonlinear media, sum-frequency and difference frequency generation, harmonic generation, parametric amplification and oscillation, stimulated Raman processes, two- and multi-photon processes, four-wave mixing and phase conjugation, transient coherent optical effects and free induction decay, optical breakdown and nonlinear effects in plasmas. Prereq: 522.

608-09 Quantum Electronics and Electro-Optics (3,3) Elecctrical and electrooptical interaction in anisotropic and periodic media, linear and quadratic electro-optic effects and devices, acousto-optic and optical devices, guided waves, phase conjugation, pico- and femtosecond optical switching and electronics, and optical computers and processors. Prereq: 606.

610 Quantum Optics (3) Quantum theory of emission and absorption of radiation; frequency-dependent susceptibility; field quantization and coherent photon states; interaction of radiation with atoms; photon optics, counting and higher-order coherence; atomic scattering phenomena. Prereq: 521.

611 Advanced Quantum Mechanics & Field Theory (3) Second quantization, quantization of electromagnetic field, emission, absorption, and scattering of light, bremsstrahlung, pair creation and annihilation, quantum fields in condensed matter, quantum mechanics, and quantum optics. Topics vary according to instructor. Prereq: 622 and 542 or equivalent. Prereq or coreq: 561 or consent of instructor.

612 Advanced Topics in Quantum Field Theory (3) Renormalization, Lamb shift, anomalous magnetic moments, gauge theories, electroweak theory, quantum chromodynamics, grand unified theories, and advanced topics in field theory and quantum mechanics. Topics vary according to interest of students, instructor and present state of physics. Prereq: 561 or consent of instructor.

617-18 Lie Algebras in Mechanics and Physics (3,3) (Same as Mathematics 617-18.)

621-22 Nuclear Structure (3,3) General properties of nucleus; two-body scattering problems; saturation and symmetry effects of nuclear forces; theory of light nuclei; nuclear spectroscopy; special nuclear models; theory of nuclear reactions; theory of beta-decay. Prereq: 571-72.

626-27 Elementary Particle Physics (3,3) 626—Survey in elementary particle physics covering experimental methods, conservation laws, invariance principles, and models of interactions. 627—Advanced topics: quark models, electroweak interactions and unification of elementary forces. Prereq: 522.

631 Advanced Topics in Relativity of Cosmology (3) Topics vary according to interests of students, instructor and present state of physics. Cosmological solutions of Einstein's field equations, black holes, inflationary universe, unified field theories or interaction between cosmology and nuclear and elementary particle physics. Prereq: 531 and 561.

641 Advanced Topics in Classical Theory (3) To meet special needs of students. Advanced dynamics and hydrodynamics, electromagnetic theory, statistical mechanics, or theory of nonequilibrium processes. Prereq: 532, 542, 551. May be repeated with consent of department. Maximum 9 hrs.

642 Advanced Topics in Quantum Theory (3) To meet special needs of students. Advanced quantum theory, beta-ray theory, theory of atomic spectra, molecular structure and valence theory, theory of radiation, electric and magnetic susceptibilities, high energy processes, scattering and collision processes, or theory of fields. Prereq: 522. May be repeated with consent of department. Maximum 9 hrs.

643 Computational Physics (3) Developing computer algorithms for solving representative problems in various fields of physics, celestial dynamics in astrophysics, boundary value problems in electromagnetism, atomic and nuclear structures, band structure on solid state physics, transport problems in statistical mechanics. Monte Carlo simulation of liquids, fitting and interpretation of data, correlation analysis, or optimization strategy. Prereq: 522, 531, 542, and 572.

651-62 Collision Interactions (3,3) Interaction of electromagnetic radiation and charged particles with atoms and molecules or free particles, scattering, ionization, transport and capture, collective excitations, Cerenkov radiation, and stopping power. Prereq: 522.

663 Advanced Plasma Physics I (3) (Same as Electrical and Computer Engineering 663.)

664 Advanced Plasma Physics II (3) (Same as Electrical and Computer Engineering 664.)


681-82 Molecular Spectroscopy (3,3) Spectroscopic methods of determining molecular properties, theoretical and experimental aspects of intra- and intermolecular energy and charge transfer, group theoretical methods and Miection rules in gases and condensed phases, normal coordinates and potential functions, vibration-rotation interaction theory, intensities, frequency doubling, and molecular transitions. Prereq: 532 and 542 or consent of instructor.

Planning

(Office of the Provost)

DEGREE

MAJOR

Planning ............................................. M.S.P.

Planners:


Associate Planners:

G. E. Bowen, M.A. George Washington; P. Fisher, Ph.D. Florida State.

The Graduate School of Planning offers a program of studies leading to the professional degree of Master of Science in Planning. The degree is the normal route for entry into professional positions in urban and regional planning or related fields. Graduates are candidates for positions in regional, city, county, and metropolitan planning agencies; in local, state, and federal agencies concerned with physical, economic, and administrative planning; in private business and organizations dealing with development problems; and in private consulting.

The Master of Science in Planning program is accredited by the Planning Accreditation Board, a joint undertaking of the American Planning Association, the American Institute of Certified Planners and the Association of Collegiate Schools of Planning.

ADMISSION REQUIREMENTS

Applicants are to submit an application for admission to The Graduate School, two letters of reference from faculty familiar with their prior academic work, and a statement describing personal career objectives. If the applicant has prior work experience in planning, a reference letter should also be provided by the work supervisor. Graduate Planning Examination scores are not required, but applicants are encouraged to submit them.

The M.S.P. is approved for SREB Academic Common Market participation in Arkansas, Kentucky, South Carolina, and West Virginia.

DEGREE REQUIREMENTS

The M.S.P. requires completion of at least 48 hours of graduate credit, at least 30 of which must be in planning. The following courses are the core curriculum required of all students: 510, 511, 515, 520, 521, 523, 530, 531, 532, 540, and 545.

Students should plan to enter the program in the fall term to take the core courses in the proper sequence.

Each student is required to develop an area of concentrated competence beyond the core curriculum. After selecting the area of concentration, usually by the end of the second semester, the student takes a prescribed set of courses in the subject area. Further enhancement of the concentration is gained by taking additional elective courses in the subject and by focusing the thesis or major paper on the subject. Concentration courses are drawn from the planning curriculum and from other departments in the University. Concentrations are available in land use planning, analytical methods in planning, economic development planning, and real estate development planning.

Students have the latitude to propose an alternate specialization consisting of at least 9 hours of course work, subject to approval of a faculty committee. Courses are available

Professors:

James A. Shuh, Director.
in transportation, health, education, environmental, and social planning.

Each student is required to demonstrate competence in individual research. This may be done in one of two ways:

**Thesis Option** — Complete a thesis for 6 hours credit.

**Non-Thesis Option** — Complete a major study with acceptable documentation. In order to be eligible for the major study option, the student must have completed at least 12 hours of graduate course work in planning with at least a 3.5 cumulative grade point average. The student meeting these criteria may present a proposal to his/her committee for a major study that will include at least 6 hours of subsequent course work. The proposal shall justify the selection of the topic, describe the approach to the study, and describe the nature of the final product. The topic will normally be expected to reinforce or complement the student's concentration.

Student academic progress is monitored by the faculty. A student failing to maintain an acceptable grade point average may be placed on probation or dismissed from the program.

401 The City in the U.S. (3) Development and character of U.S. cities. Contemporary issues and selected case studies. (Same as Urban Studies 401.)

402 Survey of Planning (3) History of city development and of planning; U.S. experience in urban and other levels of planning. State of the art, process, comprehensive plan, implementation devices. Planning issues in society. Not for credit for M.S.P degree.

500 Thesis (1-15) P/NP only, E


502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Fundamentals of Planning (2) History of planning, structure and development of urban areas, operations of contemporary planning, trends and issues.

511 Graphical and Oral Communications in Planning (1)

515 Theory of Planning (2) Analysis of nature and objectives of planning process; role of planner and planning function in public decision-making. Prereq: 510 or consent of instructor.

520 Planning Research Methods (3) Research techniques to be eligible for the major study option. Research tools, data collection and analysis as basis for planning and decision-making.

521 Computers in Planning (3) Basic computer concepts, hardware and software, use of mainframe and microcomputers in planning and government.

522 Computers in Planning II (3) Software and systems for planning and local government. Content varies. Projects in small group or individual study mode. Prereq: 521 and consent of instructor.

523 Statistics for Planners (3) Applications of basic descriptive and inferential classical and nonparametric techniques in planning research. Data organization and display, location, dispersion and association; data transformations; some basic probability theory; selected one and two sample tests; correlation, regression analysis. Prereq: 520 or consent of instructor.

524 Advanced Data Analysis (3) Applications of statistical data analysis in planning. Regression analysis, plus selected multivariate, non-parametric, and analytical graphic techniques. Use of computer packages for data analysis. Prereq: 521 and consent of instructor.


526 Library Research for Planning (1) Survey of publications of interest to planners, resources and research techniques. Use of facilities and collections of library.

530 Planning Analysis and Forecasting (3) Methods of quantitative analysis and planning for urban and regional studies. Population, employment, and economic base studies, forecasting techniques. Coreq: 520 or consent of instructor.

531 Urban and Regional Analysis (3) Past, present and possible future patterns of urban and regional structures drawing on contemporary theories, models, and empirical research.

532 Planning Methods (5) Preparation of comprehensive plans for urban areas or regions. Development of baseline data and forecasts, formulation of alternative plans and strategies, and development of plan implementation programs. Extensive laboratory experience.

537 Planning and Transportation (3) (Same as Civil Engineering 558.)

538 Urban and Site Design (3-6) Principles of design of residential subdivisions and some components of physical community, shopping centers, institutional complexes, central business districts. Problems of reviewing alternative designs against each other or written regulations. Extensive laboratory experience.

539 Planning for Historic Preservation (3) Planning for preservation, restoration, and management of historic buildings, areas and sites as related to comprehensive planning process. National, state, and local government role in preservation, designation of sites, legislative needs, financing and administrative organizations.

540 Legal Aspects of Planning (3) Legal basis for planning and guiding community development. Legal tools of planning. Prereq: 510 or consent of instructor.

545 Planning and Property Development (2) Process of urban physical growth and change; functioning of private sector real estate development and its relationship to planning. Partnership roles of public and private sectors in urban development and redevelopment. Prereq: 510 or consent of instructor.


551 State and Regional Planning (3) Theory and practice of planning at state, sub-state, and metropolitan levels.

552 Development Planning in the Third World (3) Seminar on urban and regional development in Third World countries. Population growth, settlement pattern, economic development, land framework of integrated resource management. (Same as Sociology 552.)

553 Natural Resource Management and Environmental Assessment in Developing Nations (3) (Same as Ecology 537 and Botany 537.)

554 TVA, Planning and Development (3) Review and evaluation of leading U.S. national experiment in river basin planning and development. Tennessee Valley Authority.

555 Environmental Planning (3) Role of planners and planning in maintenance of balance between natural and built environment. (Same as Ecology 555.)

560 Policy Analysis and Strategic Planning (3) Models of policy making process and role of strategic planning and applied decision making. Quantitative and qualitative approaches for the graduate and program evaluation, and impact assessment.

590 Practicum (6) Prereq: Consent of instructor. S/NC or letter grade.

591 Special Topics (1-3) Prereq: Consent of instructor.

592 Readings in Planning (1-3) Prereq: Consent of instructor. May be repeated.

593 Problems in Planning (1-3) Prereq: Consent of instructor.

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**Plant and Soil Science**

(College of Agriculture)

**MAJOR DEGREES**

Plant and Soil Science .......... M.S., Ph.D.

John E. Foss, Head

**Professors:**

F. F. Bell (Emeritus), Ph.D. Iowa State; D. L. Coffey, Ph.D. Purdue; B. V. Conger, Ph.D. Washington State; J. E. Foss, Ph.D. Minnesota; H. A. Fribourg, Ph.D. Iowa State; L. M. Josephson (Emeritus), Ph.D. Wisconsin; W. L. Parks, Ph.D. Purdue; B. S. Pickett (Emeritus), Ph.D. Michigan State; J. H. Reynolds, Ph.D. Wisconsin; L. F. Seatz (Emeritus), Ph.D. North Carolina State; L. N. Skold (Emeritus), M.S. Kansas State; M. E. Springer (Emeritus), Ph.D. California (Berkeley); H. D. Swingle (Emeritus), Ph.D. Louisiana State; E. Winters (Emeritus), Ph.D. Illinois.

**Associate Professors:**


**Assistant Professors:**


The Department of Plant and Soil Science offers graduate programs leading to the Master of Science and the Doctor of Philosophy. Concentrations for the graduate programs are offered in soil science, plant breeding and genetics, and crop physiology and ecology.

For further information, contact the department head.
land use, recognition and prevention of soil pollution.

land use. Soil as resource in development planning: environmental component and soil properties affecting

471 Statistics for Biological Research (3) Application of statistics to interpretation of biological research. Notation, descriptive statistics, probability, distributions, confidence intervals, t and chi-square tests, analysis of variance, mean separation procedures by linear regression and correlation. Prereq: Mathemat-

500 Thesis (1-15) P/NP only. E

501 Seminar (1) Application of speaking, writing, and organizational skills in preparation and presentation of scientific material to both scientific and general audiences. Preparation of abstracts for scientific pre-


631 Plant Growth Control and Herbicide Action (3) Principles of uptake, translocation, mode of action and uses of herbicides and plant growth regulators and their effects on plant morphology, metabolic sys-

653 Advanced Plant Breeding (4) Development and utilization of concepts of quantitative parameters, inbreeding, heterosis, methods of selection, in vitro breeding, interspecific hybridization, stability param-

198 Crop Production and Marketing (3) Principles of production, storage, and current commercial uses of plant growth regulators. Prereq: 411 and consent of instructor. F

114 Soil Survey and Land Use Planning (3) Soil survey techniques, land use, soil survey maps, soil survey reports, soil hazard evaluation, soil profile analysis, soil chemistry, soil physics, soil taxonomy, soil classification, soil survey and utilization. Prereq: 112 or consent of instructor. F

106 Soil and Water Conservation (3) Principles and practices of soil conservation, soil and water management, erosion control, soil survey, soil mapping, soil survey data analysis, soil survey report preparation. Prereq: 114 or consent of instructor. F

Public Administration 	M .P.A.

Political Science 	M .A ., Ph .D.

MAJORS

Political Science/Fields of Instruction 133

Political Science (College of Liberal Arts)

MAJORS

DEGREES

Political Science ... M .A ., M .P.A., Ph .D.

Public Administration ... M .P.A.

Professors:


Associate Professors:


Assistant Professors:


The Department of Political Science offers the M .A ., M .P.A., and Ph .D . Inquiries concern-

THE DOCTORAL PROGRAM

A minimum of 72 hours beyond the Bache-

lor's degree, exclusive of credit for Thesis 500, is required. Of this number, 24 hours must be Doctoral Research and Dissertation 600. A minimum of 26 hours must be com-

pleted in courses numbered above 500 exclusive of doctoral research and disserta-

tion, of which 6 must be in courses numbered above 600. A minimum of 9 hours of graduate course work taken during the doctoral program must be inside the department in one or more cognate areas.

The student and the major professor iden-

tify a doctoral committee composed of at least four faculty members holding the rank of assistant professor or above, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be from outside the department. The committee must approve all course work applied toward the degree, certify the student's mastery of the major field and any cognate fields, direct the research, and recommend the dissertation for approval and acceptance by The Gradu-

ate School.

411 Soil Microbiology (3) Soil microbial population and role in soil ecosystem, microbial transformations of inorganic and organic compounds, decomposition of residues, dynamics of soil organic matter. Prereq:

210 and Chemistry 110 or 350 or consent of instruc-

tor. F

412 Soil Genesis, Classification, and Mapping (3) Soil genesis and formation: observing and describing morphology of agricultural and forest soils; chemical and physical properties, classification; mapping. Two Saturday field trips. Prereq: 210 or consent of instruc-
tor. 2 hrs and 1 lab. Sp

413 Soil Chemistry (3) Principles concerning structure and chemical properties of soil materials; colloidal fraction as related to exchange, chemical equilibria, soil acidity, oxidation-reduction, weathering, nutrient availability and waste disposal. Prereq: 311 or con-
sent of instructor. F

414 Soil, Land Use, and the Environment (3) Soil as environment: physical, biological, and chemical properties affecting land use. Soil as resource in development planning: consideration of nonengineering aspects of site selec-
tion for land use, soil survey and resource area, in land use, recognition and prevention of soil pollution. Prereq: 210 or consent of instructor. Sp.A

431 Crop Physiology and Ecology (3) Principles of plant physiology and ecology as applied to crop produc-
tion. Effects of environmental factors on physiological processes. Prereq: 230, Botany 321. 2 hrs and 1 lab. F

433 Agricultural Pesticides (3) Regulation of pes-

ticide development, manufacture, transportation, marketing and use. Structure, use, mode of action, degradation and environmental impact of pesticides used in agriculture, forestry and related areas. Prereq:

1 yr biological sciences and 1 semester chemistry. 2 hrs and 1 lab. Sp

453 Principles of Plant Breeding (3) Genetic princi-
ples and techniques used in crop improvement. Prereq:

Biology 220 or equivalent. 2 hrs and 1 lab. Sp

471 Statistics for Biological Research (3) Application of statistics to interpretation of biological research. Notation, descriptive statistics, probability, distributions, confidence intervals, t and chi-square tests, analysis of variance, mean separation procedures by linear regression and correlation. Prereq: Mathemat-

ics 121 or equivalent, F

500 Thesis (1-15) P/NP only. E

501 Seminar (1) Application of speaking, writing, and organizational skills in preparation and presentation of scientific material to both scientific and general audiences. Preparation of abstracts for scientific pre-

sentations. F,Sp

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses research facilities or faculty time before degree is completed. May not be used toward degree requirements. May be repeat-
ed, S/NC only. E


512 Pedology (3) Physical and chemical weathering processes, factors of soil formation, soil forming processes. Prereq: 412 or consent of instructor. 2 hrs and 1 lab. F, Sp

514 Soil Physics (3) Physical and chemical relations-

ships among solid, liquid and gaseous phases of soil system. Dynamics, interrelationships and interaction of phases on soil density, moisture characteristics, aeration and relationship to plant growth. Prereq: 413 or consent of instructor. 2 hrs and 1 lab. F, Sp.A

530 Integrated Pest Management (3) (Same as Ento-

molgy and Plant Pathology 530.)

532 Advanced Crop Ecology (3) General and specific relations among environmental factors, crop organ-

isms, and agricultural systems; quantification of macro-

and microclimatic influences on crop growth; world cli

cimates, crop distribution and productivity, human cul-

tures, and their interaction. Prereq: 471 or equiva-

lent; 431 or consent of instructor. 2 hrs and 1 lab. F, Sp

551 Advanced Plant Genetics (3) Discovery of genet-

ics: controlling elements, induced mutations, genome organization, behavior, differentiation, polyploidy, chromosomal inheritance, apomixis, incompatibility systems, and genetic engineering of higher plants. Prereq: 411 and 431.

552 Quantitative Genetics (3) Genetic analysis of con-


571 Design and Analysis of Biological Research (3) (Same as Animal Science 571.)

583 Special Problems in Plant and Soil Science (1-3) May be repeated. Maximum 6 hrs. E

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Special Topics in Soil Science (1-3) Thermody-

namics of soil solutions, clay structure and surface chemistry, soil mineralogy, plant mineral nutrition, soil microbiology, water movement and use by plants, soil structure, soil thermal properties, interaction in the soil-plant environment. May be repeated. Maxi-

mum 6 hrs. E

603 Special Topics in Crop Physiology and Ecology (1-3) Microclimate of ecosystems, crop behavior and re-

sponses to stress, physiology of crop growth and reproduction. Interactions of physiology and genetics in crop improvement and application of quantitative methods in crop physiology and ecology research. May be repeated. Maximum 6 hrs. E

605 Special Topics in Plant Breeding and Genetics (1-3) Genotype by environment interactions, estima-
tion of quantitative parameters, mutations, chromosome dynamics, polyploidy, genetic engineering, inter-
specific hybridization, linkage, screening methods, genetic organization. May be repeated. Maximum 6 hrs. E

613 Advanced Soil Chemistry (3) Surface and colloid chemistry of soil minerals; recent developments in ion speciation, ion movement, surface charge, surface complexation and soil colloidal stability. Prereq: 413 or consent of instructor. F, Sp


633 Plant Growth Control and Herbicide Action (3) Principles of uptake, translocation, mode of action and uses of herbicides and plant growth regulators and their effects on plant morphology, metabolic sys-

571 Advanced Research Planning (3) Development of agricultural research proposals utilizing prescribed resources and emphasizing experimental design and statistical techniques. Prereq: 571, Animal Science 572, Statistics 461, or equivalent. (Same as Animal Science 571.) F
ADMISSION REQUIREMENTS
Three departmental recommendation forms must be submitted to The Graduate School, one of which must be completed by instructors at the institution most recently attended. In addition, scores on the general portion of the Graduate Record Examination must be submitted.

THE MASTER OF ARTS PROGRAM
A Bachelor’s degree or its equivalent is required for admission. Normally an overall average of 3.0 is also required together with an average of 3.2 in the last two years of political science or social science. In addition, a composite score of at least 1100 on the verbal and quantitative parts of the GRE is normally required.

Each candidate must earn 6 semester hours by writing a thesis and at least 24 additional hours by taking regular course work. A total of 30 hours is required. At least 12 of these hours must be in political science, 6 in the field of methodology (Political Science 510 and 512). Finally, an oral examination on the course work and thesis is required.

THE MASTER OF PUBLIC ADMINISTRATION PROGRAM
The M.P.A. Program is intended to prepare students for public service careers by acquainting them with management principles, analytical tools, and the ethical dilemmas they will face as public administrators. It consists of a total of 36 semester hours, including a core program, an elective specialization, and a recommended internship.

Applicants for admission to the program must have a Bachelor’s degree or its equivalent. Normally, an overall average of 3.0 and an average of 3.2 in the last two years of political science or social science courses is required. In addition, a composite score of at least 1100 on the verbal and quantitative parts of the GRE is normally required.

The M.P.A. is a non-thesis program. Specific requirements include the following:

1. Core - 24 hours
   a. General perspectives - required courses (6 hours), 550 Public Administration; 552 Organization Theory.
   b. General perspectives - elective courses (3 hours), 556 Policy Analysis; 558 The Politics of Administration.
   c. Analytical skills (6 hours), 512 Quantitative Political Analysis; 514 Research and Methodology in Public Administration.
   d. Management skills (6 hours), 560 Public Budgeting and Finance; 564 Human Resources Management in Public Organizations.
2. Specialization - 9 hours
   A specialization is designed by the student in consultation with the coordinator of the M.P.A. program. Possible specializations include general government, public health, budgeting and finance, planning, natural resources, program evaluation, criminal justice, public relations, personnel, and others.
3. Recommended internship with a public agency - 6 hours
4. A written final examination, which may be followed by an oral examination, is required.

THE DOCTORAL PROGRAM
The Ph.D. program prepares students for careers in college teaching, as well as careers in other occupations related to services in the public or private sectors. Applicants for admission to the program should normally have completed a Master’s degree in political science or a related field with a 3.5 grade point average and have earned a composite score of at least 1100 on the verbal and quantitative parts of the Graduate Record Examination.

Students admitted to the program must complete 78 hours of course work beyond the Bachelor’s degree, must successfully pass written and oral comprehensive examinations in three broad subfields of political science, and must pass a final oral examination on the dissertation. In addition, an examination must be passed in one foreign language.

In addition to the total hours required for the degree, the following requirements must also be met:
1. At least 63 hours must be in political science courses.
2. At least 48 hours in political science courses must be in courses numbered above 500.
3. At least 9 hours must be in political science courses numbered above 600.
4. A total of 24 hours must be earned by writing the dissertation.

401 Special Topics in United States Government and Politics (1-3) May be repeated with consent of department. Maximum 6 hrs.
420 Political Attitudes and Opinions (3) Nature, formation, development, and dissemination of politically relevant attitudes and opinions in American political system.
421 Political Parties and Interest Groups (3) Examination of role of political parties and organized groups in American politics and government.
422 Political Campaigns and Elections (3) Analysis of nature of campaigns and elections in American political process.
430 United States Constitutional Law: Sources of Power and Restraint (3) Analysis of judicial review, constitutional powers of President and Congress, federalism, sources of regulatory authority, and constitutional protection of political and economic rights.
431 U.S. Constitutional Law: Civil Rights and Liberties (3) Analysis of current issues in civil rights and liberties including: first amendment freedoms, equal protection, privacy and rights of accused.
440 Public Management and Human Resources (3) Mobilization and management of technical and human resources in pursuit of public sector organization goals.
441 Budgetary Process and Financial Management (3) Fiscal planning, budget and expenditure processes in government, their policy and administrative implications.
442 Administrative Law (3) Legal dimensions of administrative power and procedures, and constitutional controls over administrators.
452 Black African Politics (3) Recent evolution and current political environment of Black African nations. (Same as Afro-American Studies 452.)
454 Government and Politics of China and Japan (3) Examination of the political setting, structure and political processes in China and Japan.
455 Latin American Government and Politics II (3) Selected topics on Latin American political dynamics, consideration of leading theoretical explanations. (Same as Latin American Studies 455.)
459 Government and Politics of the Soviet Union (3) Origins and development of Soviet political system, and study of selected policy areas.
460 Revolution (3) Examination of characteristics, theories, and consequences of revolution with particular focus on left-wing revolutions and movements.
461 Policy Making in Democracies (3) Comparative approach to theory and process of making public policies.
463 Contemporary Middle East Politics (3) Governments and movements in Middle East, their characteristics, bases, and interrelationships.
464 Special Topics in Comparative Government (3) May be repeated with consent of department. Maximum 6 hrs.
469 Soviet Foreign Policy (3) Overview of Soviet international behavior since 1917 and examination of selected problems of Soviet foreign policy post World War II.
470 International Law (3) Nature and development of international law and compliance. Function of international law in context of international conflict.
475 Ancient and Medieval Political Thought (3) Survey of major western political thinkers from Socrates to Marsilio of Padua.
476 Modern Political Thought (3) Survey of major western political thinker from Machiavelli to Marx.
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated with consent of department. S/NC only. E
510 Scope and Methods in Political Science (3) Procedures of analysis in political science.
512 Quantitative Political Analysis (3) Methods and techniques in quantitative political analysis: univariate and bivariate statistics.
513 Quantitative Political Analysis (3) Methods and techniques in quantitative political analysis: multivariate modeling.
514 Research and Methodology in Public Administration (3) Basic assumptions and techniques of research in public administration; measurement, analysis, and reporting of data.
520 Political Theory (3) Selected political thinkers, schools, historical periods. May be repeated with consent of department. Maximum 9 hrs.
530 Topics in American Government and Politics (3) Survey of literature, approaches to research and analysis, critical examination of major works, and overviews of research in various subfields. May be repeated with consent of department. Maximum 9 hrs.
531 Topics in Parties and Elections (3) Analysis of party systems and electoral behavior. May be repeated with consent of department. Maximum 9 hrs.
534 Topics in American National Institutions (3) Deals with congress, executive or related subjects. May be repeated with consent of department. Maximum 9 hrs.
536 Comparative State Politics (3) Government and political processes of fifty states: general and particular characteristics. May be repeated with consent of department. Maximum 9 hrs.
538 Urban Politics and Administration (3) American urban structures and public policies. May be repeated with consent of department. Maximum 9 hrs.
540 Public Law (3) Selective examination of research and current approaches in subfields of constitutional law, administrative law, and judicial behavior. May be repeated with consent of department. Maximum 9 hrs.

542 The Politics of Criminal Justice (3) Selective examination of contemporary problems of research and public policy formulation: criminal process; law enforcement administration; criminal court administration; and prison administration. May be repeated with consent of department. Maximum 9 hrs.

546 Law and the Administrative Process (3) Constitutional position; decisional processes, regulation and management; limitations on governmental action; questions of structure, role, and administrative choice. May be repeated with consent of department. Maximum 9 hrs.

550 Public Administration (3) Overview of public administration theory and function.

552 Organization Theory (3) Appraisal of major theories of organization and their applicability to public sector.

554 Contemporary Public Policies (3) Problems in one or more public policy areas from political and administrative perspectives. Topics selected by instructor. May be repeated with consent of department. Maximum 9 hrs.

556 Policy Analysis (3) Role of administrators in policy analysis and decision making. May be repeated with consent of department. Maximum 9 hrs.

558 The Politics of Administration (3) Examination of public administration in context of American political system, policy making and political roles of public administrators and agencies. May be repeated with consent of department. Maximum 9 hrs.

560 Public Budgeting and Finance (3) Technical and political aspects of planning, preparing and adopting government budgets. Management implications of revenue collection, debt management, treasury function, accounting, internal auditing, purchasing risk management, post-auditing.

562 Public Management (3) Interpersonal and leadership skills, techniques and methods for planning, decision making, and implementation of management strategies in public sector. May be repeated with consent of department. Maximum 9 hrs.


566 Ethics, Values, and Morality in Public Administration (3) Moral and ethical dilemmas confronting administrators in American political system.

567 Comparative Public Administration (3) Comparison of policy-making structures and public policies in selected countries. May be repeated with consent of department. Maximum 9 hrs.

568 Special Topics in Public Administration (3) Analysis of selected issues and problems in public administration. May be repeated. Maximum 9 hrs.

569 Internship in Public Administration (3-9) Open to students participating in approved internship program. May be repeated with consent of department. Maximum 9 hrs. S/NC only.

570 Comparative Government and Politics (3) Selected topics in modern governments. May be repeated with consent of department. Maximum 9 hrs.

572 The Politics of Development (3) Selected topics dealing with political and economic development of less developed countries. May be repeated with consent of department. Maximum 9 hrs.

574 Area Seminar in Comparative Government and Politics (3) Selected topics in area studies: African, Asian, Latin America, Middle East, Soviet Union and Eastern Europe or Western Europe. May be repeated with consent of department. Maximum 9 hrs.

580 International Politics (3) Survey of literature and major aspects of international politics. May be repeated with consent of department. Maximum 9 hrs.

582 Theory and Analysis of U.S. Foreign Policy Processes (3) Theoretical approaches to decision making in foreign policy area and analysis of policy-making process. May be repeated with consent of department. Maximum 9 hrs.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

600 Doctoral Research and Dissertation (3-15) P/NP only. E.

610 Research Seminar in Empirical Theory and Methodology (3) Advanced methods and procedures of analysis in political science. May be repeated with consent of department. Maximum 9 hrs.

620 Research Seminar in Political Theory (3) Research into selected topics. May be repeated with consent of department. Maximum 8 hrs.

630 Research Seminar in the American Political Process (3) Research into selected topics. May be repeated with consent of department. Maximum 9 hrs.

640 Research Seminar in U.S. Constitutional Law (3) Systematic analysis of published research and judicial decision: development of constitutional law as major component of public policy. May be repeated with consent of department. Maximum 9 hrs.

652 Research Seminar in Public Administration (3) Research into selected topics. May be repeated with consent of department. Maximum 9 hrs.

670 Research Seminar in Comparative Government and Politics (3) Research into selected topics. May be repeated with consent of department. Maximum 9 hrs.

680 Research Seminar in International Politics (3) Research into selected topics. May be repeated with consent of department. Maximum 9 hrs.

Polymer Engineering
See Materials Science and Engineering

Psychology
(College of Liberal Arts)

MAJOR DEGREES
Psychology ........................................ M.A., Ph.D.

Raymond R. Shrader, Acting Head

Professors:

Associate Professors:

Assistant Professors:

*Part-time.

THE MASTER'S PROGRAM
Graduate study leading to the Master of Arts in general psychology is normally available only to students in the doctoral program in psychology. Requirements are (1) a score of at least 630 on the GRE in psychology; (2) at least 30 hours of graduate-level courses in psychology; and (3) a Master's thesis based on at least 6 hours of Thesis 560. A non-thesis Master's degree is available with the approval of the student's supervisory committee upon successful completion of a total of at least 36 hours in graduate-level courses in psychology and a final written examination.

THE DOCTORAL PROGRAM
A student with a B.A. or B.S. may apply to the Department of Psychology for admission to the doctoral program with a concentration in general psychology or clinical psychology. The doctoral program with a concentration in ethology or physiology is offered through the Life Sciences Program. Doctoral study in industrial and organizational psychology is offered through the Intercollegiate Program in Industrial and Organizational Psychology, to which application is made through the Department of Management.

Departmental Requirements
All students in the doctoral program in psychology must obtain a score of at least 630 on the GRE in psychology by the end of the first year, and all students must pass the departmental general psychology examination (a comprehensive, two-day essay exam offered twice each year) by the end of the second year. In addition, each student must pass the doctoral comprehensive examination, complete an acceptable doctoral dissertation, and conduct a satisfactory oral defense of the dissertation. All doctoral students must complete a minimum of 78 hours of graduate-level courses, including courses required by their program; at least 6 hours in courses outside of psychology; and at least 24 hours of dissertation research (Psychology 600).

General Psychology
This program allows students to select from a variety of specializations oriented
468 Laboratory in Physiological Psychology (3) Laboratory studies of nervous system and physiological correlates of behavior.

470 Theories of Personality (3) Survey of major theories of personality and their development. Prereq: 220 and 300 or 330.

480 Theories of Learning (3) Classical and current approaches to learning and cognition. Prereq: 310.

482 Topics in Psychology (3) Intensive analysis of special topics: Afro-American psychology or evaluation of programs in community. Prereq: 110 or equivalent. Recommended prereq: 210, 220, 385, 395. May be repeated. Maximum 9 hrs.

489 Supervised Research (1-9) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs in 899, 489, 491, 492, and 493 combined may apply toward undergraduate major.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May be used toward degree requirements. May be repeated: S/NC only. E


505 Research Design (3) Techniques for planning and conducting research involving both controlled and natural settings: experiments, quasi-experiments, observational studies, surveys, and program-evaluations. Development of questions and hypotheses for study. Design of studies to maximize validity. Prereq: Consent of instructor.

508 Readings and Special Problems in Psychology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

509 Research Practicum (2) Required of first-year graduate students in psychology. May be repeated. Maximum 9 hrs.

510 Topics in Psychology (3) Intensive examination of selected problem(s) in psychology. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

511 Developmental Psychology (3) Normal processes of human socialization; physical, cognitive, and emotional development from conception through infancy, childhood, and adolescence. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

512 Life-Span Development (3) Theories and research concerning normal human development throughout life, adulthood and old age. Prereq: Consent of instructor.

513 Foundations of Psychology: Biological factors, Perception, Learning, Thinking, Motivation (4) Intensive survey. Prereq: Consent of instructor.

516 Colloquium in Ethology (1) Current research and theory. May be repeated. Maximum 9 hrs. (Same as Zoology 516.) S/NC only.

517-18 Proseminar in Industrial and Organizational Psychology (3,3) (Same as Management 567-568.)

520 Interventions for Behavioral Change (3) Principles and techniques for planning, implementing, and evaluating interventions derived from social learning theory. Interventions by people in community: teachers or supervisors. Token economies and strategies for self-control. Prereq: Consent of instructor.

525 Laboratory Techniques and Instrumentation (3) Procedures for laboratory research involving humans and nonhuman animals; techniques for collecting, transforming, storing, and retrieving data using microcomputers. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

526 General Vertebrate Neuroanatomy (3) Lecture and laboratory. Structure and functioning of central and peripheral nervous system. Prereq: 461, 469, or equivalent and consent of instructor. (Same as Zoology 526.)
Romance Languages

(College of Liberal Arts)

MAJORS

DEGREES

French .................................................. M.A.
Spanish .................................................. M.A.
Modern Foreign Languages .................. Ph.D.

Professors:

P. E. Barrette, Ph.D. California (Berkeley);
C. W. Cobb, Ph.D. Tulane; J. C. Elliott, M.A.
Illinois; W. H. Heflin, Ph. D. Florida State;
T. B. Irving (Emeritus), Ph.D. Princeton;
F. D. Maurino (Emeritus), Ph.D. Columbia;
M. Petrovska, Ph. D. Kentucky; C. Pinsky
(Emeritus), Ph.D. California, (Berkeley);
J. B. Romeiser, Ph.D. Vanderbilt; A. M. Vazquez-
Bigi, Ph.D. Minnesota; A. H. Wallace, Ph.D.
North Carolina, (Chapel Hill);
Y. M. Washburn, Ph.D. North Carolina
(Chapel Hill).

Associate Professors:

W. F. Byess (Emeritus), Ph.D. Wisconsin;
E. J. Campion, Ph.D. Yale; R. M. DeRycke,
Ph.D. Illinois; D. M. DiPuccio, Ph.D. Kansas;
M. H. Handelman, Ph.D. Florida; K. D. Levy,
Ph.D. Kentucky.

Assistant Professors:

A. S. Allen, Ph.D. California (Berkeley);
S. DiMaria, Ph.D. Wisconsin; C. K. Duncan,
Ph.D. Illinois; F. Perez-Pineda, Ph.D.
Pennsylvania State; C. V. Rogers, Ed.D.
Georgia; B. S. West, Ph.D. North Carolina,
(Chapel Hill); L. Williamson, Ph.D. Illinois.

The Department of Romance Languages offers two advanced degrees: the Master of Arts in French and in Spanish and the Doctor of Philosophy in Modern Foreign Languages. Inquiries should be addressed to the head of the department. The head, through the coordinators of Spanish and French, will make available further departmental requirements, regulations, and materials not listed below.

THE MASTER'S PROGRAM

Thesis Option

1. Completion of a minimum of 24 semester hours in course work plus at least 6 hours in course 500 Thesis. In French, 501 is required; in Spanish, 550. A maximum of 6 hours may be taken at the 400 level, the rest at the 500 level, and under certain conditions the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours (including 6 hours of thesis) must be taken in the major, 6 in the minor.

2. A thesis, with a minimum of 6 semester hours in course 500.

3. A written examination covering the course work and selected items from a master reading list.

4. A final oral examination covering the thesis.

Non-Thesis Option

1. Completion of at least 30 semester hours, with a maximum of 9 at the 400 level, the rest at the 500 level, including 501 (French) or 550 (Spanish). Under certain conditions, the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours must be taken in the major, 6 in the minor.

2. Three term papers that have been accepted by the student's advisory committee.

3. A written examination covering the course work and selected items from a master reading list.

4. A final oral examination to discuss the papers (French M.A. only).

THE DOCTORAL PROGRAM

The Ph.D. in Modern Foreign Languages is offered jointly by the Department of Germanic and Slavic Languages and the Department of Romance Languages and requires advanced training in at least two foreign languages.

Admission Requirements

Applicants must have completed a B.A. in either French, German or Spanish to be accepted into this program. Both graduates of institutions in the United States and those with undergraduate degrees from institutions outside the United States must have a grade point average of at least 3.0. Consideration will also be given to applicants who do not have an undergraduate degree in one of the three foreign languages but do have the equivalent of an undergraduate major in one of them. Applicants should present scores that are no lower than the 40th percentile on the Graduate Record Examination (GRE) subject test in the foreign language of their first concentration.

Requirements for the Ph.D.

Candidates must complete a minimum of 63 semester hours of course work beyond the Bachelor's degree in addition to 24 hours of doctoral research and dissertation. The program shall consist of a first concentration, a second concentration, and a cognate field.

1. First Concentration: French, German or Spanish. It will consist of a minimum of 39 semester hours beyond the Bachelor's degree, distributed as follows:

   - A minimum of 21 hours at the 500 level (exclusive of thesis hours) including French 584 (3), German 560 (3), or Spanish 550 (3);
   - German 521-22 (1.1), French 512 (2), or Spanish 512 (2); French 515-16 (2.2), or German 520 (3).

   At least 12 hours at the 600 level (exclusive of dissertation hours).

2. Second Concentration: French, German, Italian, or Spanish (different from the first concentration). It shall consist of at least 18 hours of courses beyond the Bachelor's degree, at least 12 of which must be at the 500 or 600 level.

3. Cognate Field: Six hours must be in courses numbered 400 and above in a field outside the department of the first concentration but related to the student's principal area of research. If the cognate field is yet a third foreign language, a reading proficiency exam will be administered after completion.
of the 6 cognate hours by the language section concerned.

4. Additional Requirements: A student must demonstrate competence in languages of both his/her first and second concentrations by taking a test in each language. The test will include reading, writing, listening and speaking, and should be completed by the time the student reaches 40 hours of study beyond the Bachelor's degree. Standardized examinations that may be used for this purpose include applicable portions of either the National Teachers Examination, the MLA Examination for Teachers and Advanced Students, or the proficiency standards of the United States Foreign Service Institute (FSI).

If the student has not chosen a third language as his or her cognate area, basic competence (determined by a reading examination of translation into English administered by the department concerned) in a third language is required. If the student's first and second languages are Romance languages, the third language should be chosen from another language branch.

A comprehensive examination on the language and literature of the first and second concentrations must be passed before the student may be admitted to candidacy. The candidate will be required to defend his/her dissertation in an oral examination. Central emphasis is put on the doctoral dissertation as a final test of the candidate's scholarly qualifications.

Graduate Teaching Assistants in the program should have the opportunity and will be strongly encouraged to instruct in at least two foreign languages, subject to staffing needs.

Doctoral students will be strongly encouraged to reside and study abroad and will be assisted in identifying potential sources of financial support (e.g. Fulbright, McCutre, Rotary fellowships).

For additional courses, refer to Germanic and Slavic Languages.

French


411 French Literature of the 16th Century (3) Highights of 16th-century French literature. Excerpts from Rabelais and Montaigne; readings of poems from writers of first half of 16th century, Rabelais and other romantic writers. Prereq: 212, 218 or consent of instructor.


413 French Literature of the 18th Century (3) Major works of Enlightenment. Prereq: 212, 218 or equivalent.


416 Survey of Francophone Literature (3) Writing in French outside of France. Prereq: 212, 218 or equivalent.

420 French Cinema (3) French cinema from earliest days through New Wave. Prereq: 212, 216 or equivalent. May apply toward major.

422 Advanced Grammar (3) Improving one's written French by studying basic and more refined structures of French language. Writing creative free-style compositions. Prereq: 342 or 345.

423-24 Advanced Conversation (1,1) Informal conversation with native speaker on contemporary topics. Stresses in-class contact rather than outside preparation. Prereq: 342 or 345. 2 hrs weekly.

425 Introduction to Descriptive Linguistics (3) Phonetics and phonography, morphology and syntax. Types of languages, linguistic groups, dialects, and dialect geography. Application of descriptive linguistics—field linguistics, dialect study; its practical use in learning languages and in language teaching. Introduction to transformational grammar. Prereq: 6 hrs of upper-division English or 6 hrs of upper-division courses in a modern or ancient language (exclusive of German and French 301-02, courses in literature in translation, and general courses in Latin and Greek requiring no knowledge of these languages), or consent of department. (Same as German 426, Russian 425, Spanish 425, and Linguistics 426.)

426 Methods of Historical Linguistics (3) (Same as German 426, Russian 425, Spanish 426 and Linguistics 426.)

429 Romance Linguistics (3) Development of Classical Latin through Vulgar Latin into major Romance languages. (Same as Spanish 429 and Linguistics 429.)

430 Theatrical French (2-3) Performance in one or more French plays. Prereq: 212, 218 or equivalent and consent of instructor. May apply toward major.

431 Highlights of French Civilization (3) Survey of French civilization from the Gauls to World War II. Historical events, daily life, all forms of arts. Prereq: 212, 218 or equivalent.

432 Contemporary French Culture (3) French contemporary civilization and culture since World War II. Problems, trends, and organization of French society today. Prereq: 212, 218 or equivalent.

500 Thesis (1-15) P/NP only. E

501 Techniques in Literary Analysis (2) Required for M.A. program. Intensive course in exposition de texte, a close stylistic analysis of texts representative of different eras and of different genres.

502 Registration for Use of Facilities (3) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is consented. May not be used toward degree requirements. May be repeat- ed. 5/NC only. E

512 Teaching a Foreign Language (2) Practical application of techniques and methods for teaching basic language skills and foreign language skills, and cultural aspects through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships, except those whose previous training or experience warrants their being excused by department.

515-16 Bibliography and Methods of Research (2,2) Survey of critical research tools and scholarly contributions in French literature and language. Practical exercises in compiling of scholarly data.


531 French Literature of the 16th Century I (3) Literature of first half of 16th century. Rabelais and other prose writers, humanists, and poetry of Marot, Lyonnais groups and Valois. Prereq: 212, 218 or equivalent.

532 French Literature of the 17th Century II (3) Literature of second half of 16th century. Mature works of 16th-century writers; as, d'Aubigné and Sponde; Montaigne, writers of scientific works and memorialist drama.
Spanish

421 Phonetics (2) Prereq: 212, or 218 or equivalent.

422 Advanced Grammar (3) Finer points of grammatical structures. Required of all majors. Native speakers must receive consent of instructor. Prereq: 212, 218 or equivalent.

423-24 Advanced Conversation and Composition (3,3) Advanced conversational and written skills in Spanish for pre-professionals.

425 Introduction to Descriptive Linguistics (3) (Same as French 425, German 425, Russian 425, and Linguistics 425.)

426 Methods of Historical Linguistics (3) (Same as German 426, French 426, Russian 426, and Linguistics 426.)

429 Romance Linguistics (3) (Same as French 429 and Linguistics 429.)

431 Spanish Civilization (3) Major social, political, and cultural achievements of Spanish people from origins of their civilization until today. Prereq: 311, 312 or equivalent.

432 Cervantes (3) Selections from Don Quixote and study of shorter Novelas ejemplares. Prereq: 311, 312, or equivalent.

433 Masterpieces of Spanish Literature (3) Selections from both Golden Age and modern period of outstanding works of all genres. Prereq: 311, 312 or equivalent.

435-36 Survey of Spanish Literature (3,3) 435—Spanish literature through Golden Age. 436—Spanish literature since 1700. Prereq: 311, 312.

450 20th-Century Hispanic Theatre (3) Major 20th-century Spanish American dramatists. Prereq: 311, 312, or equivalent.

459 Capstone Colloquium in Spanish (3) Integrative experience. Broad range of issues and topics that affect much of Spanish-speaking world and also involve those who specialize in Hispanic studies. Prereq: 311, 312 or equivalent.

460 Capstone Tutorial in Spanish (1) Independent study project supervised closely by faculty member. Prereq: 311, 312, 459 or equivalent.

471 Latin American Civilization (3) Latin America’s diverse historical, major social and political institutions. Prereq: 311, 312 or equivalent.

472 Masterpieces of Spanish American Literature (3) Close reading of selected works by major Spanish American writers, Darío, Paz, Borges, Puentes and others, Genres and periods vary. Prereq: 311, 312 or equivalent.

473-74 Survey of Spanish American Literature (3,3) 473—Historical survey from Conquest to late 19th century. 474—Major literary movements, writers and works of 20th century. Prereq: 311, 312 or equivalent.

479 Social Protest Literature of Latin American (3) Analysis of literature as means of unmasking social ills that have traditionally beset Latin America. Indigenous, Black literature, woman writers, role of writer in Latin American society. Prereq: 311, 312 or equivalent.

500 Thesis (1-15) P/NP only. E.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E.

512 Teaching a Foreign Language (2) Practical application of methods for teaching and evaluating basic language skills and cultural aspects through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships, except those whose previous training or experience warrants their being excused by department.

522 Advanced Communication Skills for Teachers and Other Professionals (3) Advancement of oral and written proficiency in Spanish through extensive use of authentic contemporary materials; class lectures and discussions; oral and written presentations and reports. Especially recommended for graduate students, teachers and other professionals seeking to maintain or enhance high level communicative competency.

531 Old Spanish (3) Old Spanish language and medieval Spanish literature through 13th century.

532 Medieval Spanish Literature (3) Spanish literature of 14th and 15th centuries.

533 The Picaresque Novel (3) Lazarillo de Tormes, Guzmán de Alfarache, and Buscón.

534 Don Quixote (3)

535 Golden Age Poetry (3) Garcilaso, Fray Luis de León, San Juan de la Cruz, Lope de Vega, Quevedo, and Góngora.

537 The Golden Age Theatre (3) Major dramatists of period: Lope de Vega, Tirso de Molina, Ruiz de Alarcón, Guillén de Castro, Calderón de la Barca, Moro, and Rojas Zorrilla.

541 Galdós and the 19th-Century Spanish Novel (3) Analysis of works by Galdós and other major 19th-century novelists, Pardo Bazán, Valera, Clarín, and Pereda.


543 The 20th-Century Spanish Novel (3) Baroja, Azorín, Valle-Inclán, Pérez de Ayala, Cela, Delibes, Goytisolo, Matute, and at least one present-day novelist.

545 Modern Spanish Poetry (3) From Bécquer, Unamuno, A. Machado, Jiménez, Lorca, Guillén, Alexandre, and a contemporary, Celaya.

547 Modern Spanish Drama (3) Major playwrights of 20th-century Spain.

550 Techniques of Literary Analysis and Research Methods (3) Theoretical and critical essays on various techniques of literary analysis. Exploration of bibliographical and research materials.

551 Special Topics in Spanish or Spanish American Literature (3) May be repeated. Maximum 6 hrs.

552 Directed Readings (3)

559 Problems in Linguistics: Romance Languages (3) (Same as French 559 and Linguistics 559.)


573 The Spanish American Novel: Chile and the River Plate Nations (3) Novels from Chile, Argentina, Uruguay and Paraguay. Modern world.


576 Contemporary Spanish American Poetry (3) Major poets in Spanish American from post-modernismo to present day.

577 Spanish American Drama (3) Major playwrights of 20th-century Spanish America.


579 The Spanish American Short Story (3) Short story by major writers in Spanish America from Romanticism to present day, theory and criticism of genre.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

600 Doctoral Research and Dissertation (3-15) P/NP only. E.

621-32 Seminar in Spanish Literature (3,3) Topics vary in field of Peninsular literature. May be repeated with consent of department. Maximum 9 hrs.

631-32 Seminar in Spanish American Literature (3,3) Topics vary. May be repeated with consent of department. Maximum 9 hrs.

Rural Practice

(Major of Veterinary Medicine)

MAJOR DEGREE

VETERINARY MEDICINE D.V.M.

M. H. Shires, Head


See Veterinary Medicine for Program Description.

PROFESSIONAL COURSES

891 Clinical Rotations in Rural Practice (4) Clinical training in medicine, surgery, specialty disciplines and herd health of food animals and horses. Direct responsibility for diagnosis, patient care and treatment of clinical patients.

892 Clinical Rotations in Rural Practice II (4) Clinical training in medicine, surgery, specialty disciplines and herd health of food animals and horses. Direct responsibility for diagnosis, patient care and treatment of clinical patients.

893 Clinical Rotations in Rural Practice III (4) Clinical training in medicine, surgery, specialty disciplines and herd health of food animals and horses. Direct responsibility for diagnosis, patient care and treatment of clinical patients.
894 Clinical Rotations in Rural Practice IV (4) Clinical training in medicine, surgery, specialty disciplines and animal husbandry for students interested in rural animal practice.

895 Clinic Rotation in Radiology I(2) Clinical training in radiographic techniques and interpretation of radiographs as part of diagnostic process.

897 Special Problems in Rural Practice I-8) Extramural and specially designed study for students interested in select topics in medicine, surgery, animal husbandry, and pharmaceutical specialties of large animals.

GRADUATE COURSES

500 Thesis (1-15) P/Nil only. E

501 Special Topics in Large Animal Medicine and Surgery (1-4) May be repeated. Maximum 6 hrs. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

600 Doctoral Research and Dissertation (3-15) P/Nil only. E

Russian

See Germanic and Slavic Languages

Social Work

(College of Social Work)

MAJOR DEGREES

Social Work............................. M.S.S.W., Ph.D.

Ben P. Granger, Head

Professors:
L. M. Beasley, Ph.D. Denver; M. H. Bloch, M.S. Ohio State; R. C. Bonovich, D.S.W. Washington (St. Louis); G. W. Fryer (Emeritus), Ed.D. Columbia; C. A. Glisson, Ph.D. Washington (St. Louis); B. P. Granger, Ph.D. Brandeis; H. Hirayama, D.S.W. Pennsylvania; G. McLarman (Emeritus), M.S.S.W. Tennessee; M. K. Mullins, Ph.D. Chicago; R. M. Noote, D.S.W. Tulane; B. Orchard (Emeritus), M.S. Western Reserve; J. D. Orten, D.S.W. Alabama; H. Rubenstein, Ph.D. Chicago.

Associate Professors:
R. S. Avery, Ph.D. Brandeis; W. J. Bell, D.S.W. Tulane; C. Cutting, Ph.D. Washington (St. Louis); C. T. Cruthirds, D.S.W. Tulane; C. F. Fahey, Ph.D. Michigan; A. E. Moses, D.S.W. California (Berkeley); R. B. Rowen, Ph.D. Arizona; N. P. Tate, Ph.D. Brandeis; H. H. Vaughn, Ed.D. Memphis State; A. R. Wachter, M.S.S.W. Tennessee; C. S. Wilks, Ph.D. St. Louis; P. G. Zarbock, M.S.S.W. Wisconsin.

Assistant Professors:
P. M. Campbell, D.S.W. Alabama; J. W. Charing, Ph.D. Peabody; J. C. Collier, M.S.W. Tulane; I. C. Faust, M.S.W. Tennesse; A. R. Ford, M.S.W. Atlanta; V. A. Gates, M.S.S.W. Tennesse; J. Jennings, Ph.D. Michigan; D. C. Johnston, M.S.W. California (Berkeley); N. Lunn, M.S.S.W. Tennessee; M. P. Strong, M.S.W. Tulane.

THE MASTER'S PROGRAM

The Master of Science in Social Work program prepares students to provide professional leadership in: 1) the direct provision of social work practice and 2) social welfare administration and planning. These objectives are met through a curriculum requiring of all students a professional foundation and a concentration in either social work treatment or social welfare administration and planning.

Admission Requirements

Admission to the professional curriculum is based on the following requirements:

1. A Bachelor's degree from an accredited college or university with some preparation in the social sciences. At least three-fourths of the applicant's undergraduate work should be in the social sciences, humanities, physical sciences, and other liberal arts subjects. Those with other academic backgrounds may request consultation regarding ways in which they might be admitted.

2. A grade point average of 2.5 on a 4.0 scale, with those falling below this average considered for provisional admission on the basis of 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. Applications should be filed no later than March 1 for the year in which admission is desired.

Advanced Standing

The University of Tennessee College of Social Work has an advanced standing program. Admission to advanced standing requires:

1. A grade point average of 3.0 or above (on a 4.0 scale) in undergraduate work.

2. An undergraduate major in social work from a program accredited by the Council on Social Work Education.

3. Passing a qualifying examination administered by the College of Social Work faculty.

Specific information about the advanced standing program is available from the college. Application for admission to the advanced standing program is through the regular admission process.

Extended Study

Planed part-time programs are available in all three branches of the college. Admission requirements are the same as for full-time study. Course work can be completed over a three- or four-year period. One year of the student's period of study must be on a full-time basis.

General Requirements

1. A minimum of 54 semester credit hours including a) the foundation courses and field practice (15 hours), b) the course Social Work with Oppressed Populations (2 hours), and c) at least five courses (15 hours) and three semesters of field (16 hours) in the social work treatment concentration or at least four courses (12 hours) and three semesters of field (16 hours) in the social welfare administration and planning concentration.

2. Students may select a thesis or non-thesis option. Those students pursuing the thesis option receive 6 credit hours for successful completion of a thesis.

3. Successful completion of a comprehensive exam or thesis defense.

4. An overall GPA of 3.0 or better on all graded courses and satisfactory performance in field.

The Professional Curriculum

The professional curriculum is a 15-month sequence of five basic areas required of all students before entering either of the concentration programs. As the initial phase of the educational program, the foundation curriculum contributes to the process of professional identification while presenting a comprehensive and broad knowledge base from which to operate in the future as practitioners, supervisors, administrators, and planners.

Upon completion of the foundation curriculum (at the beginning of the second semester), students select a concentration in either social work treatment or social welfare administration and planning.

Social Work Treatment:
The social work treatment concentration provides the educational basis for practice with individuals, families, and groups in order to enhance their social functioning, ameliorate problems, and prevent social dysfunction. The specialization provides knowledge of the theory and methodology basic to varied individual, family, and group methods applicable in the treatment of diverse client problems.

Social Welfare Administration and Planning:
The social welfare administration and planning concentration provides the educational basis for leadership in the design, implementation, and continued delivery of effective human service programs at local, regional, and state levels. This concentration emphasizes theory and skills related to administration and planning, and permits considerable flexibility in tailoring a program to fit the student's individual interests, capabilities, and career goals.

Field Practice

Field instruction is a critical component of the student's first- and second-year program. Through cooperation with a wide range of social agencies and human service programs throughout Tennessee and areas adjacent to the state, the college is able to provide field placements in a variety of social work practice areas. The faculty works closely with the placement agencies and the field instructors to ensure that students have quality field practice experiences, meeting the objectives of the core curriculum and the concentration.

The college uses a concurrent class and field plan. Students are in field two days per week during the first year and three days per week in the second year.

First-year agency placements are selected to provide practical experiences related to the foundation curriculum content and beginning concentration. Within the placement, each student's experiences are planned and designed according to educational objectives.
Second-year placements are selected according to the student’s area of concentration, individual career interests, and educational needs. The student actively participates with the field practice coordinator and the concentration committee in selection of the second-year placement. The second-year field placement experience focuses on the integration of social work knowledge and values, and emphasizes the acquisition and development of professional skills.

Students are responsible for meeting the requirements of their placement agencies in terms of office hours and workload coverage. This responsibility takes precedence over scheduled University breaks and may result in variations in holidays and office hours for the student.

Transfer Credits
Course work equivalent to the first year of the Master’s program, completed in another accredited graduate social work program, is usually accepted toward degree requirements. Applicants must meet the admission requirements of the College of Social Work and the College of Social Work. Transfer courses must be approved as equivalent to required and/or elective courses taken for graduate credit and passed with a grade of B or better. S/NC credit earned for the field practicum is also accepted. In addition, transfer courses must be part of an otherwise satisfactory graduate program (B average) and be approved by the dean. This course work must be completed within the six-year period prior to the receipt of the degree.

A maximum of 6 semester credits from work earned in disciplines other than social work may be transferred as elective credits. The student’s academic committee must approve the request and the transfer credit must meet Graduate School requirements.

Proficiency Examination
Students in the Master’s program may earn a maximum of nine hours by proficiency examination, with the exception of field practicums. Courses. Students interested in proficiency examinations are referred to The Graduate School and the department, and are scheduled over an academic year. Students and their committees can develop a plan for completing a portion of research in Nashville and Memphis based on availability of course offerings and dissertation resources.

Admission Requirements
The Ph.D. program is designed for students who have completed a Master’s degree in an accredited school of social work and three years of post-Master’s social work/social welfare experience. Applicants who do not meet these requirements will need to achieve equivalent credentials as specified by the Doctoral Admission Committee before initial registration.

General Requirements
1. A minimum of 60 semester hours beyond the MSW including a) completion of 21 credits of required coursework, b) completion of 15 credits of advanced electives, at least 12 of which are taken outside the department, and c) completion of the dissertation, and 2. Successful completion of comprehensive and final examinations.

Curriculum
The curriculum of the Ph.D. program consists of foundation course work, electives, and dissertation research. The foundation curriculum consists of 21 hours of course work in the history and philosophy of social work, issues in direct service and administration and planning, areas of practice, and research methodology and statistics. Upon this foundation, students and their academic committees develop a plan of study consisting of course work in Social Work and other departments of the University. Typically, the foundation curriculum is completed and elective course work begun during the first year of study; the elective requirement is completed and dissertation research begun in the second year of study, and dissertation research is completed in the third year of study. While it is generally expected that the foundation curriculum is completed on a full-time basis, subsequent course work and dissertation research can be completed on a planned part-time basis. Specific course requirements are 500, 601, 602, 612, 613, 640, and Statistics 531 and 532. A student working full-time on the dissertation registers for 12 hours of 600 per semester.

Examinations
All doctoral students are required to pass a comprehensive examination and a final examination. The comprehensive examination consists of a written part covering foundation curriculum and a second part requiring an oral defense of the dissertation research proposal. The final examination is administered by members of the doctoral committee and is designed for the student to demonstrate comprehensive knowledge of the dissertation area and field specialty. In case of failure of either examination, the student may request a retake. The result of the second examination is final.

Graduate students majoring in fields other than social work are admitted to certain social work courses with the approval of the College of Social Work and the student’s major professor.

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
508 Practicum in Social Work Research (3-6) Supervised practice in application of research methods to social work. Prereq: 510 and consent of faculty conducting investigation. May be repeated. Maximum 6 hrs. S/NC only. E
509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nursing 509, Nutrition and Food Science 509, Physical Education 509.)
510 Social Work Research (3) Research methodology applied to problems in social welfare. Problem formulation; research design; ethics; instrument construction; data collection; sampling; frequency distributions; statistical procedures; research reporting; and evaluation and utilization of research. Prereq: Admission to college or consent of instructor. F
512 Social Work Practice (3) Basic theory, values, and methodology general to social work practice at various system levels presented from ecological perspective. Assessment, planning, conception, organization, and evaluation skills. Classroom and skills laboratory experience. Prereq: Admission to college or consent of instructor. F
514 Human Behavior and Social Environment (3) Theories pertaining to individual, family, small group, and community in context of functions, structure, roles, and processes. Systems conceptualized along functional-dysfunctional and normal-deviant continuum: stress, development and maturation. Open systems approach to social work intervention. Prereq: Foundation or consent of instructor. F
516 Social Welfare Policy and Services (3) Development of contemporary social policy at local, state, national, and international levels. Contribution of social work professionals to formal policy-making process through which macro-social problems are identified and through which aggregate social welfare services are provided. Investigated, financed, and programmed. Theories of contemporary organizations applied to social welfare service delivery settings. Prereq: Admission to college or consent of instructor. F
518 Social Work with Oppressed Populations (2) Social work’s professional role in working with individuals and groups in American society whose oppression is based upon distinguishing characteristics: age, sex, economic class, religion, sexual preference, handicapping conditions, ethnicity and race. Prereq: Admission to college or consent of instructor. Sp
520 Social Work Treatment with Individuals and Families (3) Nature and process of practice with individuals and families in helping them resolve or cope with problems of living. Working with disadvantaged clients and enhancing client competence. Prereq: Foundation or consent of instructor. S
522 Social Work Treatment with Groups (3) Theories and practice of social work with small groups. Treatment groups, task groups. Prereq: Foundation or consent of instructor. S
524 Psychopathology and Social Deviance (3) Theories of and recent research in etiology of psychic malfunctions and social dysfunction and social variance. Categorical approach to psychopathology. Prereq: Foundation or consent of instructor. S
526 Research for Assessment of Social Work Treatment (3) Application of research methods for assessment of social work treatment. Prereq: Foundation, 520 or 522, or consent of instructor. Sp
561 Supervision and Consultation in Social Work (3) Roles, techniques, and practices of social work supervision and consultation. Prereq: Foundation or consent of instructor.

562 Social Work and Black Families (3) Historical and contemporary theories about black family systems. Development of frameworks to assess and plan for black families within social systems. Prereq: Foundation or consent of instructor.

563 Social Aspects of Illness (3) Social, economic, and emotional problems arising from or related to illness and disability and their implications for social work. Prereq: Foundation or consent of instructor.

564 Substance Abuse (3) Survey and analysis of social, cultural, medical and psychological factors underlying alcoholism and drug abuse and addiction; recent research and treatment innovations. Prereq: Foundation or consent of instructor.

565 Roles and Status of Women (3) Causes and consequences of women's social and economic roles and statuses in American society. Variations in women's experiences by race and ethnicity, class, age, and life-cycle. Prereq: Foundation or consent of instructor.

566 Social Gerontology (3) Physical, psychological and social aspects of aging. Major social policies and programs. Prereq: Foundation or consent of instruc-tor.

570 Advanced Standing (12) Twelve-week program providing qualified students with intensive academic and field experience to complete first year of graduate study upon successful completion of term. S/NC only.

580 Field Practice (3) Instruction and supervision in social work practice. Prereq or coreq: 512. S/NC only. E

581 Field Practice (4) Instruction and supervision in social work practice. Prereq: students' selected concentration in social work or social work administration and planning. Prereq: Foundation. S/NC only. Sp

582 Field Practice (6) Instruction and supervision in social work practice or social welfare administration and planning. Prereq: Foundation, 581. Prereq or coreq: Treatment: 520, 524. S/NC only. F

583 Field Practice (6) Instruction and supervision in social work practice or social welfare administration and planning. Prereq: Foundation, 582. S/NC only. Sp

584 Field Practice (2-6) Instruction and supervision in social work practice. Prereq or coreq: 512. May be repeated. S/NC only. E

593 Independent Study (1-9) Individualized study, student selected concentration, examination of special issue or problem. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F,Sp

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Research for Social Work Practice I (3) Epistemological and methodological considerations for both quantitative and qualitative research for social work practice. F

602 Research for Social Work Practice II (3) Epistemological and methodological considerations for both quantitative and qualitative research for social work practice. Sp

604 Research in Social Service Settings (3) Advanced research, under faculty supervision, of practice issues in community agency. Prereq: First year required Ph.D courses or consent of instructor. May be repeated. Maximum 9 hrs. F,Sp

608 Evaluative Research for Social Work Practice, Programs and Policy (3) Techniques and strategies for quantitative and qualitative analysis of research for policy's impact on individuals and groups and for evaluating processes and outcomes of social work practice. F


613 Social Work Practice and Its Social Context II (3) Critical analysis of knowledge bases of major practice modalities in administration and planning. Sp

640 History of American Social Work (3) Social, cultural, economic and political contexts for development of social work profession, development of education for profession, and modern welfare system. F

660 Issues in Social Work Knowledge Building (3) Advanced seminar in theory and model building in direct intervention, administration and planning. Prereq: First year required Ph.D courses or consent of instructor. May be repeated. Maximum 9 hrs. F,Sp

693 Directed Study in Social Work Research (3) Advanced individual study, under faculty guidance, of social work practice issues. Prereq: First year required Ph.D courses or consent of instructor. May be repeated. Maximum 9 hrs. F,Sp

Sociology (College of Liberal Arts)

DEGREES

MAJOR

Sociology

Thomas C. Hood, Head

Professors:
D. M. Betz, Ph.D. Michigan State; J. A. Black, Ph.D. Iowa; D. J. Champion, Ph.D. Purdue; D. Hastings, Ph.D. Massachusetts; T. C. Hood, Ph.D. Duke; D. R. Ploch, Ph.D. North Carolina; N. Shover, Ph.D. Illinois; S. Wallace, Ph.D. Minnesota.

Associate Professors:

The Sociology Department offers graduate study leading to the Master of Arts and the Doctor of Philosophy. The M.A. program includes a thesis and non-thesis option. The graduate program has concentrations in criminology; energy, environment, and resource policy; and political economy. The criminology concentration includes 505, 551, 653, and 655. The energy, environment and resource policy concentration includes 560, 561, 562, 663, and 665. The political economy concentration includes 504, 540, 541, 643, 644, and 645. Both the Master's and the doctoral program allow for the construction of individualized programs of study. Detailed information may be obtained from the Director of Graduate Studies in Sociology. All incoming students will be advised by the Director of Graduate Studies.

ADMISSION REQUIREMENTS
1. Acceptable scores on the general Graduate Record Examination (GRE scores in sociology are requested but not required).
2. Three letters of recommendation (forms may be obtained from the department).
3. Completion of the appropriate previous degree (baccalaureate, preferably with a major in one of the social sciences, for the M.A. program; Master's degree in one of the social sciences for the doctoral program).

THE MASTER'S PROGRAM

Thesis Option
A total of 30 hours, including 24 hours of course work and 6 hours of Thesis 500, is
required. Students are strongly encouraged to complete 3-6 hours of theory (521, 622), 6 hours in methodology (531, 534), and 6 hours in statistics (535-36). Two-thirds of all credits must be approved at or above the 500 level. Sociology courses at the 400 level must be approved by the student's advisor. An oral final examination is given at the end of the student's program. Students planning to pursue a Ph.D. program are strongly encouraged to take the thesis option.

**Non-Thesis Option**
A total of 30 hours of course work is required. Students are encouraged to complete 3 hours of theory (521), 5 hours in methodology (531, 534), and 6 hours of statistics (535-36). Non-thesis students may select one of two plans: Plan 1 (concentration and secondary area) or Plan 2 (specialization within concentrations). Doctoral students are strongly encouraged to pursue a Ph.D. program.

**Plan 1:** A final written examination in one of the department's concentrations is required. The concentration may include 6 hours of course work in a secondary area of specialization required. The secondary area may be chosen from outside the department, subject to approval of the student's advisor and the Graduate Program Committee.

**Plan 2:** The student must complete a specialization of study in one of the department's concentrations, subject to approval of the student's advisor and the Graduate Program Committee. A final written examination in the area of specialization is required. Subject to approval by the student's committee, up to 12 hours may be taken in courses outside the department for either program.

**THE DOCTORAL PROGRAM**

**Course Work**
Forty-eight hours of course work beyond the baccalaureate degree are required (exclusive of S/NC credits). Students who enter the program without the courses recommended for the M.A. program (521, 531, 534, 535-36) or equivalents are required to take remedial work beyond the minimum course requirements. Completion of 622 is recommended. Completion of nine hours in each of two concentrations is encouraged. A student who cannot achieve his/her educational goals within the department's concentrations may construct an individualized course of study subject to the approval of the student's advisor and the Graduate Program Committee. Twelve hours of course credit in sociology at the 600 level is required. Sociology courses at the 400 level may not be taken without the consent of the student's advisor and the Graduate Program Committee. Six hours may be taken in related fields without petitioning the Graduate Program Committee for approval. The student's program may include a minor or cognate field.

**Comprehensive Examinations**
Written examinations in four areas are required (theory, research methodology, and two substantive areas). Doctoral students are eligible to take the theory and methodology examinations whenever offered. Substantive examinations may be taken upon completion of theory and methodology examinations, specializations within concentrations, or other areas of specialization. Detailed information on examinations may be obtained from the department.

**Dissertation and Final Examination**
A dissertation based on original research must be completed (24 hours). The candidate must pass a final defense of the dissertation, including the theory and methodology related to the research, in accordance with the deadlines specified by The Graduate School.

405 Sociology of Sport (3) Social meaning, organization, and process of sport. Prereq: 291 or consent of instructor. (Same as Physical Education 405.)

413 Formal Organization (3) Analysis of organizational models, types, and theories; hierarchy of authority; communication; interpersonal relations in work settings; organizational change.

414 Organization of Medical Care (3) Organization of health care facilities, staff-patient relationships, demographic characteristics, and prevalence of disease.

415 Sociology of Aging (3) How roles and statuses change with age, especially in relation to major social institutions; impact that rapidly increasing number of older people has on society, effect of society on older people.

446 The Modern World System (3) Critical examination of capitalist world-system as social system, its coherence, boundaries, regions, member groups, cleavages, and patterns of conflict. Analysis of who gets what, why, and how in global political economy.


455 Society and Law (3) How laws and legal processes are affected by social change, social impact of legal sanctions, relations between law and social justice.

459 Organizational and Corporate Crime (3) Analysis and the deviance committed by organizations. Case studies of corporate and organizational crime, organizational dynamics of crime, theories of corporate crime, and organized responses to this type of crime by governmental regulatory agencies.

462 Populations (3) Demographic factors and social structure; trends in fertility, mortality, population growth, migration, distribution, and composition; population policy.

464 Urban Ecology (3) Relation of humans to their urban environment: conservation and use of appropriate technology. (Same as Urban Studies 464.)

471 Sociolinguistics (3) (Same as English 471 and Linguistics 471.)

480 Diffusion of Agricultural Technology (3) (Same as Rural Sociology 480.)

500 Thesis (1-15) P/NP only.

506 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

504 Sociological Foundations of Political Economy (3) Survey of contemporary sociological theories of political economy, sources of political and economic power and conflict.

505 Foundations of Criminology (3) Critical overview of contemporary developments in criminology, theories of crime causation and theories of responses to crime. Prereq: 350 or equivalent.

507 Foundations of Social Psychology (3) Current and classical theoretical perspectives in social psychology.

510 Teaching Sociology (3) Art and craft of teaching sociology. Introduction to teaching and learning strategies and techniques. May be repeated. Maximum 6 hrs.

521 Sociological Theory I (3) Assessment of what sociological theory is; its major figures and their approaches to understanding society.

531 Research Methods in Sociology (3) Research design, measurement, sampling, quantitative and qualitative data collection techniques, data, reduction, and analysis.

534 Advanced Sociological Analysis (3) Underlying assumptions and logical procedures used by sociologists in formulating explanations; foundations of sociological research strategies and techniques.

535-36 Statistical Analysis I and II in Sociology (3,3) Should be taken in sequence. 535—Data reduction, exploratory data analysis, general linear model. 536—Sampling; inferential statistics; based on general linear model, introduction to multi-variate analysis. Prereq: Statistics 201 or consent of instructor.

540 Occupations (3) Occupations in relation to individuals and society, technology, economic stratification, and social organizations.

541 Collective Behavior, Social Movements, Social Change (3) Basic theories and research on conditions of social unrest in human collectivities and efforts of collectives to change existing society.

542 Sociological Aspects of Sports and Physical Education (3) (Same as Physical Education 542.)

551 Delinquency and the Social Structure (3) How study of delinquency and juvenile justice is affected by changing structures of childhood and adolescence, changing demographic and institutional influences, and changing views about responsibility and punishment.

560 Environmental Sociology (3) Systematic treatment of current research in environmental sociology. Social impact analysis and conflicts over environmental issues.

639 Demographic Techniques (3) Standard rates and measures of demographic variables, life table analysis, increment-decrement models, and survey techniques of population analysis.

580 Advanced Rural Sociology (3) (Same as Rural Sociology 580.)

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Social Theories of Sport (3) (Same as Physical Education 545.)

595 Special Topics in Rural Sociology (1-3) (Same as Rural Sociology 593.)

598 Readings (3) Selected topics. May be repeated. Maximum 6 hrs.

600 Doctoral Research and Dissertation (3-15) P/NP only. E

611 Complex Organization (3) Selected topics in formal organizations: cases and incident process analysis; examines strategies for dealing with organizational change, authority hierarchies, communication patterns; technology and organizational structure; job satisfaction, motivation, morale and interpersonal phenomena.

622 Sociological Theory II (3) Distinct schools of sociological theory and contributions of their principal exponents. Prereq: 521 or consent of instructor.

629 Supplementary Readings in Sociological Theory (3) Individual guidance. Preparation for comprehensive examination. Prereq: Consent of instructor. S/NC only.

633 Survey Design and Analysis (3) Systematic exploration of survey problems through student participation in design and analysis of survey. Prereq: 531 or consent of instructor.
Special Services Education/Fields of Instruction

530 Inquiry in the Liberal Arts (2) Seminar on nature of creative inquiry in liberal arts and sciences; an overview of pivotal issues within and between disciplines pertinent to identifying and solving problems related to personal and social progress.

530 Learning in the Liberal Arts (2) Builds upon readings, presentations, and discussions of 510 and 520 by reflecting on them in distinct but related contexts—classroom, region called Appalachia, and perspectives and experiences associated with liberal arts.

Special Services Education
(College of Education)

MAJORS

Special Education..........................M.S.
Rehabilitation Counseling..................M.S.

DEGREES

Laurence J. Coleman, Head

Professors:

Associate Professors:

Assistant Professors:
J. D. McLean, Ph.D. Chicago; K. M. Warden, Ph.D. Tennessee.

Instructors:
D. H. Ashmore, M.S. Tennessee; M. Griffin, M.S. Tennessee; G. D. Tyler, M.S. Tennessee.

Lecturer:
H. L. Byrd, Jr., M.S. Tennessee.

The Department of Special Services Education offers graduate programs leading to the Master of Science with a major in Special Education or in Rehabilitation Counseling. The department also participates in the Doctor of Philosophy program in Education as described under Education. A new curricular area, Human Services, has joined the department and the faculty will share in teaching cross-disciplinary courses in special education and rehabilitation.

THE MASTER’S PROGRAMS
The Master’s program in Special Education offers concentrations in the following areas: 1) hearing impaired; 2) gifted; 3) learning disabilities; 4) mental retardation; 5) multiple disabilities; 6) socially or emotionally maladjusted; and 7) general special education.

Teacher certification can be obtained while working toward the Master’s degree. Course offerings are available that lead to general special education teacher certification and to certification to teach hearing impaired children.

The Rehabilitation Counseling program enables counselors to acquire competencies which facilitate the movement of a person with disabilities toward optional functioning in the three broad areas of living, learning, and working. The rehabilitation counselor works primarily with adults who are being served in various public and private settings. Students should expect to spend a minimum of four semesters, including summer, in coursework and in internships.

Both majors have a thesis and non-thesis option. If a student elects to do a thesis, the Master’s program will contain a minimum of 30 semester hours including 6 hours of Thesis 500. Eighteen semester hours in special education course work is required. The non-thesis option requires a minimum of 30 semester hours total with a minimum of 18 in special education. In the non-thesis option, a final written comprehensive with an oral examination is required.

ADDITIONAL PROGRAMS
Under the sponsorship of the Office of Special Education and Rehabilitative Services (R.S.A.), a specialized institute for the preparation of professionals to adapt their skills toward services to hearing impaired and deaf people is provided.

Details concerning each program can be obtained by writing to the department head.

Special Education

410 Pre-Internship Seminar (1) Orientation, objectives and policies of internship program. Must be completed term immediately preceding internship. Prereq: Admission to teacher education program. S/NC only. Sp,Su

423 Communication Processes for the Hearing Impaired (3) Expressive and receptive vocabulary development in sign communication. Fingerspelling and educational applications of sign language.

424 Nature of Hearing Impairments (3) Basic principles of audiology; anatomy and physiology of hearing; nature and causes of hearing loss; methods and instrumentation for assessment of hearing level; interpretation of audiologic services to medical and other rehabilitative disciplines.

425 Introduction to the Psychology and Education of the Hearing Impaired (3) Primarily for those planning to teach hearing impaired. Overview of research related to psychology, social adjustment, communication methodology, language development and education of hearing impaired. Survey of literature. Visits to programs. (Same as Audiology and Speech Pathology 425.)

433 Clinical Practice in Speech-Language Pathology (1-4) (Same as Audiology and Speech Pathology 433)

434 Clinical Practice in Speech-Language Pathology (1-4) (Same as Audiology and Speech Pathology 434)

440 Voice Disorders (3) (Same as Audiology and Speech Pathology 440)

451 Psychology and Education of the Mildly Handi-
547 Practicum in Rehabilitation (3) Supervised experience in area of rehabilitation; application of concepts, principles, and skills. Prerequisite: Consent of instructor.

549 Internship in Rehabilitation Counseling (12) Supervised practice in rehabilitation counseling, including at least one clinical experience for second-year students (600 clock hrs required).

551 Psychology of Learning Disabilities (3) Overview of learning disabilities; review of field's historical perspectives and emerging direction; basic theories of learning disabilities; medical aspects of research, assessment and treatment; characteristics of children and youth, educational implications.

552 Instructional Systems for Learning Disabilities (3) Formal assessment for determining what and how to teach, data collection, instructional programming, and decision-making related to nature and needs of persons with learning disabilities.

553 Assessment of Exceptional Students (3) Historical and legal issues related to assessment; concepts and models of evaluation; test instruments and assessment processes demonstrated, practiced, results applied to educational programming; basic statistics relative to norm and criterion-referenced testing covered. Corequisite: 553 F.

555 Characteristics of Social and Emotional Disturbances of Children and Youth. Definition, identification, symptoms of disturbed child compared and contrasted to normal social and emotional growth.

556 Instructional Systems for the Emotionally Disturbed and Deaf-Handicapped (3) Educational strategies and techniques related to assessment, instruction, simulation, demonstration, and media. Teaching techniques, materials, and teacher/pupil/peer family interactions. Therapeutic forms of education through art, music, role play, puppetry, bibliotherapy, and group interactions.

558 Neuromuscular and Health Disorders: Educational Implications (3) Neuromuscular impairments, physical disabilities, and special health conditions, autism, investigation of instructional techniques and adaptations.

561 Psychology of Mental Retardation (3) Psychological, social, legal, and ethical issues relative to mental retardation.

562 Instructional Systems for the Mentally Retarded (3) Specific developmental, behavioral strategies and techniques. Curricular design techniques and evaluation. Educational needs of mentally retarded children and youth.

Speech Communications

(College of Liberal Arts)

Professors:


Associate Professors:

M. L. Ambrester, Ph.D. Ohio State; J. E. Buckley, Ph.D. Northwestern; N. C. Cook, M.A. Alabama; R. W. Glenn, Ph.D. Northwestern.

Assistant Professor:

R. S. Ambler, Ph.D. Ohio State.

Graduate courses in Speech Communications provide opportunities for students in a variety of disciplines to investigate how oral language can effect changes in the knowledge, the understanding, the ideas, the attitudes, or the behavior of other human beings.

420 Communication and Conflict (3) Communication as significant factor in development, management, and resolution of conflict at interpersonal, small group, organizational or societal levels.

440 Organizational Communication (3) Organizational setting and variables of communication process that affect quality of human interaction both within and outside organization. May be repeated. Maximum 6 hrs.

460 History of Rhetorical Theory (3) Western rhetorical theory from Plato to present.

465 Studies in Rhetorical History and Criticism (3) Historical and critical study of public address. May be repeated. Maximum 6 hrs.

466 Rhetoric of the Women's Rights Movement (3) Historical and critical study of public address in campaign for women's rights from 1830's to present. (Same as Women's Studies 456.)

470 Theories of Argumentation (3) Studies of conceptual bases of argumentation from classical to contemporary theorists. Prereq: Consent of instructor.

480 Ensemble Interpretation (3) Study and presentation of literary texts through group performance.

500 Thesis (1-15) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

505 Fundamentals in Graduate Research in Speech (3) Techniques of historical, descriptive and experimental research.

510 Studies in Persuasion (3) Prereq: 310 or equivalent or consent of instructor.

530 Topics in Group and Interpersonal Communication (3) Prereq: 320, 330, 420, or consent of instructor. May be repeated. Maximum 6 hrs.

550 Communication Theory (3) Analysis of contemporary theories of human communication; similarities and differences of communication processes in interpersonal, group, organizational and public communication. Prereq: 350 or equivalent or consent of instructor.
tical applications of statistics. Through involvement in The University of Tennessee Institute for Productivity Through Quality and related programs, department faculty participate in a variety of consulting and research projects in cooperation with industry. Students may supplement their classroom study with an industrial internship and participation in research projects dealing with industrial problems. Collaborative research efforts by other departments in fields, such as the College of Agriculture and the Knoxville Unit of the College of Medicine, provide the student with the opportunity to gain experience as a research assistant. All students are required to participate in supervised internship or consulting activities as part of their graduate program.

Individuals with undergraduate or graduate degrees in other disciplines are encouraged to enter the program. The candidate's mathematics background should include differential and integral calculus of several variables. Individuals with limited mathematics background should seek departmental advisory input from the program faculty. Students are required to participate in supervised internship or consulting activities as part of their graduate program.

Degree Requirements

The program offers the M.S. in Statistics with a minor in another department, a joint major program in which the student earns a Master's or doctoral degree in the student's sponsoring department along with the M.S. in Statistics, and a joint major and minor program in which the student earns a Master's or doctoral degree in the student's sponsoring department along with a minor in Statistics. The table below presents the minimum number of semester hours in statistics for each of the program options. The student selects courses to satisfy the requirements established by the student's sponsoring department and approved by the Program Executive Committee.

The student's committee must include a faculty member of the Statistics Department at the rank of Assistant Professor or above. The student's formal examination procedure as established by the sponsoring department must include an appropriate section on statistics. Successful completion of the Statistics minor/major is recognized by appropriate documentation on the student's transcript. Students who do not complete all requirements for the Statistics major/minor will still receive academic credit for statistics courses they have successfully completed.

Degree Requirements Program:

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<td>M.S.</td>
<td>M.S.</td>
<td>Doctorate in Statistics,“M.S. outside of Statistics,”** minor in Statistics</td>
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*Approved Statistics courses from the Department of Statistics and/or other departments.

**Courses taken for the minor or the Master’s degree in Statistics may fulfill requirements for the doctoral degree.

Contact the home department for details.

BUSINESS ADMINISTRATION CONCENTRATION

For complete listing of MBA program requirements, see Business Administration.

MBA Concentration

Statistics

Minimum Course Requirements for MBA Concentration: Prereq or coreq: 561.

Requirements: 571, 560, 572.

411 Introduction to Statistical Computing (3) Use of computer operating system commands and packaged programs for statistical analysis and file management. Not available for credit for statistics majors. Prereq: 201 or 251.


500 Thesis (1-15) P/NP only. E.

501 Statistics for Management (3) Fundamentals of descriptive and inferential statistics. Introduction to probability models, statistical inference, statistical process control, correlations and regression, basic time series. Open only to MBA students.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when students use University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeat ed. S/NC only. E.

531 Statistical Methods for the Social Sciences I (3) Probability distributions, sampling distributions, parametric and nonparametric estimation and hypothesis testing, simple linear regression and correlation. Credit not given for both 531 and 537. Prereq: 1 yr college mathematics and 1 course in statistics.

532 Statistical Methods for the Social Sciences II (3) Multiple regression and correlation, use of dummy variables, general linear model, analysis of variance and covariance. Prereq: 551.

537 Statistics for Research in the Behavioral and Biological Sciences I (3) Principles and applications of statistical methodology, integrated with considerable use of major statistical computing system. Probability and probability distributions, forming and testing hypotheses using parametric and nonparametric inference methods. Matrix-based simple linear regression and correlation. Career in research. Credit not given for both 531 and 537. Prereq: 1 yr undergraduate mathematics and 1 undergraduate statistics course.

538 Statistics for Research in the Behavioral and Biological Sciences II (3) General linear model as applied to multiple regression and analysis of variance. Diagnostic and influence techniques. One-way, factorial, blocking, and nested designs, preplanned versus post-hoc contrasts. Random factors and repeated measures. Prereq: 537.

561 Introduction to Computing for Data Management and Analysis (1) UKT computing environment for beginning graduate students. Operating system commands, system editor, utility programs and major statistical package, SAS, for data entry and editing, file management, and statistical analysis in interactive and batch environments, IBM, CMS, and MVS. Use of microcomputers for statistical analysis. Coreq: 531, 537, or 571, or consent of instructor.

564 Theory of Statistical Inference (3) Introductory theory underlying common statistical procedures of hypothesis testing and estimation. Prereq: 563.

566 Statistical Techniques in Industrial Processes (3) Applications of control charts and other statistical techniques in industrial settings. Attributes and variables control charts, process capability analysis, aspects of sampling, statistical tolerancing, estimation of variance components, problems of measurement, special industrial applications. Prereq: 571 or equivalent.


572 Applied Linear Models (3) Simple and multiple linear regression using matrix algebra and general linear model: polynomial regression, weighted least squares regression, variable selection techniques, multicollinearity, regression diagnostics, general linear model approach to analysis of data from designed experiments. Use of standard computer packages. Prereq: 571 and matrix algebra.

573 Design of Experiments (3) One-way ANOVA, multiple range tests, equal and unequal variances, transformations, factorial experiments, completely randomized designs, analysis of covariance, split-plot and nested designs, fractional factorials, sequential designs. Prereq: 571.

585 Principles of Statistical Process Management (3) Control charts and other statistical techniques applied to management of business processes. Prereq: Consent of department head.

587 Graduate Seminar (1-3) Directed readings and active participation in colloquium program of Department of Statistics and of student's minor program. Prereq: Consent of statistics department director of graduate studies. May be repeated. Maximum 2 hrs. S/NC only.

592 Internship (1-6) Supervised off-campus experience in application of statistical principles and methods in business, industry, or government. Written and oral report. Prereq: 2 courses in graduate-level statistics and consent of department director of graduate studies. May be repeated. Maximum 6 hrs. S/NC only.

593 Independent Study (2-6) Faculty directed directed readings and investigation of specified topic in probability or statistics. Written a report and oral presentation. Prereq: 2 courses in statistics and consent of the statistics department director of graduate studies. May be repeated. Maximum 6 hrs. S/NC or letter grade.

596 Statistical Consulting Practicum (1-4) Supervised experiance helping on-campus researchers plan, manage data, and develop and perform analyses specific to designs and hypotheses. Discussion of activities in regular seminar meetings. Final written reports and/or detailed diaries. Prereq: 572 or 538. May be repeated. Maximum 4 hrs.


673 Linear Models (3) Review of full rank models and models not of full rank with application to unbalanced designs, estimation, tests of hypotheses, estimable functions, b.l.u.e., linear hypothesis testing, reductions in sums of squares, least squares means, mixed model equations, methods of variance component estimation from unbalanced data. Prereq: Analysis of variance.

675 Categorical Data Analysis (3) Log-linear analysis of multidimensional contingency tables. Logistic regression. Theory, applications, and use of statistical software. Prereq: 1 yr graduate-level statistics, regression analysis and analysis of variance and familiarity with CMS or VAX; or consent of instructor.

681 Special Topics in Probability (1-3) Presentation of specialized topics in probability and stochastic processes. May be repeated. Maximum 6 hrs.

683 Special Topics in Statistics (1-3) Presentation of specialized topics in statistics. May be repeated. Maximum 6 hrs.

### Technological and Adult Education

**MAJORS**

- **DEGREES**
  - Adult Education
  - Business Education
  - Industrial Education
  - Vocational-Technical Education

**Professors**

- W. A. Cameron, Ph.D. Ohio State
- C. P. Campbell, Ed.D. Maryland
- G. D. Cheek, Ph.D. Kansas State
- C. B. Coakley (Coordinator, Marketing Education)
- Ph.D. Wisconsin
- D. G. Craig, Ed.D. Cornell
- R. W. Haskell (Coordinator, Industrial Education)
- Ph.D. Purdue
- J. L. Matthews
- Ph.D. Arizona State
- K. O. McCullough, Ph.D. Florida State
- J. M. Peters (Coordinator, Adult Education)
- Ed.D. North Carolina State
- J. L. Reed (Emeritus)
- M.S. Oklahoma State
- G. A. Wagoner (Emeritus)
- M.S. Indiana
- G. W. Wiegers, Jr.
- Ph.D. Missouri
- R. J. Woodin (Emeritus)
- Ph.D. Ohio State

**Associate Professors**

- E. Brewer, Ed.D. Tennessee
- R. Hanson
- Ph.D. Purdue
- G. K. LaBorde, Ed.D. Tennessee
- B. J. Ledford, Ed.D. Tennessee
- E. C. Mann, Ed.D. Pennsylvania State
- G. C. Petty, Ph.D. Missouri
- B. J. Redcliff (Coordinator, Business Education)
- M.S. West Virginia

**Assistant Professors**

- R. Pierce, Ph.D. Ohio State
- T. L. Powell
- M.S. Oklahoma

**Instructor**

- C. W. Wright, M.T. Arizona State

### The MASTER'S PROGRAM

The Department of Technological and Adult Education offers master's degree programs leading to the Master of Science with majors in Vocational-Technical Education, Adult Education, Business Education, and Industrial Education. Each of the degrees has two options: thesis or non-thesis option requiring a minimum of 33 hours and a non-thesis option requiring a minimum of 36 hours. The Vocational-Technical Education major is available with concentrations in business and office education, distribute and marketing education, industrial education, industrial training, and technical education. Details and specific requirements for the various degree options may be obtained from the coordinators of the services.

### THE DOCTORAL PROGRAM

The comprehensive Ed.D. program in the department is designed to provide opportunities for graduate students to achieve professional objectives, develop needed competencies, and gain desirable experiences and understanding of technological and adult education.

The minimum requirements in the doctoral program consist of the following: departmental specialization, 12 hours; departmental core and electives, 21 hours; cognate field, 9 hours; professional education core, 9 hours; research techniques, 12 hours; and dissertation, 24 hours. A minimum of 90 hours above the baccalaureate is required.

The Doctor of Philosophy with a major in Adult Education includes concentrations and specializations as listed under education.

### 401 Utilization of Community Resources (3) Strategies of developing linkages between vocational education and private sector through advisory committees, councils, and working partnerships. Development and management of public relations programs. Prereq: 3 yrs teaching experience. Sp.

### 415 Coordination Techniques (3) Necessary procedures, duties and responsibilities to implement, maintain, and evaluate successful cooperative education program. Prereq: Senior standing and consent of instructor. Sp.

### 430 Principles and Organization of Business and Marketing Education (3) Historical background and development needs. Principles of educational theory and practice in business and marketing, curriculum implications; establishing, evaluating, and improving programs.

### 432 Methods and Materials in Business and Marketing Education (3) Teaching techniques, aids and evaluation in subject matter fields. Prereq: Consent of instructor. F, Su.

### 436 Supervised Occupational Experience (3) Practical field experience in business and marketing settings under supervision of practitioner and departmental representative. May be repeated. Maximum 9 hrs.

### 439 Areas of Business Marketing (3) Marketing, personnel development, operations, and management as affects industrial training program in marketing education. Prereq: 432. F, Su.

### 454 Training Aids Development (3) Study and preparation of instructional aids and non-print media commonly used by technical instructors and trainers. Prereq: Senior standing or consent of instructor. F, Su.

522 Adult Development (3) Changes in characteristics of adults over life span and implications for adult education. Prereq: Consent of instructor. F, Su

523 Post-Secondary Education for Adults (3) History, evolution, philosophy, structure and functions of post-secondary, sub-university institutions, their programs and clientele. Prereq: Consent of instructor. Sp, Su

524 Continuing Professional Education (3) Theories and concepts supporting design and management of educational programs for adults in professions. Prereq: 510 or equivalent. Sp, Su

530 Methods and Materials for VOE Programs (3) Development of instructional aids, recent developments and research, individualized instructional, and occupational clusters. Prereq: 516 or equivalent. Sp, Su

531 Organization and Supervision of VOE and Marketing Programs (3) Developing office and marketing occupations, guidelines in cooperative laboratory, and model office programs. Trends in office and marketing education, physical facilities, state plans, instructor qualifications and advisory committees. Prereq: Consent of instructor. F, Su

532 Improvement of Instruction in Basic Business and Marketing Education (3) issues, research findings, methods and improved instruction of both secondary and post-secondary levels. Prereq: 12 hrs of graduate credit. Sp, Su

533 Improvement of Instruction in Office Technological Programs (3) Research findings, issues, and materials in typewriting, wordprocessing, business communications, and office procedures. Prereq: Consent of instructor.

534 Improvement of Instruction in Accounting and Data Processing (3) Principles of learning, issues, research findings and materials in basic accounting, automated accounting and data processing at secondary and post-secondary levels. Prereq: Consent of instructor. F, Su


536 Organizing and Teaching Adult Business and Marketing Education (3) Planning, organizing, promoting, teaching and evaluating continuing education programs in business and marketing education; utilizing trade associations, employment agencies, business groups, and advisory committees in program implementation. Prereq: 3 yrs teaching experience and consent of instructor. F, Su

537 Measurement in Business and Marketing Education (3) Testing and evaluation of learner performance in business and marketing education; teacher-made tests. Prereq: Consent of instructor. Sp, Su

540 Special Topics in Business and Marketing Education (3) Special topics, activities and evaluations vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

541 Practicum in Business/Marketing Education (3) Practical updating and upgrading experiences in non-traditional settings for business and marketing teachers. Prereq: 15 hrs of graduate credit. E

542 Problems in Business and Marketing Education (3) Selective research problems in teaching of business and marketing education and related areas. Prereq: Consent of instructor. E

559 Administration of Industrial Education Programs (3) Developing, staffing, administering and evaluating trade, industrial and technical education programs in secondary and post-secondary school settings. Prereq: Consent of instructor. Sp, Su

551 Supervision of Industrial Education Programs (3) Techniques used to improve industrial education programs. Staff development, curriculum improvement, and program evaluation techniques. Prereq: 455 or equivalent. F, Su

552 History and Philosophy of Industrial Education (3) Social, political, and economic events that impact development of industrial education. Philosophical problems, justification, values, principles and concepts of industrial education. Prereq: Consent of instructor. F, Su

553 Planning Technical Education Facilities (3) Preparation educational specifications, use of consultants, and working relationships with other professionals involved in process of planning technical-education facilities. Prereq: Consent of instructor. Sp, Su

554 Technical Program Planning (3) Instructional systems and methods to analyze, design, development, implementation, and evaluation of trade, technical supervisor and related training. Prereq: Curriculum development course and consent of instructor. F, Su

555 Curriculum Planning for Industrial Education Programs (3) Designing part-time, weekend, criterion-referenced instructional programs. Prereq: 374 or 554 or consent of instructor. Sp, Su

556 Staff Development Programs (3) Strategies for assessing, planning, and implementing programs for professional development of vocational-technical personnel. Prereq: 551 or consent of instructor. Sp

557 Advanced Methods of Teaching Technical Subjects (3) Proper selection and effective application of innovative methods and teaching specialized skills and technical information. Diversifying and individualizing teaching of technical subjects. Prereq: 373. Sp, Su

558 Seminar in Industrial Education (1-3) Current issues, innovations, problems associated with technical programs. Prereq: 12 hrs of graduate course. May be repeated. Maximum 6 hrs. F, Su

559 Evaluation of Technical Training Programs (3) Internal and external evaluation of training programs to maintain quality control and/or to justify revisions. Prereq: 455 and consent of instructor. F

571 Supervisory Skills for Improving Industrial Productivity (3) Philosophy of improving industrial productivity through quality and introduction to basic tools of statistical process control. Deming philosophy, control charting and capability, techniques for training hourly workers in quality control, and measurement procedures for quality control. Prereq: Statistics course and consent of instructor. F, Su

572 Advanced Training Methods for Industrial Productivity (3) Techniques of training hourly workers in use of statistical process control tools. Techniques for involving hourly workers and supervisors in quality assurance, inventory control, and productivity improvement groups. Prereq: 571. Sp, Su

600 Doctoral Research and Dissertation (3-15) P/NP only. E

601 Curriculum Planning in Technological and Adult Education (3) Curriculum theory, models, contents, planning evaluation and implementation of specialized program areas. Prereq: 555 or equivalent. Sp, Su

602 Planning and Evaluation of Programs in Technological and Adult Education (3) Techniques utilized in planning, developing, and evaluating instructional programs. Prereq: 500-level planning course and consent of instructor. Sp, Su

604 Seminar in Technological and Adult Education (1) Required 2 consecutive semesters during doctoral residency. May be repeated. Maximum 3 hrs. S/NC only. E

605 Administration and Supervision of Technological and Adult Education (3) Leadership, policy, organization, planning, personnel, student development services, and budgeting relative to vocational, technical and adult education at secondary, post-secondary, and higher education levels. Designing and implementing instruction, solving, and management activities. Prereq: Administrative theory course and consent of instructor. F, Su

610 Research Development in Technological and Adult Education (3) Proposal development, theoretical base, research design, sampling, application of statistics, and evaluation of research in technological and adult education. Prereq: Statistics courses and consent of instructor. Sp, Su
611 Internship in Technological and Adult Education (3) Field experience in relevant organizations. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

613 Special Topics in Technological and Adult Education (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

615 Advanced Microcomputer Software Applications (3) Advanced programming and applications of intelligent or program-generating software. Progression of commercial relational data-base management programming environments. Concepts and applications of communications and networking. Hands-on environment. Prereq: 516 or equivalent. Sp,Su


620 Seminar in Adult Education (3) Issues in adult education theories and concepts, philosophical positions, research trends and methodologies. Prereq: 510 or equivalent. F,S,Su

621 Advanced Seminar in Program Planning (3) Concepts, principles, and theories related to program planning in adult education. Prereq: 521 or equivalent. Sp

622 Advanced Seminar in Adult Development (3) Adult development research and designing research for studies of life cycle. Prereq: 522 or equivalent. Sp,Su

626 Adult Problem Solving and Learning (3) Contemporary research and theories in adult problem solving and learning. Prereq: 522 or equivalent. F,Su


631 Higher Education in Business and Marketing Education (3)

Textiles, Merchandising and Design (College of Human Ecology)

MAJORS DEGREES

Interior Design .................................................. M.S.
Textiles and Apparel ............................................. M.S.
Human Ecology .................................................. Ph.D.

Jacquelyn O. DeJonge, Head

Professors:

R. G. Blakemore, Ph.D. Florida State;
A. J. DeLong, Ph.D. Pennsylvania State;
J. O. DeLong, Ph.D. Iowa State;
M. F. Drake, Ph.D. Pennsylvania State;

Associate Professors:

R. R. Bresser, Ph.D. Florida State;

Assistant Professors:

F. Calogero, Ph.D. North Carolina State;
J. L. Crouse, Ph.D. North Carolina State;
S. J. Dillard, M.S. Florida State; J. B. Havaas, Ph.D. Ohio State; T. L. Houser, M.S. Tennessee.

Interior Design

The Department of Textiles, Merchandising and Design offers a Master's degree in Interior Design. To enter the program, students are expected to have a good foundation in this area. The program of study will prepare students for careers with interior design or architectural firms, public and private agencies, and educational institutions. Interested students should contact the department head for more information. Prospective graduate students pursuing a degree in advanced interior design should submit a portfolio of their undergraduate studio work to the department. This portfolio may include slides or original work.

ACADEMIC STANDARDS

1. Evaluation of student progress will normally occur prior to enrollment for the first hour and during the second semester of full time enrollment in interior design. The review of the student will be undertaken by the interior design faculty with consideration given to factors such as: GPA (minimum 3.0), portfolio evaluation, and demonstrated research capability.

2. If progress or performance is deemed insufficient, the faculty may recommend probation with specific goals set for a specified time or termination.

THE MASTER’S PROGRAM

Major (Required courses: 510, 552, 562, 564, 590) 18-21 hours
Cognate Area 9 hours
Research Methods 3 hours
Thesis 6 hours

TOTAL 36 hours

A comprehensive oral examination, administered by the thesis committee, will occur upon completion of thesis research. A non-thesis option is not available.

410 Environment as Code (3) Advanced theoretical issues in considering environment as medium of human communication. Prereq: 200, 400 or consent of instructor. Sp,A

475 History of American Interior Architecture (3) Major styles of interior architecture, decoration, and decorative arts within cultural context; colonial era through nineteenth century. European influences. Prereq: 370 or consent of instructor. Sp

479 Environmental Design (3) Advanced design methodologies related to interior architectural environments. Design requirements from anatomy, physiology, anthropology and social and behavioral sciences. Prereq: 6 hrs behavioral science and 6 hrs natural science, or consent of instructor. Sp

500 Thesis (1-15) P/NC only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Problem Solving in Interior Design (3) Use of systematic design methodology and design research methods as part of design problem-solving experience. Lecture and studio. May be repeated. Maximum 6 hrs. Prereq: Admission to graduate program. F

520 Integrative Interior Design Studio (3) Identification, integration and synthesis of multidisciplinary data input. Advanced programming techniques and design evaluation. Lecture and studio. Prereq: 510, 564, or consent of instructor. Sp

530 Practicum in Interior Design (1-12) Field experience in selected agencies or firms that focus on solutions to problems in interior design. Prereq: 9 hrs graduate level interior design or consent of instructor. E

531 Research Methods in Historical Preservation (3) Methodology for historic preservation problems in interior design. Prereq: Architecture 403 or consent of instructor. Sp

542 Special Topics: History of American Interior Design (3) Philosophical and stylistic movements, America of the seventeenth, eighteenth, or nineteenth centuries. Topics vary. Prereq: 475 or consent of instructor. May be repeated. Maximum 9 hrs. F

552 Seminar in Interior Design (3) Twentieth-century design concepts, personalities and creative components leading to visual innovation. Prereq: 479 or consent of instructor. F

562 Research Methods in Interior Design (3) Methodological approaches appropriate to interior design. Prereq: 9 hrs of graduate level interior design or consent of instructor. May be repeated. Maximum 9 hrs. E

564 Environmental Factors in Interior Design (3) Human factors and associated research techniques and design methodologies related to interior architectural environments. Design requirements from anatomy, physiology, anthropology and social and behavioral sciences. Prereq: 6 hrs behavioral science and 6 hrs natural science, or consent of instructor. Sp

574 Environmental Design Analysis (3) Integrative problem-solving/studio from multidisciplinary perspective. Systems approaches. Available to students from design disciplines and social and behavioral sciences. Prereq: 564 or consent of instructor. May be repeated. Maximum 6 hrs. F,A

580 Directed Study in Interior Design (1-3) Independent advanced research in selected areas from field of interior design. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E

581 Directed Study in Historic Preservation (1-3) Independent advanced research in historic preservation relevant for interior design. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E

582 Directed Study in Historic Design (1-3) Independent advanced research in area of historic stylistic movements in interior design. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E

583 Directed Study in Furniture Design (1-3) Independent advanced research in furniture design. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E

584 Directed Study in Environmental Design (1-3) Independent advanced research in environmental design. Prereq: 574 or consent of instructor. May be repeated. Maximum 9 hrs. E

590 Research Seminar (1-2) S/NC only. E

Textiles and Apparel

The Department of Textiles, Merchandising and Design offers the Master's degree. Students are expected to have a good foundation in one of these areas to enter the program. The program of study will prepare students for careers in industry, business, public and private agencies, and educational institutions. Interested students should contact the department head for more information.

ACADEMIC STANDARDS

1. Each graduate student will be evaluated at the end of the second semester (or after completing a minimum of 18 graduate hours).

2. If the student’s GPA is below 3.0, the faculty may recommend probation with
specific goals set for a specified time or termination.

THE MASTER'S PROGRAM
Major (Required courses: 540, 550/552*, 580, 590) 19 hours
Cognate Area 6 hours
Statistics 3 hours
Thesis 6 hours

TOTAL 34 hours

*Students with textile science background must take 550; students without must take 522.

A comprehensive oral examination, administered by the thesis committee, will be given upon completion of the thesis research.

A non-thesis option is not available.

THE PH.D. CONCENTRATION
Students enrolled in the Ph.D. program in Human Ecology with a concentration in textiles and apparel take one common course which provides a foundation for the integration of textiles and apparel in the context of the near environment. A required departmental research seminar exposes students to research being conducted in all areas of study in the department. Textiles and apparel concentration requirements include:

1. Nineteen hours in required textiles and apparel courses: 550, 552, 540, 590, 641, 685, and 695;
2. College Professional Seminar, Human Ecology 610;
3. Research Seminar, 590. Attendance at seminar is required for all full-time students;
4. Nine credit hours in research methods including 6 hours of 500-level statistics;
5. Nine hours in a cognate area;
6. Textiles and apparel courses in area of specialization (15-20 hours); and
7. Dissertation (24 hours).

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester for which the student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
510 International Retail Systems (3) Acquisition and management of information for retail decision; analytical decision making skills. International differences in system planning and design strategies in retail areas. Prereq: 410 or equivalent. Sp
520 Textile Microscopy and Physical Testing (3) Optical and electron microscopy techniques for textile fibers, yarns and fabrics. Methods and equipment used in physical testing following approved textile standards. Prereq: 320 or equivalent. Sp
522 Fiber Chemistry (4) Chemistry of textile fibers; structure, preparation and reactions; dyeing and finishing of fabrics. Introduction to color science. Prereq: Organic chemistry. 2 hrs and 4 labs. Sp
524 Advanced Textile Dyeing and Finishing (4) Chemistry, processing and fastness of chemical finishes and various classes of dyes on different fibers. Prereq: 522 or consent of instructor. 2 hrs and 4 labs. Sp
525 Physical Properties and Processing of Textiles (3) Methods and mechanics of processing staple and continuous filament yarns; mechanics of deformation of fibers, yarns and fabrics; physical behavior and textile structure. Prereq: Engineering Science and Mechanics 321, Mathematics 142, or equivalent. F,A
530 New Technology in the Textile/Apparel Industry (3) Innovations in equipment which affect textile and apparel industries; computer-aided design and computer applications; improvements which give U.S. textile industry competitive edge. Field trips. Prereq: Computer literacy. F
540 Socio-Psychological Aspects of Apparel (3) Apparel and human behavior in social situations. Prereq: 6 hrs or equivalent from sociology and psychology. F
546 Fashion Development in Historic Perspective (3) Style in relation to contemporary conditions (cultural determinants): commerce, economics and social phenomena. Sp
548 International Textiles (2) Development of traditional textiles, influence of culture, economics and commerce. Prereq: 3 hrs textiles. Sp,A
550 Consumer Economics and Market Choices (3) Economic framework for evaluating consumer behavior and consumer choice within market system. Theory of consumer preferences and decision making; consumer demand and market demands for individuals and households, international consumer economics, issues and policies. Prereq: 350 or consent of instructor. F
552 Textile Economics and Technology (3) New developments in processing textile fibers, yarns and fabrics into consumer products. Economic developments and analysis of textile complex; economic and functional performance and consumer issues; U.S. and international focus. F
560 Research Methods in Textiles, Apparel and Design (3) Fundamentals of scientific research methods; issues of applied research in textiles, apparel and interior design. Sp
590 Research Seminar (1) Research topics in textiles and apparel. S/NC only. F,Sp
593 Directed Study (1-3) Individual problems in textiles, merchandising or apparel. Prereq: 9 hrs textiles/apparel graduate coursework. May be repeated. Maximum 9 hrs.
595 Advanced Topics in Textiles and Apparel (1-3) Lecture, group discussion on specialized topics: apparel production management, functional design, handicapped/elderly, historic costume, historic textiles, international fairs and non-wovens, thermal properties. Prereq: 9 hrs textiles/apparel graduate coursework. May be repeated. Maximum 9 hrs. Sp
600 Dissertation (3-15) P/NP only. E
625 Physical Chemistry of Fibers (3) Physical chemistry of fibers and fiber forming polymers; surface chemistry and thermal properties. Prereq: 522, Mathematics 231, or equivalent. Sp,A
626 Physics of Fiber Structures (3) Morphology of polymeric structures; thermal and processing history on mechanical, electrical and chemical properties of fibers. Prereq: 522, Physics 231 and Mathematics 231 or equivalent. F,A
641 Social and Psychological Theories of Apparel Consumption (3) Theories and concepts from social science, fashion, consumer behavior in relation to apparel. Prereq: 540 and 6 hrs of sociology and/or psychology, or consent of instructor. Sp,A
651 The Consumer and Public Policy (3) Economic, social, legal and political framework for policy decisions; economic evaluation of policies that affect consumer behavior. Economic implications for societal groups, disadvantaged. Prereq: 550 or 562, or consent of instructor. Sp
685 Integrative Design: Development and Marketing (3) Systems-oriented approach to strategies involved in product development; methods for identifying critical factors central to decision making and techniques for synthesizing information. Prereq: 24 hrs graduate coursework. F
695 Advanced Topics in Textiles and Apparel (3) Lecture, group discussion, individual research on advanced topics and research areas of current significance to future direction, professional issues, theoretical approaches. Prereq: 9 hrs textiles/apparel graduate coursework. May be repeated. Maximum 9 hrs.

DEGREE
MAJOR
Theatre

DEGREE
M.A.

THE DEPARTMENT OF THEATRE OFFERS THE MASTER OF FINE ARTS IN THEATRE WITH AREA CONCENTRATIONS IN ACTING/DIRECTING, PLAYWRITING/DRAMATURGY, AND DESIGN/TECHNICAL PRODUCTION. APPLICANTS MUST HAVE COMPLETED UNDERGRADUATE DEGREES APPROXIMATELY EQUIVALENT IN REQUIREMENTS TO THOSE SPECIFIED FOR DEGREES CONFERRED BY THE UNIVERSITY OF TENNESSEE, KNOXVILLE.

THE GRADUATE RECORD EXAMINATION IS REQUIRED OF ALL APPLICANTS AS WELL AS A WRITTEN COMPREHENSIVE EXAM, USUALLY ADMINISTERED IN THE SECOND YEAR OF RESIDENCE. ALL MFA APPLICANTS MUST SUBMIT THREE LETTERS OF RECOMMENDATION. INTERVIEWS WITH APPROPRIATE FACULTY ARE REQUIRED OF ALL APPLICANTS. APPLICANTS FOR ADMISSION TO MFA DESIGN/TECHNICAL THEATRE AND PLAYWRITING/DRAMATURGY PROGRAMS MUST SUBMIT SAMPLES OF THEIR WORK.

FOR DETAILED INFORMATION ABOUT THE GRADUATE PROGRAM, CONTACT THE DIRECTOR OF GRADUATE STUDIES, DEPARTMENT OF THEATRE.

MOTHER OF FINE ARTS PROGRAM
At least 60 semester hours, 40 of which must be at the 500 level or above, are required for the degree of Master of Fine Arts with a major in Theatre, which is normally to be completed in three consecutive years of full-time residence. Theatre 501 is required the first semester of residence. Also required are Theatre 401, 310-11, and at least 3 hours in advanced theatre history and dramatic theory/criticism, including at least one course from each of the two areas.

In addition to the core requirements listed above, each area of concentration has specific requirements:

Design/Technical Production

Required courses are at least 12 hours of 580 Design and Technical Production Seminar, and at least 3 hours in the projects courses. Theatre 401 Principles of Design is
required the first year of residence. Theatre 430 Play Directing is required of scene design students lacking an appropriate undergraduate foundation in directing.

Acting

Theatre 520-21-22-23-24-25 Master Class and required, along with one course in directing and two hours each in voice and dance.

Directing

Required are 430 Directing, 520-21-22-23-24-25 MMaster Class, and 3 hours of 536 Projects.

Playwriting

Required are 470-71 Playwriting, at least 12 hours of 573 Playwriting Seminar, and at least 3 hours of 585 Production Workshops.

Dramaturgy

An additional two courses in dramatic theory and criticism are required as are Theatre 570 Dramaturg, applied up to 12 credit hours at 585 Production Workshops, 430 Play Directing, 3 hours of 536 Projects in Directing, and 12 hours of 573 Seminar and Projects. In addition, students must select an arts and humanities specialization comprising at least one year of language study plus 6 hours in the selected area.

Students in the MFA program are evaluated annually by juried performance or portfolio submission. Continuance in the program is with the approval of the faculty committee for the MFA program. Satisfactory completion of the comprehensive examination is prerequisite to entry into the third year. Thesis and oral defense (Theatre 500, 6 hours minimum) must be completed satisfactorily before the degree is conferred.

REQUIREMENTS FOR SECOND MASTER’S DEGREE

Students admitted to the MFA program who have already earned a Master’s or a doctoral degree, may apply up to 12 credit hours from the previous graduate program to the MFA degree with approval of the student’s committee, the Dean of the College of Liberal Arts, and the Dean of The Graduate School.

Any such credits applied from a previous graduate program would be from courses that are directly relevant to the student’s MFA curriculum and must have been earned within the time limit (6 years) established for completion of the MFA degree.

401 Principles of Theatrical Design (3) Fundamental principles of design; visual and structural relationships. Projects assigned to develop understanding and perception.

409 Stage Make-up (2) Problems in make-up design and application; character analysis, physiognomy and chiroscuro. Prereq: 100

410 Dramatic Theory and Criticism (3) Theatre aesthetics from Aristotle to present.

420 Special Studies in Acting (3) Content varies: Exercise in selected concentrated areas; styles, techniques, approaches: Shakespeare, movement, humor. Prereq: 320.

426 Advanced Phonetics (3) Phonetic aspects of contemporary dialects of English language. Prereq: Consent of instructor.

430 Principles of Play Directing (4) Problems in composition, picturization, rhythm, movement. Prereq: 220, 221, and consent of instructor.


445 Advanced Costume Construction (3) Advanced studies in construction technique, tailoring, vacuum forming, plastics in design, and cobbling. Prereq: 345 or consent of instructor.

446 Costume Patternmaking (3) Draping patterns for period costumes. Consistency and study of historic patterns 1500-1900. Prereq: 345 or consent of instructor.

450 Advanced Scenery Technology I (3) Study and practice of theatre woodworking; production participation required. Prereq: 250. Graduate credit to theatre M.F.A. students only.

451 Advanced Scenery Technology II (3) Study and practice of metalworking and plastics for theatrical productions; production participation required. Prereq: 250. Graduate credit to theatre M.F.A. students only.

452 Advanced Scenery Technology III (3) Study and practice of stage rigging for theatrical productions; production participation required. Prereq: 250. Graduate credit to theatre M.F.A. students only.

454 Scenery Painting (2) Introduction to materials, techniques, principles of craft. Gaining and understanding through studio experience. Prereq: Consent of instructor.


461 Special Effects in Lighting and Sound (4) Projects in special effects, creative application of technology. Problem solving, drafting, and execution of effects for production. Production participation required. Prereq: 260 or consent of instructor.

462 Advanced Lighting Design (3) Advanced problems in lighting design and theory. Musical theatre, opera, and dance. Prereq: 362 or consent of instructor.

463 Sound Design (3) Sound design for performing arts. Review of equipment and acoustical factors that affect sound production. Sound design plotted from selected plays. Final projects mixed, edited, and cued for production.

465 Introduction to Lighting Design for Non-Designers (3) Theory and practice of stage lighting design, relationship between designers and non-design practitioners: directors, actors, choreographers, architects. Not open for specialization in lighting design.

500 Thesis (1-15) P/NP only. E

501 Introduction to Graduate Research in Theatre (3) Research tools and methods for theatre artist and scholar.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is complete. May be used toward degree requirements. May be repeated. S/NC only. E

510 Studies in Theatre History (3) Intensive study of selected topics in theatre history. May be repeated. Maximum 9 hrs.

580-21-22-23-24-25 Master Classes in Acting (4, 4, 4, 4, 4) Master classes in acting techniques, voice, and movement. Theatre MFA students only.

536 Projects in Play Directing (3) Practical work in play direction involving various lengths and kinds of scripts. May be repeated. Maximum 9 hrs.

539 Play Production in the Secondary Schools (3) Principles and methods for directing high school dramatic programs.

542 The Social History of Costume (3) Study and analysis of costume as related to society's manners and mores, architecture and furniture.


545 Millinery for the Stage (2) Pattern making and construction techniques for hats from antiquity to present. Prereq: Consent of instructor.

546 Advanced Costume Patternmaking (3) Advanced studies in patterning period costume. Development of historic patterns through flat pattern method. Prereq: 446.

549 Projects in Costume Technology (1-3) Individualized studies in costume technology in theatre production. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.


553 Projects in Scenic Design (1-3) Conception and completion of major scenic designs for actual, in scene design. May be repeated. Maximum 9 hrs.

554 Studies in Scenic Design (3) Advanced scene design techniques and approaches to design for complex dramas and varied dramatic forms. May be repeated. Maximum 6 hrs.

560 Projects in Lighting Design (1-3) Conception and completion of major projects, both hypothetical and actual, in lighting design. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

562 Special Problems in Lighting Design (3) Advanced problems in lighting design and theory, problems in Broadway production and touring. Prereq: 462 or consent of instructor.

563 Projects in Sound Design (1-6) Production assignment as sound designer on approved play and/or relevant projects in field of sound design/history/methodology. Prereq: Consent of advisor. May be repeated. Maximum 9 hrs.

570 Dramaturgy: Theory and Practice (3) Methods and materials. Prereq: Consent of instructor.

571 Seminar & Projects in Dramaturgy (3) Directed study and experience. Prereq: Consent of instructor. May be repeated. Maximum 18 hrs.

572 Seminar in Playwriting (3) Exercises and projects tailored for advanced students in playwriting. Prereq: Consent of instructor. May be repeated. Maximum 18 hrs.

575-76 Studies in Dramatic Theory and Criticism (3, 3) Broad-based study of major ideas about drama.

580 Design and Technical Production Seminar (1-6) Selected aspects of scenic design and technical production. Prereq: Consent of instructor. May be repeated. Maximum 18 hrs.

585 Production Workshops (1-6) Directed experience in production collaborations. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.


599 Project and Thesis (1-6) Available to theatre MFA students only. Prereq: Minimum of 30 hrs toward MFA degree and consent of advisor. May be repeated. Maximum 18 hrs.
Transportation
See Marketing, Logistics and Transportation

Urban Practice
(College of Veterinary Medicine)

MAJOR
Veterinary Medicine

DEGREE
D.V.M.

J. D. Krahwinkel, Head

Professors:
J. Braae, D.V.M. California (Davis);
R. M. Bright, D.V.M. Ohio State; A. S. Dorn,
D.V.M. Illinois; D. J. Krahwinkel, D.V.M.
Auburn; A. M. Legendro, D.V.M. Auburn.

Associate Professors:
R. E. Gompf, D.V.M. Ohio State;
R. R. Paddleford, D.V.M. Missouri;
R. R. Salter, D.V.M. Texas A & M;
M. A. Walker, D.V.M. Texas A & M;
T. L. Walker, D.V.M. Texas A & M;
J. P. Wiegel, D.V.M. Colorado State.

Assistant Professors:
J. M. Bright, D.V.M. Purdue; D. E. Brooks,
D.V.M. Illinois, Ph.D. Florida;
R. C. Denovo, Jr., D.V.M. Illinois;
R. C. Harvey, D.V.M. Tennessee; L. J. Laratta,
D.V.M. Michigan State; L. P. Schmeitzel,
D.V.M. Auburn.

Residents:
L. Blackford, D.V.M. Texas A & M;
D. L. Golden, D.V.M. Florida; C. C. Jenkins,
D.V.M. Tuskegee; K. L. Mitchener, D.V.M.
Tennessee; A. D. Pardo, D.V.M. California
(Davis); J. E. Sackman, D.V.M. Michigan
State; M. E. Stanton, D.V.M. Minnesota;
L. Wantschek, D.V.M. Texas A & M.

See Veterinary Medicine for program description.

PROFESSIONAL COURSES

881 Clinical Rotations in Urban Practice I (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, patient care, and treatment of clinical patients.

882 Clinical Rotations in Urban Practice II (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, patient care, and treatment of clinical patients.

883 Clinical Rotations in Urban Practice III (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, patient care, and treatment of clinical patients.

884 Clinical Rotations in Urban Practice IV (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, patient care, and treatment of clinical patients.

885 Clinical Rotation in Radiology I (2) Clinical training in radiographic techniques and interpretation of radiographs as part of diagnostic process.

887 Special Problems in Urban Practice (1-8) Extra- mural and specially designed study for students interested in select topics in medicine, surgery, anesthesiology, radiology and medical specialties of small companion animals.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E

501 Special Topics in Small Animal Medicine and Surgery (1-4) May be repeated. Maximum 6 hrs. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

600 Doctoral Research and Dissertation (3-15) P/NP only. E

VETERINARY MEDICINE

(College of Veterinary Medicine)

MAJOR
Veterinary Medicine

DEGREE
D.V.M.

PROFESSIONAL CURRICULUM

The curriculum of the College of Veterinary Medicine is a nine-semester, four-year program. Each class begins in August and graduates four years later in May. The first three years follow the traditional fall and spring semesters with the summer break following each year. The final year of the professional curriculum begins immediately following semester six and is a continuous clinical training schedule extending over one calendar year.

The first year consists mostly of pre-clinical subjects such as anatomy, physiology, histology, and microbiology. Included in this first year also are subjects such as physical diagnosis and anesthesiology. Considerable integration of subject matter is incorporated during this time.

The second and third years include the study of diseases, their causes, diagnoses, treatment and prevention and are taught on a body system-oriented basis. The final year (three semesters) is devoted to intensive training in the solving of animal disease problems, including extensive clinical experience in the Teaching Hospital.

The final year consists of a series of clinical blocks through which each student will rotate.

An innovative feature of this curriculum is the designation of semester six as one in which the individual student may select his or her courses of study. This format allows select students with an interest in advanced or dual-degree programs to enroll in all, some, or none of the regularly scheduled courses during that semester. Students will be required to complete at least 16 credit hours and these hours will be credited toward the D.V.M. The semester of elective study offers a unique educational alternative for select students in the CVM which is intended to enhance professional growth, specialization and additional career choices.

In addition to education in the science and art of veterinary medicine, students receive instruction in paramedical subjects such as animal behavior, medical communications, professional ethics, jurisprudence, economics, and practice management.

The curriculum requires successful completion of 154 semester credits.

GRADUATE PROGRAM

The College also administers a graduate program involving all departments and leading to the Master of Science and the Doctor of Philosophy. Because of the inter-disciplinary departmental administration of the College of Veterinary Medicine, the faculty have opportunities in the graduate programs of other instructional units, including Animal Science and Experimental Medicine, Microbiology (bacteriology, virology and immunology), Ecology (environmental toxicology), Public Health, and Comparative and Experimental Medicine (see page 64). This program provides a wide spectrum of interdisciplinary training that prepares graduates to assume positions in biomedical environments and in teaching or research capacities involving humans or animals.

PROFESSIONAL COURSES

830 Art of Veterinary Medicine (1) Paramedical subjects important to veterinary practice: practice management, interpersonal relations, communications, jurisprudence, ethics, careers, animal behavior and veterinary history. May be repeated. S/NC only.

831 Physical Diagnosis (1) Basic care, feeding, restraint, and handling domestic animals. Introduction to physical examination and diagnostic techniques used by veterinarian.

832 Anesthesiology (2) Principles of anesthesiology: pharmacology of anesthetic agents, and introduction to anesthetic techniques in veterinary medicine.

833 Epidemiology/Public Health (4) Principles of epidemiology and public health: Host-agent relationships, public health aspects of veterinary medicine, and role of veterinarian in ecology and food hygiene.

834 Hematopoietic System (3) Pathophysiology, special pathology, and clinical management of diseases of the hematopoietic and lymphoid organs and tissues. Principles, methods of laboratory evaluation of diseases from other organ systems.

835 Medical Interaction (2) Multidisciplinary labora-
tory sections of gross, histologic, physiologic, pharmacologic and surgical concepts. Applied techniques in animal handling to facilitate anesthesia, surgery, post-surgical recovery and wound healing. Demonstration of physiologic processes and drug effects.

836 Toxicology (2) Principles of toxicology: molecular mechanisms, pathologic processes and clinical features of animal diseases caused by common toxic agents.

840 Integumentary System (3) Pathophysiology, special pathology, medicine and surgery of diseases of integumentary system of all species of animals. Laboratory examination, pathology, diagnosis and treatment.

841 Reproductive System (4) Pathophysiology, special pathology, medicine and surgery of diseases of male and female reproductive systems and mamma-
ry gland of all species of animals.

842 Alimentary System (5) Pathophysiology, special pathology, medicine and surgery of diseases of alimentary system of all species of animals.

843 Musculoskeletal Systems I (3) Pathophysiology, special pathology, medicine and surgery of diseases of muscular and skeletal systems of all species of animals. Basic principles, pathologic changes and radiographic interpretation.

844 Musculoskeletal Systems II (3) Pathophysiology, special pathology, medicine and surgery of diseases of muscular and skeletal systems of all species of animals. Advanced principles of radiographic interpretation and surgical procedures.
845 Principles of Medical Science (2) Physiologic and pathologic principles underlying mechanisms of disease. Selected examples of human and animal diseases; recent scientific advances in biomedical sciences. Prereq: Consent of instructor. F

846 Multispecies Medicine (4) Anatomy, pathophysiology, medicine, and surgery of avian species, laboratory and zoo animals and reptiles. Species and diseases seen by practicing veterinarian. Current topics on foreign animal diseases.

847 Current Topics in Veterinary Medicine (1-3) Elective subjects in veterinary medicine: basic sciences, clinical specialties and issues related to veterinary practice.

848 Art of Veterinary Medicine II (1) Paramedical subjects important to veterinary practice: practice management, interpersonal relations, communications, jurisprudence, ethics, careers, animal behavior and veterinary history. May be repeated. S/NC only.

849 General Elective in Clinics (2) Special rotation with clinical training in urban practice, rural practice, environmental practice and pathobiology.

850 Introduction to Clinics (1) Clinical veterinary practice with discussions and practical experience. Problem-solving and integration of basic sciences with clinical applications. Problem-oriented veterinary medical record.

851 Urinary System (3) Pathophysiology, special pathology, medicine and surgery of diseases of urinary system of all species of animals. Urinary renal system in health and disease.

852 Cardiovascular System (3) Pathophysiology, special pathology, medicine and surgery of diseases of cardiovascular systems of all species of animals. Anatomic, physiologic and pharmacologic principles which provide basis for treatment.

853 Endocrine System (2) Pathophysiology, medicine and surgery of diseases of endocrine system of all species of animals. Mechanisms of endocrine and metabolic diseases: therapy and prevention.

854 Respiratory System (3) Pathophysiology, special pathology, medicine and surgery of diseases of respiratory system of all species of animals. Upper and lower respiratory system: infections and noninfectious diseases.

855 Radiology (3) Basic, advanced and special techniques in radiology with interpretation and use of radiologic and related techniques in diagnosis and treatment of diseases of all species.

856 Special Senses (2) Pathophysiology, special pathology, medicine and surgery of diseases of visual and auditory systems of all species of animals.

857 Nervous System (3) Pathophysiology, special pathology, medicine and surgery of diseases of nervous systems of all species of animals: clinical neurology and neuropathology.

858 Clinical Rotation in Specialties (2) Clinical training in specialty services: anesthesiology, ophthalmology or radiology. Direct responsibility for diagnosis, patient care, and treatment of clinical cases in both urban and rural practice.

859 Clinical Clerkship (2) Advanced clinical training in urban practice, rural practice, environmental practice, and pathobiology.

GRADUATE COURSES


536 Toxicology (2) Principles of toxicology: molecular mechanisms, pathologic processes and clinical features of animal diseases caused by common toxic agents. Prereq: Consent of instructor. F

537 Multispecies Medicine (4) Anatomy, pathophysiology, medicine and surgery of birds, reptiles and laboratory and zoo mammals. Common species and diseases. Prereq: Consent of instructor. Sp

545 Principles of Medical Science (2) Physiologic and pathologic principles underlying mechanisms of disease. Selected examples of human and animal diseases; recent scientific advances in biomedical sciences. Prereq: Consent of instructor. Sp

Zoology

(155)

MAJOR

Zoology

DEGREES

M.S., Ph.D.

Arthur C. Echternacht, Head

Professors:

R. M. Bagby, Ph.D. Illinois; D. L. Bunting, Ph.D. Oklahoma State; J. G. Carson (Alumni Distinguished Service Professor) (Emeritus), Ph.D. Pennsylvania; A. C. Echternacht, Ph.D. Kansas; D. A. Ettier, Ph.D. Minnesota; B. Hochman, Ph.D. California (Berkeley); E. T. Howley, Ph.D. Wisconsin; K. W. Jeon, Ph.D. London (England); J. R. Kennedy, Ph.D. Iowa; J. L. Liles, Ph.D. North Carolina State; J. A. McOsborne, Ph.D. California (Davis); S. E. Riechert, Ph.D. Wisconsin; L. E. Roth, Ph.D. Chicago; C. A. Shivers, Ph.D. Michigan State; J. T. Tanner (Emeritus), Ph.D. Cornell; H. G. Welch, Ph.D. Florida; G. L. Whitson, Ph.D. Iowa.

Associate Professors:


Research Associate Professor:

T. Ashley, Ph.D. Florida State.

Assistant Professors:

J. A. Drake, Ph.D. Purdue; R. Granguly, Ph.D. Nebraska; L. C. Rome, Ph.D. Harvard.

Research Assistant Professor:


The Department of Zoology offers the Master of Science and Doctor of Philosophy with concentrations in aquatic biology, ecology, cell and molecular biology, physiology, genetics, and reproductive and developmental biology.

REQUESTS 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. one year of general zoology or biology;
2. 18 semester hours of upper division zoology or biology;
3. two years of chemistry including one year of general inorganic chemistry;
4. one year of mathematics including calculus;
5. one year of physics;
6. Graduate Record Examination scores (general and biology); and
7. a grade point average of 3.0 out of 4.0. Otherwise superior students, deficient in one or more of the above requirements, may be admitted at the discretion of the department's Graduate Affairs Committee.

PREPARATION FOR THESIS OR DISSERTATION

During the first year the qualifying examination and a special research problem in each of two faculty members' laboratories will determine the student's preparation for thesis or dissertation study. A course in biostatistics is required of all candidates for an advanced degree in Zoology.

All aspirants for advanced degrees in Zoology must exhibit competency in 3 (for M.S.) or 4 (for Ph.D.) areas of zoology as determined by a qualifying examination. Students must take this examination during the spring semester of the first year and may repeat the examination the following spring semester if unsatisfactory scores are received. Competency must be exhibited within this two-year period for a student to continue in the program.

THE MASTER'S PROGRAM

Special requirements in Zoology are as follows: (1) completion of course requirements as determined by the candidate's faculty committee; (2) achievement of a 3.0 or better GPA in all courses taken for graduate credit; (3) completion of a thesis.

THE DOCTORAL PROGRAM

Special requirements in Zoology are as follows:

1. courses as determined by the candidate's faculty committee;
2. an oral and comprehensive written examination in zoology and allied fields in which the candidate has had training;
3. 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 a grade of at least a B in the second semester of a special language reading course for graduate students. This foreign language requirement must be fulfilled before a student can take the comprehensive examination.

403 General Genetics Laboratory (2) Experiments designed to illustrate basic principles of inheritance, primary organisms—Drosophila. Prereq: Biology 220. 2 labs.

404 Cytological Technique (2) Practical experience with variety of techniques: microscopy, embedding and sectioning, chromosome preparations, autoradiography, in situ hybridization, histochemistry, and immunofluorescence. Prereq: Biology 216. 2 labs.

405-06 Minicourse in Zoology (1,1) Select advanced topics in zoology, which may be repeated. Consult departmental listing for topics offered. Prereq: As announced. May be repeated. Maximum 3 hrs. May apply toward major.

410 Advanced Cell Biology (3) Molecular and supramolecular structure and functions of eukaryotic cells: regulatory mechanisms, physiology, behavior and cellular interactions. Prereq: Biology 210, 220. 2 hrs and 1 lab.
415 Parasitology (3) Parasitic relationships: physiological, ecological, evolutionary and economic aspects. Prereq: Biology 230 or consent of instructor. 2 hrs and 1 lab.

420 Cell and Tissue Structure and Function (4) Study of animal cells and tissues at light and electron microscope levels. Prereq: Biology 210. 2 hrs and 2 labs.

430 Immunology (2) (Same as Microbiology 430.)

439 Immunology Laboratory (1) (Same as Microbiology 439.)


449 Laboratory in Physiology (2) Prereq or coreq: Biology 210, 230, 2 yrs of chemistry. Recommended prereq: Biology 210.


455 Comparative Animal Behavior Laboratory (3) Introduction to observational and experimental research in ethology. Coreq: Coreq. (Same as Psychology 450.)

460 Evolution (3) Modern concepts of animal evolution. Prereq: Biology 220.

465 Human Genetics (3) Genetic and molecular principles and problems of human inheritance. Prereq: Biology 220.

470 Aquatic Ecology (3) Introduction to physiological and structural adaptations of aquatic life forms to their environments. Prereq: Chemistry 120-30 and Biology 230. 2 hrs and 1 lab.

472 Arachnology (3) Biology of spiders, mites, scorpions and relatives. Prereq: 360 or 380. 2 hrs and 1 lab.

473 Herpetology (3) Biology of amphibians and reptiles, ecology and adaptive radiation. Prereq: Biology 230. 2 hrs and 1 lab.

474 Ichthyology (3) Evolution, classification, collection and identification, distribution and biology of fishes, freshwater fauna of Eastern North American. Prereq: Biology 230 or consent of instructor. 2 hrs and 1 lab.

475 Ornithology (3) Behavior, ecology, populations, evolution and field identification of birds. Prereq: Biology 230. 2 hrs and 1 lab.

476 Mammalogy (3) Evolution, classification, biogeography, ecology, behavior and functional anatomy of mammals. Prereq: Biology 230 or equivalent. 2 hrs and 1 lab.

480 Physiology of Exercise (3) Functions of body in muscular work: physiological aspects of fatigue, training and adaptation to environment. Prereq: 230 or 440. 2 hrs and 1 lab.

490 Comparative Endocrinology (3) Comparative analysis of physiology and morphology of endocrine glands in vertebrates and invertebrates, their role and interaction in maintenance of organism and species. Prereq: 440 or equivalent.

500 Thesis (1-15) P/NP only. E
FACILITIES FOR RESEARCH AND SERVICE
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RESEARCH AND SERVICE
Facilities for Research and Service

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 212 CEB. The research activities relate to the development of research proposals, conducting and/or assisting in research, and assisting others in development of research proposals in the College of Education. Developmental activities relate to change efforts in curricular content and instrumental methodology. Educational services include a wide list of activities such as in-service educational programs, consultant services, and technical assistance 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.

Center for Business and Economic Research

David A. Hake, Director

The staff of the Center for Business and Economic Research engages in studies of the business and economic environment in Tennessee, the southeast, and the nation. The Center serves the business community, state government, individuals, and The University through dissemination of various kinds of economic and socioeconomic information; supports the faculty of the College in seeking funding for research projects; and, through its Computer Resources Group, provides support for integration of technology in the College of Business Administration. Staff members conduct research in regional economics, public finance, and areas related to socioeconomic problems in the region. The Center publishes the results of research 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 the Tennessee Statistical Abstract and the Survey of Business. The Center is a member of the Association for University Business and Economic Research.

Center for Computer Integrated Engineering and Manufacturing

The Center for Computer Integrated Engineering and Manufacturing (CCIEM) was established in 1985 and is an interdisciplinary organization within the College of Engineering. The Center provides education, research, and service to American industry in the integration of engineering design, manufacturing, and management. CCIEM state-of-the-art computer hardware and software enables faculty and staff to undertake a design and manufacturing agenda crucial to industry. The goals of the Center are to: (1) utilize state-of-the-art CAD/CAM and CIM technologies in engineering research, education, and practice; (2) perform research in communication technologies between heterogeneous computers and control devices; (3) develop computer-based education course-ware; and (4) work with industry in the automation of manufacturing processes and office functions. CCIEM is supported by U.S. corporations through an industrial participation agreement with The University of Tennessee. CCIEM, in turn, supports industry, as well as the academic needs of the College of Engineering faculty, through research and access to necessary computer hardware and software.

Center for International Education

David Larsen, Director

The Center for International Education (CIE), 201 Alumni Hall, telephone 974-3177, promotes and supports all aspects of international education and international exchange at UTK, both for American students and faculty and for students and faculty from other countries. The administration of official linkage agreements between UTK and institutions of higher education in other countries is coordinated by CIE.

American students: CIE provides information and advice about study-abroad options open to UTK students, including the exchange programs it administers between UTK and universities in thirty countries on six continents. CIE coordinates campus administration of such international grants and scholarships as the Fulbright, Rhodes, and Marshall programs, and provides information about other sources of funding for overseas study and research, including the Rotary Foundation, St. Andrews, and German Academic Exchange Service (DAAD) grants. Within its library on study, work and travel abroad, CIE has information about student summer job programs in six countries.

International students and scholars: CIE provides information and assistance in matters relating to United States visa regulations, to UTK requirements for international students, and to UTK academic policies and registration procedures. It publishes The Link, a monthly newsletter for UTK's international community, and administers the insurance policy required of all international students at the University. International student advisors are available to discuss academic and personal concerns. Orientation programs conducted at the beginning of each term facilitate adjustment to the campus and community, as does the international student orientation camp prior to the fall term.

The International House, 1515 Cumberland Avenue, is CIE's on-campus social, recreational, and programming center that serves as a meeting place for international and U.S. students, faculty and staff.
International students seeking admission to UTK should write directly to the Office of Graduate Admissions and Records.

Center for Measurement and Control Engineering
E. C. (Bud) Muly, Director
The Measurement and Control Engineering Center is a University/Industry Cooperative Research Center sponsored by the College of Engineering of The University of Tennessee, the Instrumentation and the Control Division of Oak Ridge National Laboratory, and the National Science Foundation. The Center’s program combines education, research, and technology transfer. Interested graduate students apply for affiliation with the Center and are required to take graduate-level courses in measurement science and control theory. Graduate assistantships are provided for qualified students by the Center. The research is funded by major U.S. industrial companies and focuses on theoretical and practical developments in measurement science and control theory. Graduate assistantships are provided for qualified students by the Center.

Centers of Excellence
The Centers of Excellence grew out of Tennessee’s Better Schools Program, an initiative to upgrade state-aided education at all levels. State officials and legislators wanted to give a few outstanding academic programs in state-aided colleges and universities a special push toward prominence, well beyond regular annual increases for all programs. In 1984, the General Assembly appropriated and the governor approved $10 million for the first Centers of Excellence throughout the state. The public colleges and universities submitted their proposals for Centers of Excellence to the Tennessee Higher Education Commission, which made the final determinations. Funding has been extended each successive year, and now seven of the University’s twelve Centers of Excellence are sponsored by UT, Knoxville.

Concurrently, the University has received state funding, which it must match dollar for dollar, for Centers of Excellence. These Chairs are $1 million endowed professorships in areas of significance to the University and to the individual, foundation, or corporation providing the matching gift money.

The combination of the Centers of Excellence and Chairs of Excellence adds a dimension to The University of Tennessee that is not easily equaled by other institutions. UT’s reputation as the premiere university in the state and as a regional and national leader in instruction, research, and public service is enhanced as a result of the infusion of these special funds.

For information concerning the individual centers sponsored by UTK, contact:

Center for Laser Applications
Dr. Dennis Keefer, Director
UT Space Institute
Tullahoma, Tn 37388

(615) 455-0631 Ext. 475

Center for Livestock Diseases and Human Health
Dr. Hyram Kitchen, Director
108 Morgan Hall
UT Knoxville
Knoxville, TN 37996
(615) 974-7262

Center for Materials Processing
Dr. Joseph Spruill, Director
435 Dougherty Engineering Building
UT Knoxville
Knoxville, TN 37996
(615) 974-5336

Center for Theatre Excellence
Dr. Robert Mashburn
206 McClung Tower
UT Knoxville
Knoxville, TN 37996
(615) 974-6011

Center of Excellence in New Venture Analysis and Entrepreneurship
Dr. Roger Jenkins
327 Stokely Management Center
UT Knoxville
Knoxville, TN 37996
(615) 974-5033

Science Alliance
Dr. Lee Riedinger
611 Physics Building
UT Knoxville
Knoxville, TN 37996
(615) 974-7805, 974-6765

Waste Management Research and Education Institute
Dr. William Colglazier
327 South Stadium Hall
UT Knoxville
Knoxville, TN 37996
(615) 974-4251

Communications Research Center
The Communications Research Center is an adjunct to the communications graduate program. Objectives of the Center are: (1) to conduct original research in mass and public communication; (2) to disseminate research-generated information; and (3) to provide research services to faculty and students, professional communicators, and others interested in improving the quality of human communications.

Computing Center
Gordon Sherman, Director
The University of Tennessee Computing Center (UTCC) provides computing facilities and services for the University’s teaching, research, public service, and administrative activities.

UTCC maintains 20 user work areas on the Knoxville campus, including locations in five residence halls, for interactive computing and submission to batch processing. Seven of the areas provide high speed printing. Computing services to the other UT campuses are supplied through remote job entry facilities.

UTCC operates several mainframe computers on the Knoxville campus: an IBM 3081-D with 32 million bytes (MB) of main memory, an IBM 4381/3 with 16 MB of main memory, and a VAXcluster comprised of two DEC VAX-11/785 and two VAX 8650 central processors. One VAX 785 has 10 MB of memory; the other has 12 MB of memory. Each VAX 8650 has 32 MB of memory.

Batch computing is available on the IBM 3081-D under the MV/S operating system with JES2. Timesharing services are offered on all the UTCC mainframe computers: the Conversational Monitor System (CMS) runs under the VM/S operating system on the IBM 4381/3; the VAXcluster operates under the VMS operating system; and Coursewriter III, an online Computer Assisted Instruction system, and Time Sharing Option (TSO) are available on the IBM 3081-D.

Software available on the mainframe computers includes most of the commonly used compilers and interpreters, as well as a large number of programs for statistical, mathematical, engineering, operations research, and graphics applications. UTCC also provides users access to some public domain software for microcomputers and is the administrator for a number of site licenses for microcomputer software. Included is communications software for connecting several types of microcomputers to the mainframes for terminal emulation and file transfer.

UTCC timesharing can be accessed through a terminal of microcomputer attached to one of more than 800 directly connected lines or 60 dialup lines. Two classes of interactive terminals are supported—ASCII start/stop and IBM 3270. All ASCII terminals access timesharing through the Digital Communications Associates (DCA) terminal port selection and multiplexing links system. In addition, DECnet links the VAXcluster at UTCC with VAX computers located in the Computer Science Department and the College of Engineering on the Knoxville campus, at the UT Space Institute in Tullahoma, and at the University of Tennessee, Memphis.

Through the UTCC computers, The University of Tennessee has access to several computer networks. BITNET is a network of more than 1,700 computers located at educational and research institutions throughout the United States, Canada, Europe, and Asia. It allows the rapid exchange of messages and files associated with university work.

The Southeastern University Research Association Network (SURAnet) connects to the National Science Foundation Network (NSFnet) which directly connects the five NSF supercomputing centers: Cornell University, the University of Illinois, the Pittsburgh Supercomputing Center, the San Diego Supercomputer Center, and the John von Neumann Center. UTCC is an affiliate of the Pittsburgh Supercomputing Center and the Cornell National Supercomputer Facility and provides consulting services on those systems to UT researchers whose work is supported by the National Science Foundation. The National Supercomputer Facility has an IBM 3090-400 with four vector facilities and seven attached array processors from Floating Point Systems. The Pittsburgh Supercomputing Center has a

four-processor Cray X-MP/48 with scalar and vector processor capability and two and a half GB of virtual VAX computer memory. A graphics center, located in Ferris Hall on the Knoxville campus, has storage and refresh graphics terminals, digitizing tablets, graphics workstations with integrated tablet and digitizer capabilities. Additional graphics equipment, including terminals and a large digitizing tablet, is located in the user work area in the Art and Architecture Building. Many of the terminals and microcomputer work areas are capable of being used for graphics. A CalComp 1051 vector plotter is used to produce graphics output from jobs run on the IBM and the VAXcluster computers. An IBM 6670 and an Imagen laser printer are used to produce high quality printed output. The Imagen printer can also produce graphics at 300 dots per inch.

Data entry services are provided with two Nixdorf 600/55 key-to-disk systems located in Andy Holt Tower. Noncredit short courses, one to five hours in length, are taught throughout the year on topics including programming languages, job control language, the use of graphics, and the statistical and matrix handling software packages available at UTCC. During each term break, UTCC consultants conduct a four-day seminar on the use of either the IBM or VAXcluster computers for faculty, staff, and graduate students. Many courses are available on videotape in Audiovisual Services in the John C. Hodges Library. Short courses are announced in the UTCC Newsletter, the “Campus Capsule” section of the UT Daily Beacon, and on the UTCC Bulletin Board.

UTCC maintains more than 100 online and printed documents describing the availability and use of system hardware and software. The IBM User’s Guide, the VAXcluster User’s Guide, and the Graphics User’s Guide are available at the UT Book & Supply Store. A monthly UTCC Newsletter announces systems, equipment, and procedural changes and contains other items of interest to users.

Users at UTCC facilities are assigned a consultant who is available to answer questions about UTCC resources and to assist in accessing the UTCC library of computer programs. Forms to request computing services are available at the receptionist, 200 Stokely Management Center. UTCC offices and principal computing facilities are located on the first two floors of Stokely Management Center, on the second floor of Dunford Hall, and on the P2 level and first floor of Andy Holt Tower.

Energy, Environment, and Resources Center

E. William Colglazier, Jr., Director

The Energy, Environment, and Resources Center was created to encourage interdisciplinary research directed at solutions to problems related to energy and the environment. The Center provides assistance to faculty interested in developing research and public service projects, manages research and development projects that involve several disciplines, and assists Tennessee government and industry in specific problems related to energy, environmental, resource, and technology policy issues. The Center has a close working relationship with researchers at the Oak Ridge National Laboratory and the Tennessee Valley Authority.

Current research includes hazardous and radioactive waste management, information systems, industrial fuel use trends, energy conservation in buildings and industry, electricity system operational research needs, energy education and information, probabilistic risk assessment, and ethical and value issues in technology policy.

Institute of Agriculture

D. M. (Pete) Gossett, Vice President
Bobby H. Pentecost, Assistant Vice President

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 Institution, Tennessee has been expanded to include research for the development of systems, equipment, and procedural changes for dissemination of such knowledge to rural people. Thus the Institute of Agriculture has come to include the work of three main divisions: Agricultural Experiment Station, Agricultural Extension Service, and College of Agriculture.

In 1974 the College of Veterinary Medicine was established within the Institute. The college is developing research and graduate programs in veterinary and biomedical sciences in addition to the professional curriculum leading to the degree, Doctor of Veterinary Medicine.

Agricultural Experiment Station

John I. Sewell, Associate Dean
Thomas H. Klintz, Assistant Dean

The Agricultural Experiment Station was established by The University’s Board of Trustees on June 6, 1882, five years before the passage of the Hatch Experiment Station Act by the U.S. Congress. The University was one of the first five institutions in the U.S. to establish an Agricultural Experiment Station. Since its beginning, the Station has given first attention to investigations of concern to the agriculture of Tennessee. The investigations of the Station follow a systematic method of gaining and applying knowledge efficiently to the biological, physical, and economic phases of producing, processing, and distributing farm and forest products; to the social and economic aspects of rural living; and to consumer health and nutrition. Both farm and urban populations gain from the accomplishments of the Agricultural Experiment Station. Examples of some of these accomplishments are new and improved varieties of crops, new and better methods of controlling crop and livestock pests, more efficient production of crops and pasture through improved fertilization and mechanization, and more efficient feeding and management of livestock.

The program is designed and administered through sixteen subject matter departments located at Knoxville. A number of the staff have teaching responsibilities in addition to their research. To assist in the research program, the Station supports a large number of graduate students. To serve Tennessee’s diverse agriculture, branch stations are operated at Jackson, Milan, Grand Junction, Spring Hill, Springfield, Crossville, Knoxville, Martin and a forestry branch station at Oak Ridge. Professional and technical staff are in residence at these locations.

Agricultural Extension Service

M. Lloyd Downen, Dean
Mary H. Hinton, Associate Dean
Mildred F. Fink, Associate Dean
Billy G. Hicks, Associate 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. Educational emphasis includes work in four major program areas: agriculture and natural resources, educational and resource development, home economics, and education of young people through 4-H Clubs. County Extension staff members working directly with local people are supported in the various programs either by a specialist staff, members of which are stationed either in Knoxville, Nashville, or Jackson.

The Agricultural Extension Service operates administratively as part of the Station and federal government and a County Agricultural Extension Committee represents county government in this partnership.

Library, The University of Tennessee, Knoxville

Donald Hunt, Director

The University of Tennessee, Knoxville Library owns approximately 1,600,000 volumes, more than 3,000,000 manuscripts, 70,000 microfilm reels, and 1,600,000 items of other microtext, plus recordings, tapes, United States and United Nations documents, and more than 17,000 periodicals and other serial titles, which are received annually. The library’s membership in the Association of Research Libraries reflects the University’s emphasis on graduate instruction and research and the support of large, comprehensive collections of library materials on a permanent basis.

Library holdings in Knoxville are housed in the greatly expanded John C. Hodges Library located on the campus. The Library is a repository of regional and local materials, Tennessee, and associated subjects and has a special legislative papers and mementos of many Tennessee
Off-campus Graduate Centers

Kingsport University Center: UTK offers at Kingsport resident graduate programs in science and engineering at both the Master's and doctoral levels. The program is operated within the policies formulated by the Graduate Council of UTK and 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 UTK. Information and application forms may be obtained from Marvin K. Goodman, Director, Kingsport University Center, The University of Tennessee, University Boulevard, Kingsport, Tennessee 37660.

The Psychological Clinic

Alvin G. Burstein, Director

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, upon referral by a physician.

Transportation Center

Gary N. Dicer, Director

The Transportation Center was created in 1970 to foster and facilitate interdisciplinary research and publications in the field of transportation at The University of Tennessee. It began operating full-time in 1972 and since then has contributed greatly to the overall research program of The University. The Center is a University-level organization administratively positioned with the Office of the Vice Provost for Research at UTK. The Center's staff is organized into four research divisions and one support division. The five division managers provide the overall management needed to conduct transportation research, service, and training activities efficiently and effectively.

The University of Tennessee Space Institute

Kenneth E. Harwell, Dean

The University of Tennessee Space Institute is a graduate education and research institution established in 1964 on a 355-acre lakeshore campus in Middle Tennessee. UTSI has evolved into an internationally recognized institution for graduate study and research in engineering, physics, mathematics, and computer science. The accredited academic programs and educational policies of the Space Institute cover their origins in appropriate departments of The University of Tennessee, Knoxville. The more than 40 faculty members of the Institute carry out these accredited academic programs through classroom teaching, informal seminars, and research.
and directing the research of their students in an environment of creative work and advanced study. Programs are available to students devoting full-time effort toward M.S. and Ph.D. degrees, those interested in continuing education for updating and broadening knowledge, and those who wish to pursue post-doctoral research.

Graduate degree programs are available with majors in Aerospace Engineering, Avionics, Computer Science, Electrical Engineering, Engineering Science, Industrial Engineering (engineering management concentration), Mathematics, Mechanical Engineering, and Physics. In addition to the fundamental studies characteristic of each discipline, research opportunities are available in many areas including aerodynamics, atmospheric science, fluid mechanics, computer graphics, knowledge engineering, energy conversion processes, thermal sciences, space systems, remote sensing, propulsion, computational fluid dynamics, and other aspects of atmospheric and space flight.

The Institute has an established Center of Excellence in Laser Applications and offers graduate studies and research opportunities in laser diagnostics, laser materials interactions, pico-second processes, and coherent and non-linear optics.

The Institute was established in part to increase the research and engineering resources of Tennessee through education and practice in relevant scientific and technical areas and in part to interface University faculty and student research with the Air Force Arnold Engineering Development Center. The faculty, research activities, and facilities of the Institute, and those available at Arnold Center through appropriate contractual arrangements, provide students an unusual opportunity for significant research in these areas. Students who enroll at UT are admitted to The Graduate School, The University of Tennessee, Knoxville. Graduate Research Assistantships are available for qualified students. Further information may be obtained from the Dean, The University of Tennessee Space Institute, Tullahoma, Tennessee 37388.

### Water Resources Research Center

E. William Colglazier, Director

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