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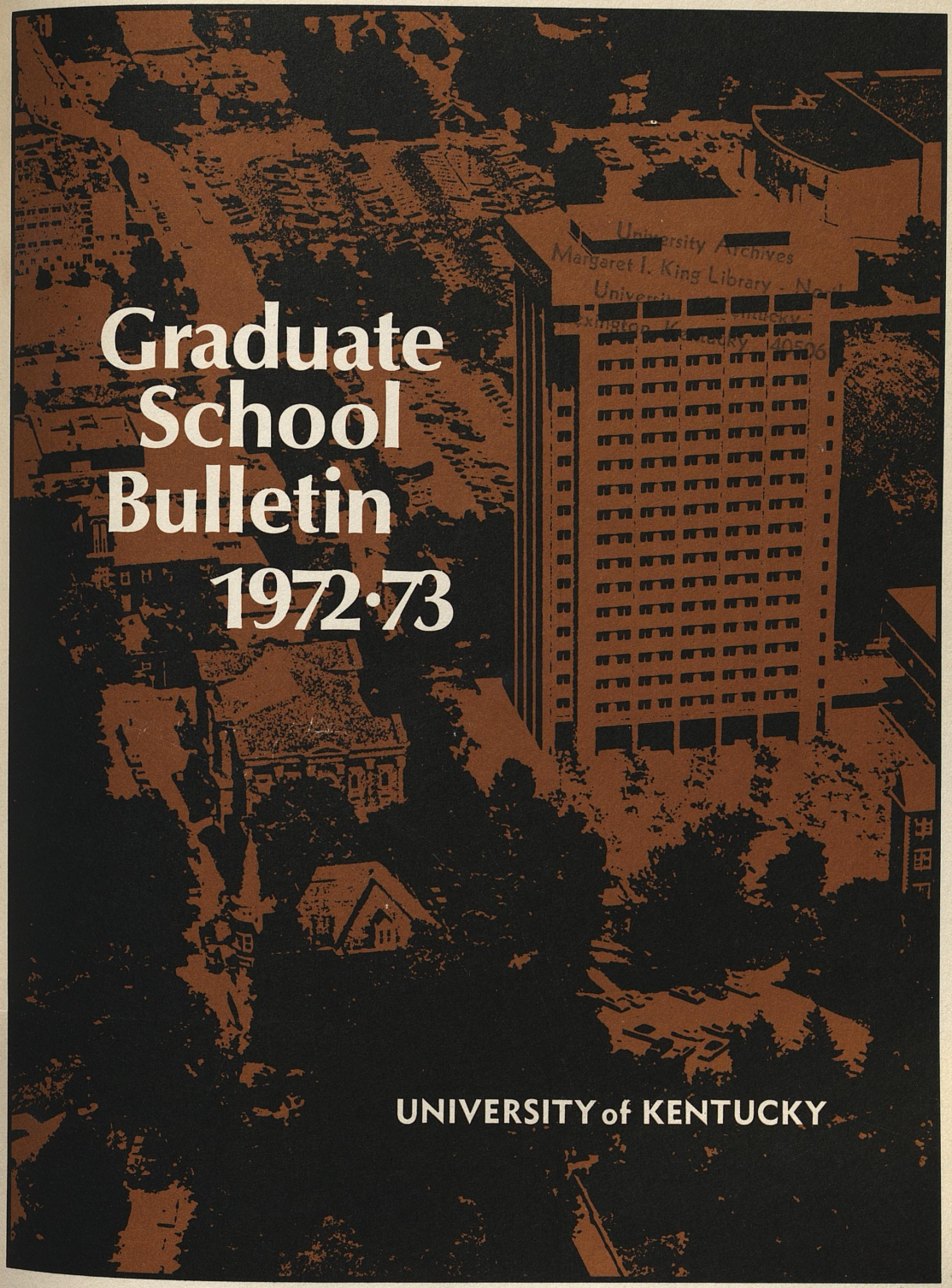

Graduate School Bulletin 1972-73

UNIVERSITY of KENTUCKY

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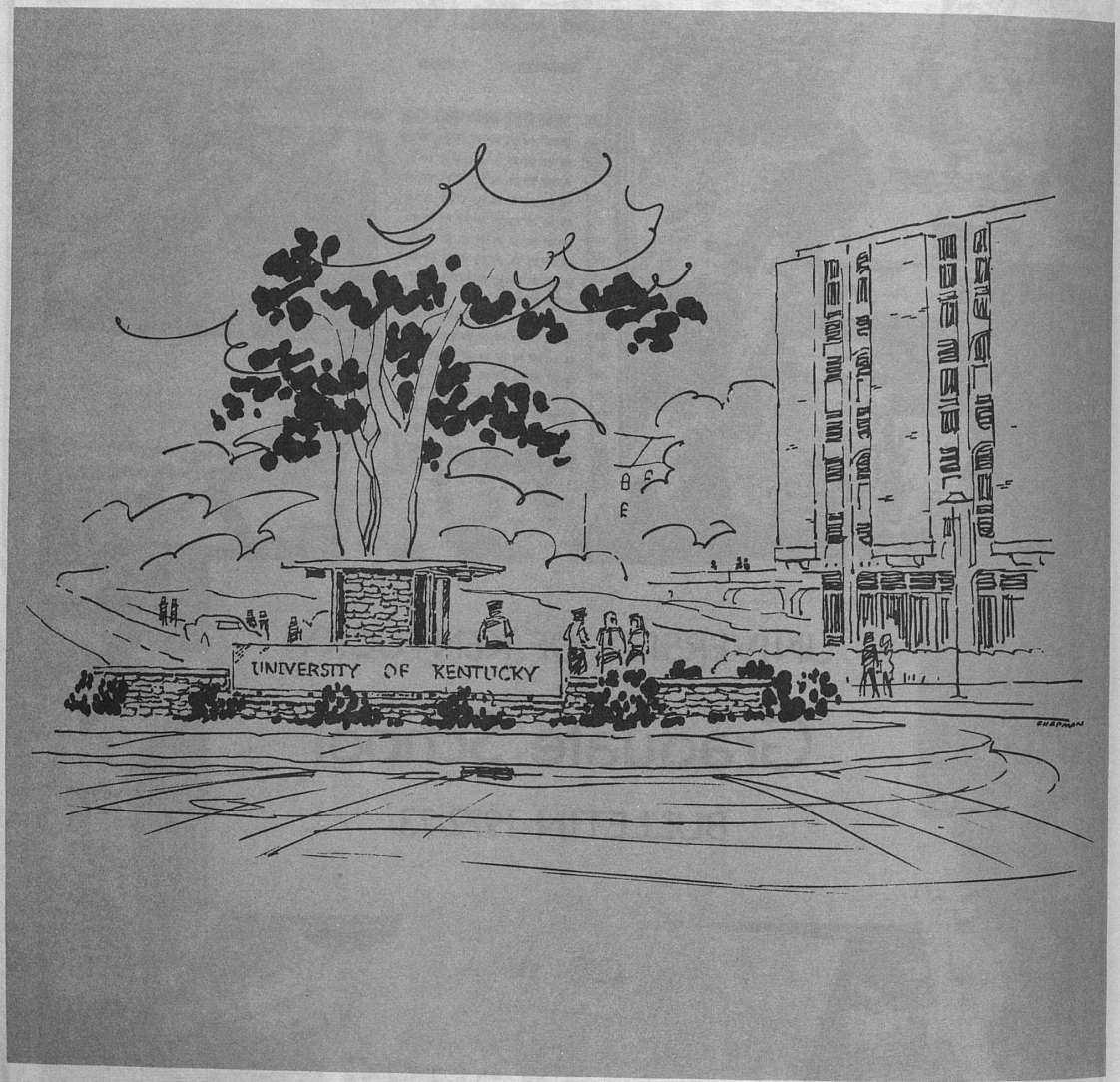
UNIVERSITY OF KENTUCKY

Graduate School

BULLETIN 1972-73


UNIVERSITY OF KENTUCKY

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CALENDAR

1972 Fall Semester

July 28—Friday—Last date to submit all required documents to Graduate Admissions Office for admission and readmission to the 1972 Fall Semester

August 28, 29—Monday and Tuesday—Classification, registration

August 30—Wednesday—Class work begins

September 4—Monday — Labor Day (Academic Holiday)

September 6—Wednesday—Last day to enter an organized class for Fall Semester

September 11—Monday—Last day to drop a course without a grade

September 27, 28—Wednesday and Thursday—Last days for filing application for a December degree in College Dean's Office

October 20—Friday—Last day to withdraw from the University and receive any refund

October 30—Monday—Last day to pay graduation fee in Billings and Collections Office for a December degree

November 8-21—Wednesday through Tuesday—Advance registration for 1973 Spring Semester

November 10—Friday—Last day to withdraw from a class before finals

November 23, 24, 25—Thursday through Saturday—Thanksgiving Holidays (Academic Holidays)

December 4—Monday—Thesis Deadline

December 13—Wednesday—Class work ends

December 15—Friday—Last date to submit all required documents to Graduate Admissions Office for admission and readmission to the 1973 Spring Semester

December 15-21—Friday through Thursday—Final examinations

December 21—Thursday—End of Fall Semester

December 26—Tuesday—All grades due in Registrar's Office by 4 p.m.

1973 Spring Semester

January 15, 16—Monday and Tuesday—Classification, registration

January 17—Wednesday—Class work begins

January 23—Tuesday—Last day to enter an organized class for Spring Semester

January 29—Monday—Last day to drop a course without a grade

February 14, 15—Wednesday and Thursday—Last days for filing application for a May degree in College Dean's Office

March 8—Thursday—Last day to withdraw from the University and receive any refund

March 19—Monday—Last day to pay graduation fees for May degree in Billings and Collections Office

March 19-25—Monday through Sunday—Spring vacation

April 2—Monday—Last day to withdraw from a class before finals

April 13—Friday—Thesis Deadline

April 13—Friday—Last date to submit all required documents to Graduate Admissions Office for admission to 1973 Four-Week Intersession

April 16-27—Monday through Friday—Advance registration for 1973 Fall Semester

May 5—Saturday—End of class work

May 11—Friday—Last date to submit all required documents to Graduate Admissions Office for admission to the 1973 8-Week and 6-Week Summer Session

May 7-12—Monday through Saturday—Final examinations

May 12—Saturday—End of Spring Semester

May 15—Tuesday—All grades due in Registrar's Office by 4 p.m.

1973 Summer Session

June 11, 12—Monday and Tuesday—Registration

June 13—Class work begins

June 18—Monday—Last day to enter an organized class for the 1973 Summer Session

June 25—Monday—Last day to drop a course without a grade

June 26, 27—Tuesday and Wednesday—Last days for filing application for an August degree in College Dean's Office

July 4—Wednesday — Independence Day (Academic Holiday)

July 11—Wednesday—Registration automatically cancelled if fees not paid in full

July 12—Thursday—Last day for paying graduation fees for August degree in Billings and Collections Office

July 19—Thursday—Thesis Deadline

July 25—Wednesday—Last day to withdraw from a class before the end of the Summer Session

July 27—Friday—Last date to submit all required documents to Graduate Admissions Office for admission and readmission to the 1973 Fall Semester

August 8—Wednesday—End of Summer Session

August 10—Friday—All grades due in Registrar's Office by 4 p.m.

Wimberly C. Royster, Ph.D., Dean

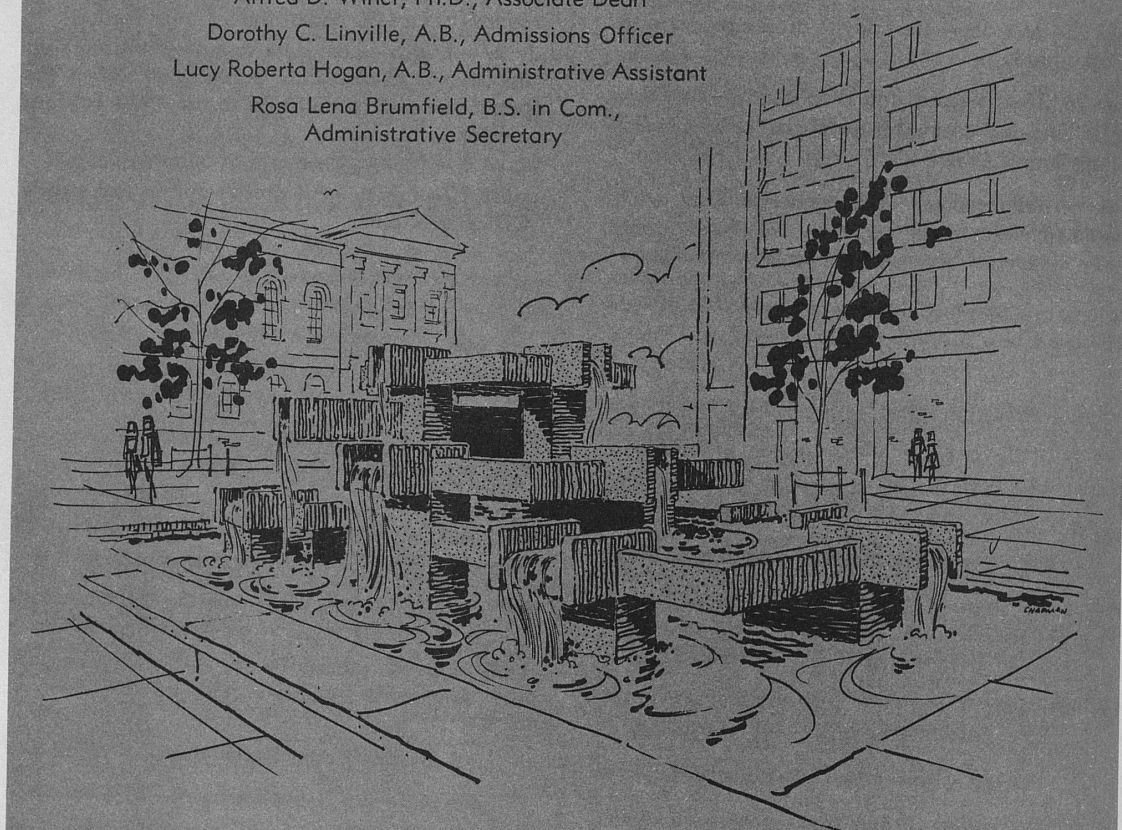
Herbert Lyon, Ph.D., Associate Dean

Alfred D. Winer, Ph.D., Associate Dean

Dorothy C. Linville, A.B., Admissions Officer

Lucy Roberta Hogan, A.B., Administrative Assistant

Rosa Lena Brumfield, B.S. in Com.,
Administrative Secretary



The Graduate School

The University of Kentucky began offering graduate work in 1870 and awarding graduate degrees in 1876. The Graduate School as a distinct unit was organized in 1912.

The Graduate School is concerned with advanced study and research carried on by the faculty and students of all colleges and departments. Under it the total graduate resources of the University are merged in order to promote the achievement of knowledge in an atmosphere of free and lively inquiry.

Graduate work is offered in most colleges in the University. A general description, tabulation of courses, and name of the Director of Graduate Study for each of the various programs is given in the Subjects and Directors of Graduate Study section of this bulletin.

The following advanced degrees are conferred:

Doctor of Philosophy

Offered in following fields:

- Agricultural Economics
- Agricultural Engineering
- Anatomy
- Animal Sciences
- Anthropology
- Biology
- Biochemistry
- Chemical Engineering
- Chemical Physics
- Chemistry
- Civil Engineering
- Crop Science
- Diplomacy and International Commerce
- Economics
- Electrical Engineering
- Engineering Mechanics
- English
- Entomology
- French
- Geography
- Geology
- Germanic Languages
- History
- Mathematics
- Mechanical Engineering
- Metallurgical Engineering and Materials Science
- Microbiology
- Musicology
- Pharmaceutical Sciences
- Pharmacology
- Physics
- Physiology and Biophysics
- Plant Pathology
- Plant Physiology
- Political Science
- Psychology
- Sociology
- Soil Science
- Spanish
- Statistics
- Toxicology
- Veterinary Science

Master of Arts

Offered in following fields:

- Anthropology
- Art
- Botany
- Classical Languages
- Communications
- Diplomacy
- Economics
- English
- French
- Geography
- German
- History
- Library Science
- Mathematics
- Music
- Philosophy
- Political Science
- Psychology
- Sociology
- Spanish
- Theatre Arts
- Zoology

Master of Science

Offered in following fields:

- Anatomy
- Agricultural Economics
- Agronomy
- Animal Sciences
- Biochemistry
- Botany
- Chemistry
- Economics
- Entomology
- Geology

Mathematics
Microbiology
Pharmacology
Pharmaceutical Science
Physics
Physiology and Biophysics
Physical Education
Plant Pathology
Psychology
Statistics
Toxicology
Zoology

Master of Science in Agriculture

Offered in following fields:

Agricultural Economics
Agronomy
Animal Sciences
Entomology
Horticulture
Plant Pathology
Sociology

Other Degrees

Master of Arts in Education
Master of Science in Education
Master of Business Administration
Master of Fine Arts
Master of Music
Master of Science in Accounting
Master of Science in Agricultural Engineering
Master of Science in Chemical Engineering
Master of Science in Civil Engineering
Master of Science in Clinical Nutrition
Master of Science in Computer Science
Master of Science in Dentistry with Specialty in Orthodontics
Master of Science in Electrical Engineering
Master of Science in Engineering Mechanics
Master of Science in Home Economics
Master of Science in Library Science
Master of Science in Mechanical Engineering
Master of Science in Medical Radiation
Master of Science in Metallurgical Engineering
Master of Science in Nuclear Engineering
Master of Science in Nursing
Master of Science in Radiological Health
Master of Social Work
Specialist in Education
Doctor of Business Administration
Doctor of Education
Doctor of Musical Arts in Music Teaching

Organization of the Graduate School

The Graduate Faculty consists of the Dean of the Graduate School and all persons appointed thereto by the President of the University. As the chief University agency for the promotion of the ideals of graduate study, it determines the policies of the Graduate School and makes recommendations to the University Senate and to the President, or to other administrative officials as appropriate. All rules affecting graduate work and the inauguration of new graduate programs must be approved by the Graduate Faculty.

Any proposed change in the rules of the Graduate School must be included in the agenda of the meeting and circulated to the Graduate Faculty at least 10 days prior to the meeting at which it is to be considered.

New Graduate Faculty members may be proposed to the Dean of the Graduate School at any time by the college deans and department chairmen concerned, or in the case of persons not attached to a college faculty, by the Vice President for Academic Affairs of the University. Eligibility qualifications are as follows:

1. The doctor's degree or its equivalent in scholarly reputation.
2. The rank of assistant professor (or equivalent), or higher.
3. Scholarly maturity and professional productivity as demonstrated by publications, editorial services, research surveys, creative work, or patents; and research in progress at the time of appointment.
4. Definite interest in graduate work and the willingness to participate in the graduate program.

Appointment to the Graduate Faculty is made by the President of the University on nomination by the Dean of the Graduate School after he and the Graduate Council have studied the credentials submitted in support of the proposed members.

Associate members are appointed by the Dean of the Graduate School upon nomination by the Director of Graduate Study. Associate membership is limited to non-tenured assistant professors who hold the doctorate, have been full-time members of a faculty for at least one year, and have initiated a significant research effort. This membership may continue no more than five years. Associate members are authorized to teach graduate courses, direct masters' theses, serve on and co-chair doctoral committees, and attend and participate in Graduate Faculty meetings. They do not have voting privileges in the Graduate Faculty.

Administrative officers assigning teaching and other duties to members of the Graduate Faculty who are taking an active part in the graduate program (i.e., are heavily engaged in directing theses,

carrying on productive research, etc.) should make appropriate reduction in the duties required of such teachers.

The Dean and His Office

The Dean of the Graduate School is charged with the administration of the policies adopted by the Graduate Faculty and the University Senate relating to graduate studies. He presides over all meetings of the Graduate Faculty and calls meetings of this faculty whenever he thinks it advisable or whenever requested to do so by one-fourth of the membership. He makes recommendations to the Graduate Faculty respecting the requirements for advanced degrees, the regulations necessary to insure a high standard of graduate work, and all other aspects of the graduate program. He appoints a committee for each graduate student, arranges for final examinations, advises students with regard to their studies and the requirements of the Graduate School, and in all other ways administers the graduate program in the interests of efficient instruction and the highest attainment possible on the part of each graduate student. He is responsible for determining and certifying to the Registrar candidates who have fulfilled requirements for advanced degrees.

The President and the Dean of the Graduate School are members ex officio of all committees of the Graduate Faculty.

The Graduate Council

The Graduate Council is composed of 13 members and the Dean of the Graduate School, who is chairman. There are eight elected faculty representatives and three faculty members appointed by the Dean of the Graduate School. One of the elected members is from the College of Agriculture, two from the College of Arts and Sciences, one from the College of Business and Economics, two from the College of Education, one from the College of Engineering, and one from the College of Medicine. The member or members from each of these colleges are elected by the Graduate Faculty members in that college. Two graduate student members are selected by the Council from a panel of four submitted by the Graduate and Professional Student Association. The term of office of the elected and appointed members is three years, and that of the graduate students is one year. No member may succeed himself until three years have elapsed since the completion of his last term.

The Graduate Council approves or disapproves proposals concerning courses offered for graduate credit, and advises and lends assistance to the Dean in his execution of policies and regulations determined by the Graduate Faculty. Specifically, the Council:

1. Studies requests of departments relating to proposed graduate programs.
2. Reviews existing programs and courses.
3. In cooperation with the Dean, initiates recommendations to the Graduate Faculty. (This procedure is not intended to prevent a faculty member from bringing any recommendation or request directly before the Graduate Faculty.)

The Graduate Council has such authority as is herein granted, or such as the Dean or the Graduate Faculty may delegate to it. A majority of the Graduate Council constitutes a quorum for the transaction of business.

Directors of Graduate Study

A Director of Graduate Study serves as adviser to each student majoring in his area until the student has a thesis director. The Director of Graduate Study then recommends that this thesis director be appointed the student's adviser or committee chairman. In areas where theses are not required, the Director of Graduate Study is the adviser for all students not writing theses. All student schedules must be endorsed by the student's adviser.

If it is desirable, a Director of Graduate Study may recommend that additional advisers in the area be appointed. A Director of Graduate Study who is to be absent from the University for as long as a semester must call this fact to the attention of the Dean so that a substitute may be appointed.

The Dean of the Graduate School, with the advice of the college dean(s) and the approval of the President, may recommend to the Graduate Faculty the areas of graduate study and research into which the University may be divided. (The logical unit for an area is a department. By common consent, however, certain departments may be grouped into an area; and in exceptional cases a department may be divided into two or more areas.) The Directors of Graduate Study for the various areas are appointed by the Dean of the Graduate School.

Establishment and Modification of Graduate Programs

An area which wishes to establish a new graduate program or modify an existing one must submit its program to the Graduate Council, which will make recommendation concerning it to the Graduate Faculty.

Honorary Degrees

The selection of candidates for honorary degrees originates in the Graduate Faculty, and the Graduate Faculty makes its recommendations to the University Senate.

Honorary degrees are normally conferred at the May Commencement, but may be conferred at other times with the approval of the Graduate Faculty. Recipients must be present in order to receive honorary degrees.

Admission

A student who has a baccalaureate degree from a fully accredited institution of higher learning and has an undergraduate grade-point standing on all work attempted of at least 2.5 on the basis of 4.0 or who, on the recommendation of a graduate program, can satisfy the Graduate Council that he has the equivalent of such a background may be considered for admission to the Graduate School by submitting to the Graduate Admissions Office two official transcripts of all college courses and a written application at least a month before anticipated entrance. This 30 day requirement may be waived only under special circumstances. Application blanks may be obtained from the Admissions Office of the Graduate School. A student with a grade-point average of less than 2.5, or a graduate of a non-accredited institution, may be admitted only after the Graduate Record Examination or other evidence acceptable to the Dean of the Graduate Schoool, and to the Department, indicate that he is capable of doing satisfactory graduate work. Individual departments may establish higher requirements.

It should be clearly understood that a graduate student may not be able to begin immediately a full graduate program leading to the degree he desires; it may be necessary for him to satisfy prerequisites which he omitted in his undergraduate curriculum. Deficiences are determined by the department in which the major work is to be done. Ordinarily, a graduate student may begin a full program in any field in which he has a balanced undergraduate major or its equivalent.

Admission to the Graduate School entitles a student to take such courses as he desires, provided he has the necessary prerequisites. **However, admission does not automatically make a student a candidate for a graduate degree.**

Attendance in the Graduate School at the University of Kentucky is not a right. It is a privilege which may be withdrawn by the University or any area of graduate study if it is deemed necessary by the Dean of the Graduate School in order to safeguard the University's standards.

GRADUATING SENIORS AS PART-TIME GRADUATE STUDENTS

A senior in the University of Kentucky lacking no more than six credit hours for graduation and having an undergraduate average of at least 2.5 on all work attempted may register in the Graduate School with the consent of his college dean and the Dean of the Graduate School. Approval of the appropriate director of graduate study is required if the student is to be an applicant for a degree. The total load of such a student may not exceed 12 credit hours. Graduate credit will be allowed for each credit hour of graduate work beyond the six or fewer credit hours needed to complete undergraduate requirements. The incidental fee is that of a full-time student in the school in which more than half of the work is taken. In cases where the load is evenly divided between the schools, the larger fee is assessed. Requirements for the undergraduate degree must be completed during the semester in which the student is allowed to register for part-time graduate work. Students desiring to enroll in the Graduate School under these conditions must fill out in duplicate a petition listing the course or courses to be taken in order to complete their undergraduate requirements. The petition must be approved by both deans concerned.

ADVANCED DEGREES FOR FACULTY MEMBERS

Members of the faculty, excepting those in the Community College System, having a rank higher than that of Instructor may not be considered as candidates for degrees in the discipline in which they are employed or above the Master's degree at the University.

STUDENT RESPONSIBILITY

It is the responsibility of the student to inform himself concerning, and to observe all regulations and procedures required by the course he is pursuing. **In no case will a regulation be waived or an exception granted because a student pleads ignorance** of the regulation or asserts that he was not informed of it by his adviser or other authority. Therefore, the student should become familiar with

the Graduate School Bulletin, including (1) the section presenting the requirements for the degree which he plans to take, and (2) the offerings and requirements of his major department.

The student should consult the Director of Graduate Study of the department in which he will do his work concerning course requirements, any deficiencies, the planning of a program, and special regulations. Departments may have degree requirements that are not listed in the Bulletin.

It is to be noted that the Graduate Dean interprets the Graduate Bulletin; and other interpretations are unofficial. Only the Graduate Council may waive requirements stated in this Bulletin.

General Requirements for All Advanced Degrees

REGISTRATION AND CLASSIFICATION

All students expecting graduate credit must be enrolled in the Graduate School. Graduate students will conform to the general registration schedule of the University and may not enter later than the last allowable date set by the Registrar.

Before registering, a graduate student must obtain his adviser's approval of his proposed program.

THE GRADUATE RECORD EXAMINATION

All students working for graduate degrees must take the Aptitude Test of the Graduate Record Examination. In addition, individual programs may require other portions of this examination. This must be done no later than the first term of graduate work.

The College of Business and Economics may substitute the Admission Test for Graduate Study in Business (ATGSB) for the Graduate Record Examination for MBA, DBA and Accounting students.

APPLICATION FOR FULL GRADUATE STANDING

A graduate student desiring to earn a graduate degree **must be approved for full graduate standing** by the Director of Graduate Study in the area in which he intends to major and by the Graduate School. Application should be made as soon as scores on the Graduate Record Examination are available, and in any case prior to the beginning of the semester or term in which the degree is sought.

To be admitted to full graduate standing, a student must have scores on the Graduate Record Examination satisfactory to the department concerned and to the Dean of the Graduate School, and a B average or higher on all graduate work attempted at the University of Kentucky.

Graduate work taken before a student is admitted to full graduate standing will be evaluated by the Director of Graduate Study in the major area and by the Dean of the Graduate School at the time the application for full graduate standing is considered.

GRADUATE COURSES—GRADE AVERAGE

All courses numbered 500 through 799 may be counted for credit toward a graduate degree provided they are approved as an appropriate part of the student's graduate program by his graduate adviser or committee. Courses numbered 400 to 499 carry graduate credit for nonmajors only. An over-all average of B on all work taken as a graduate student, as well as a B average on all work carrying graduate credit, must be attained before an advanced degree may be awarded. All work is to be counted and none of it may be omitted in computing the average. However, those grades in courses which do not give graduate credit may be omitted from a student's average by the Dean of the Graduate School on recommendation of the student's adviser. D grades are not given to graduate students. An "incomplete" (I), unless the Dean of the Graduate School grants an extension of time, must be removed within one calendar year after the close of the term in which the I is assigned if the student is to receive credit.

Courses numbered at the 600 or 700 level shall be taught only by members of the Graduate Faculty or by such other instructors as are approved by the Graduate Dean.

DROPPING OF COURSES

During the first 10 class days of the term a graduate student may drop a regular course without a grade, provided he has the approval of his instructor, his Director of Graduate Study, and the Dean. Regular courses may not be dropped later in the term without the assignment of a grade: W if a student withdraws passing, E if he is failing. However, only under very special circumstances may he be allowed to withdraw from a class within five weeks of the final examination period.

GRADES

The official grades of graduate students are recorded in the office of the Registrar. The Registrar provides official transcripts on the same basis as for undergraduate students. Also, he provides the Dean with the grades of all students in order that the Dean may be able to advise students concerning their programs.

The grading of graduate students is done according to the following scale:

A—high achievement	4 grade points per credit
B—satisfactory achievement	3 grade points per credit
C—minimum passing grade	2 grade points per credit
E—failure	0 grade points per credit
I—incomplete	see explanation following
S—satisfactory	see explanation following

A grade of I (incomplete) may be assigned to a graduate student if a part of the work of a course remains undone and there is a reasonable possibility that a passing grade will result from completion of the work. No student may graduate with an I on his record without the permission of his adviser and the approval of the Dean of the Graduate School.

A grade of S (satisfactory work in progress) may be recorded for students in graduate courses which carry no credit and in graduate seminars, independent work courses, and research courses which extend beyond the normal limits of a semester or summer term. The grade may not be given to a student in a course carrying credit if the student has done unsatisfactory work or if he has failed to do a reasonable amount of work. The project must be substantially continuous in its progress. When the work has been completed, a final grade will be substituted for the S.

Once a grade (other than an I or S) has been reported to the Registrar's Office, it may not be changed unless an error was made at the time the grade was given and recorded, and then only upon the written unanimous approval of the instructor, the Registrar, and the Dean of the Graduate School.

CREDIT EQUIVALENCE

Certain research courses carry no credit hours or grades but do contribute to the residence requirements of graduate degrees. For these courses the credit equivalent is stated in the course descriptions.

ACADEMIC LOAD

The total term load of a student is the sum of all credits and credit equivalents being carried. The normal load of a graduate student during any semester is 12 credit hours or equivalent and under no circumstances may it exceed 15 credit hours or equivalent. In the summer session, the load for the eight-week session is nine credit hours, the six-week session is six credit hours, and the four-week intersession is four credit hours. The maximum load for any combination of the six and eight-week sessions shall be nine credit hours. The maximum load for summer and intersessions is thus 12 credit hours. Students satisfactorily completing in residence nine course credits, or equivalent, of graduate level work during a semester, or six course credits, or equivalent, during a summer term are classified as full-time or full-residence students. Those completing less than these amounts are classified as part-time or part-residence students.

A full-residence student who falls below the minimum full-residence equivalent as the result of failing or dropping one or more courses is reclassified as a part-time or part-residence student for that term.

A master's candidate working on his thesis may register for up to the equivalent of six course credits by signing for course 768 in the appropriate department and indicating the desired credit equivalent in parentheses on the registration card.

A doctoral candidate working on his dissertation may register for up to the equivalent of 12 course credits by signing for course 769 in the appropriate department and indicating the desired credit equivalent in parentheses on the registration card.

Graduate students serving in the University as assistants or part-time instructors should register for less than the normal load, as determined by their advisers. Persons holding full-time working or professional assignments, whether employed by the University or not, may not take more than five credit hours for graduate credit toward a degree in any single semester or term. A student may petition for a waiver of this rule if he meets the following conditions: (1) has satisfactorily completed six credit hours of graduate work; (2) has attained higher than national average scores on the aptitude and advanced tests of the Graduate Record Examination; and (3) has appropriate employment facilities and conditions.

SHORT COURSES—WEEKLY COURSES

Short courses are defined as courses of less than a term in length; weekly courses are courses of more than one credit that meet only once a week.

A short course may not carry credits greater than the number of weeks during which it is offered. Two short courses of four weeks or less or two full-term courses and a short course may not be taken simultaneously. A total graduate program may not be made up of short courses. Not more than 12 hours of the course work requirements for a degree may consist of courses (resident and extension) that meet only once a week.

TIME LIMIT FOR DEGREES

No course or equivalent credit may be given for graduate study completed more than eight years prior to the end of the semester at which the student expects to receive his degree unless such credit or equivalent is specifically validated by the Graduate Council on written recommendation of the appropriate director of graduate study. No course or equivalent credit may be validated in this manner if completed more than 12 years prior to the end of the semester in which the student expects to receive his degree.

GRADUATION

Advanced degrees may be conferred at the close of any semester or summer session, but commencement exercises are held only at the close of the academic year. A student who is scheduled to receive his degree at the close of the academic year is expected to attend the commencement exercises unless he is excused in writing by the Dean of the Graduate School. Students who are eligible to receive degrees at the end of a first semester or a summer session may elect to defer their graduation and participate in the next commencement exercises. Appropriate academic costume must be worn. The graduation charges cover the cost of binding of the thesis or dissertation, microfilming, and copyright as appropriate to the degree.

To be eligible for a degree, the student must file an application at the Graduate Office within 30 days after the beginning of the semester or 15 days in the Summer Session in which he expects to complete his work. The degree applicant must pay his graduation charges within 60 days after the beginning of the semester or 30 days in the Summer Session in which he expects to complete his work.

FEES

Registration fees per semester are $215 for residents of Kentucky, $572.50 for non-residents. Part-time graduate students who are legal residents of the state pay $24 per semester hour; non-residents pay $64 per semester hour. Resident students in the summer will pay $24 per semester hour, non-residents $64 per semester hour. The Registrar determines the status of one's residence for purposes of assessing fees.

Graduate fellows, graduate assistants, and instructors pay the fees assigned to Kentucky residents.

1973-74 in-state : $30 hr. $260 full time
out-of-state : $70 hr. $630 full time

General Requirements for All Masters' Degrees

(See also General Requirements for All Advanced Degrees)

ON-CAMPUS RESIDENCE

At least 18 semester hours of the minimum degree requirements must be earned while in residence on the Lexington campus of the University of Kentucky. Normally, candidates for masters' degrees must spend at least two full summer terms or one semester in full residence at the University. For individual superior students the full residence requirement may be waived if recommended by the Director of Graduate Study in the student's major area and approved by the Graduate Dean. Minimum eligibility for being so recommended includes: (1) the satisfactory completion of 12 credit hours of graduate work, (2) the attainment of national average scores on the Graduate Record Examination, and (3) the availability of employment facilities and conditions which make feasible satisfactory completion of degree requirements while the student is fully employed.

TRANSFER OF CREDITS

With the approval of his graduate adviser and the dean, a student may transfer up to six credit hours toward the satisfaction of the minimum requirements of the Graduate School for the master's degree, provided the work in question was taken while he was enrolled in residence in an approved graduate school.

EXTENSION AND CORRESPONDENCE WORK

Under certain conditions, up to six of the credit hours required for any master's degree may be earned in extension courses given in person by University of Kentucky instructors. No graduate credit is given for courses taken by correspondence.

COURSES AND CURRICULA

Graduate students are eligible to take regular courses which meet as organized classes and independent-study or research courses in which each student carries on investigations independent of class meetings. **Independent study or research courses may not duplicate thesis work;** thesis work must be done in addition to the minimum course requirements. At least two-thirds of the minimum requirements for the master's degree must be in regular courses, and at least half of the minimum requirements must be in courses numbered on the 600 or 700 level. Exceptions to this rule may be made only with the approval of the Graduate Council.

A student may work toward only one master's degree at a time. He must establish at least one year of residence while earning a second master's degree.

EXAMINATION

A final examination (oral and/or written) is given all candidates for master's degrees not later than eight days before the close of the semester in which the degree is to be awarded. The examination is scheduled by the Graduate Dean and the report is returned to him upon completion of the examination, which in no case may be later than two weeks after the start of the examination. The examining committee consists of at least three qualified members recommended by the Director of Graduate Study and appointed by the Dean of the Graduate School.

If the candidate fails his final examination, the committee may recommend to the Graduate Council the conditions under which a second examination may be administered. Insofar as it is practicable the same examining committee gives this examination. In all decisions the majority opinion of the committee prevails. If the committee is evenly divided, the candidate fails. A third examination may not be allowed.

FEES

Before any master's degree may be conferred the student must pay the appropriate commencement charges at the Billings and Collections Office.

Requirements for the Degrees of Master of Arts and Master of Science

The Graduate School authorizes all graduate programs which wish to do so to permit students to satisfy the requirements for the M.A. and the M.S. degrees by either of two plans.

Plan A

In addition to meeting all general requirements for masters' degrees (see section on General Requirements for All Advanced Degrees) the candidate must complete at least 24 semester credit hours of graduate course work with a standing of 3.0 (B) or higher, satisfy the language requirements, and write a thesis. A candidate must have a major area (defined usually as an academic department) and must (with the exceptions noted below) take at least two-thirds of his courses in this area; the other one-third may be taken in this area or in areas which have a graduate relationship to it. In Education, Agriculture, and Communications only one-half of the work must be in the major area. When the setting up of major topics seems to require it, the Graduate Council may, on recommendation of the appropriate Director of Graduate Study, authorize courses taught outside the major to count on the major.

Thesis

Two typewritten, unbound copies of the thesis must be presented to the Graduate School Office not later than the dates given in the calendar in the front of this bulletin. These copies must be approved by the thesis director and the appropriate Director of Graduate Study, must be on 100 percent rag or cotton fiber paper, and must be in a form acceptable to the Graduate School. Instructions for the preparation of theses should be obtained from the Graduate Office **before** the thesis is typed. The candidate must also submit an abstract of his thesis which does not exceed 200 words and is suitable for publication. **The final examination may not be taken before the thesis has been accepted by the Graduate School Office.**

Theses must be developed under the direction of a member or associate member of the Graduate Faculty. Collaborative effort by two or more graduate students is not forbidden, but there must be enough independent effort to enable each student to make a separate contribution and to prepare an individual thesis.

Each thesis must be acceptable to the examining committee at the time of the final examination.

Theses submitted by candidates become the physical property of the University of Kentucky and authors agree that the University may decide the

conditions under which they may be used or published. The University protects the authors' rights by placing certain restrictions upon borrowers' use of theses as long as they are unpublished. A copy of the following regulations (to be prepared by the student) is placed before the title page of every thesis:

> Unpublished theses submitted for the masters' and doctors' degrees and deposited in the University of Kentucky Library are as a rule open for inspection, but are to be used only with due regard to the rights of the authors. Bibliographical references may be noted, but quotations or summaries of parts may be published only with the permission of the author, and with the usual scholarly acknowledgements.
>
> Extensive copying or publication of the thesis in whole or in part requires also the consent of the Dean of the Graduate School of the University of Kentucky.
>
> A library which borrows this thesis for use by its patrons is expected to secure the signature of each user.

Foreign Language Requirement

A reading knowledge of a modern foreign language is required by some departments. Ordinarily this language will be French, German, or Russion, but another language may be substituted if it can be shown to be pertinent to the student's program and is approved by the adviser and the Dean of the Graduate School. The language requirement must be satisfied by an examination given by the appropriate language department of the University or by such persons as the Graduate Dean may specify, or by passing, with a grade of A or B, one or more of the accelerated courses especially designed for this purpose (French 011, German 021, Italian 009, Spanish 011). The student who satisfies the undergraduate foreign language requirement at the University of Kentucky with a grade average of B or better may use this as satisfying a graduate foreign language requirement with the approval of his adviser and the Dean of the Graduate School. A candidate for a degree in the language which is his native tongue must do a full major (one-third of his work) in areas in which English is the language employed.

Plan B

Plan B (which is not necessarily available in all departments that have Plan A) has the same minimum requirements as Plan A except that six or more credit hours of course work may be submitted for a thesis. A student may follow this plan only with approval of the program concerned.

A student should consult his adviser for any additional requirements that may have been set up for Plan B by his area of study.

Requirements for the Degree of Doctor of Philosophy

The degree of Doctor of Philosophy is conferred upon a candidate who, after completing not fewer than three years of graduate work devoted to study of a special field of knowledge, presents a satisfactory dissertation, passes a comprehensive examination on his dissertation subject and chosen field, and shows sufficient promise of scholarly attainment.

The doctor's degree is intended to represent not a specified amount of work covering a specified time, but the attainment, through long study, of independent and comprehensive scholarship in a special field. Such scholarship should be evidenced both by the student's grasp of subject matter and by his capacity to do research.

THE STUDENT'S ADVISER AND SPECIAL COMMITTEE

The Director of Graduate Study in the student's major area serves initially as the student's adviser and signs his schedule before it is presented to the Dean. When the dissertation director has been chosen, the student's special committee is set up by the Dean after he has conferred with the student, the Director of Graduate Study, and the dissertation director.

The special committee consists of the dissertation director as chairman, two or three other members from the major area, and at least one representative from each minor area—in all, no fewer than five members. This committee advises the applicant and sets the requirements which the student must meet before he may be admitted to the qualifying examination. This special committee keeps minutes of all meetings and sends abbreviated copies to the Dean to be made a part of the student's record. Ordinarily this committee determines when the qualifying examination is to be administered, and the chairman schedules the examination in writing, sending a copy of the announcement to the Dean. The committee is the final judge on a majority basis of the questions to be asked on the qualifying examination and of whether the student passes.

A department which elects to do so may give a

uniform departmental qualifying examination to its candidates instead of delegating full responsibility to the special committee.

MAJOR AND MINOR SUBJECTS

Every applicant for the Ph.D. degree must select a major area of study and some programs require one or two minor areas. The major area is one in which the student intends to concentrate his efforts.

If a minor area is required, this area must be approved by the Graduate Dean and the subjects to be included in the minor(s) must be approved by the representatives of the minor(s) on the special committee. Normally, when an outside minor is required, at least one-sixth of the student's program should be devoted to study in this area.

RESIDENCE REQUIREMENTS

A minimum of three collegiate years of full-residence graduate work or its equivalent in a combination of full- and part-time residence, is required for the doctorate. At least two semesters (exclusive of summer sessions) of the required residence above the master's degree (or its residence equivalent) must be earned at the University of Kentucky in full-residence status, or in a combination of graduate study, research, and not more than half-time assignment as a research or teaching assistant. "Residence equivalent" to the master's degree is interpreted as one academic year of full-residence graduate work or its equivalent in a combination of full- and part-time residence.

A year of residence is required after the qualifying examination before the degree is conferred. If the examination is completed within the first six weeks of a semester, that semester will count as half the year. If a student has passed his qualifying examination but has earned less than one year of residence after the qualifying examination, he may petition the Graduate Dean for a waiver of this requirement.

The amount of residence to be transferred on account of prior graduate work at some other institution is determined jointly by the Director of Graduate Study in the area and the Dean of the Graduate School. Ordinarily, however, graduate students may be allowed only one year of residence toward the doctorate for earlier study which has been used to satisfy the requirements for a master's degree or masters' degrees.

Candidates working on the dissertation project who need residence credit should register for course 769 in proportion to the amount of time to be devoted to the project. Students working full-time on the dissertation should register for the equivalent of 12 credits; i.e., 769 (12). Those devoting less than full time should register for proportionately less 769 residence.

Should conditions merit or require that all or part of the dissertation project be carried out away from the campus of the University of Kentucky and the arrangement has the approval of the candidate's dissertation director and the Dean of the Graduate School, needed minimum residence credit can be gained by registering for course 769 as described above for on-campus candidates.

Students with full-time positions and who are taking no credit course work may register for no more than the 769 equivalent of five credits per semester or three credits per summer term.

While it is expected that a well-prepared student of good ability may secure the degree upon completion of three years of full-time study, it should be understood that this requirement is a minimum and is wholly secondary to scholarly accomplishment.

Students who have fulfilled the minimum residence requirements for a graduate degree and who are not registering for course credits but who are carrying out on-campus dissertation work, hence are utilizing University faculty and/or facilities either full-time or part-time, must register during each term of such on-campus activity.

LANGUAGE REQUIREMENTS

As stated in the specific program description, an applicant must have a reading knowledge of one or two modern foreign languages. The language or languages will normally be chosen from French, German, or Russian. However, with the approval of the student's special committee, the Director of Graduate Study in the area, and the Graduate Dean, certain substitutions may be made:

1. Some other language may be substituted for one of those normally required if it can be demonstrated that the student's scholarly needs will be better served thereby.
2. In special cases fluency in one foreign language may be substituted for a reading knowledge of two languages.

If after four semesters of full-time graduate work (i.e., above the A.B.) the student has not satisfied the foreign language requirement, he must register for a language course or courses as a part of his

course load. **The language requirement must be satisfied before the applicant may be admitted to the qualifying examinations.** The acceptable ways for satisfying this requirement are given in the section, "Requirements for the degrees of Master of Arts and Master of Sciences, Plan A, Foreign Language Requirement."

THE QUALIFYING EXAMINATION

A qualifying examination is required of all applicants for the doctorate in order to determine whether the applicant should be admitted to candidacy. Normally this examination is prepared by the student's special committee (see The Student's Adviser and Special Committee Section) and should be taken during or after the student's fourth semester of full-time graduate study, or the equivalent. The qualifying examination shall be both written and oral. The special committee reports to the Dean the result of the examination within 60 days of the beginning. If the result is failure, the committee recommends the conditions to be met before another examination may be administered. The minimum time before another examination may be given is four months. The same committee, or as many of the members as are available, plus those added by the Dean to fill vacancies, gives the second examination. A third examination may not be allowed.

THE DISSERTATION

Each candidate must present a dissertation which is the result of original research and adds to or otherwise modifies what was previously known on the subject. Unless the director of the dissertation specifically recommends departures, the dissertation must be in conformity with the instructions prepared by the Graduate School, must be on 100 percent rag or cotton fiber paper, and must be satisfactory in style and composition.

Before the dissertation is formally submitted, the student must bring it to the Graduate Office to have it checked for form. Two typewritten copies of the dissertation (unbound) and two typewritten copies of an abstract, usually of not less than 400 words nor more than 600 words, must be presented to the Dean of the Graduate School not later than the dates given in the calendar in the front of this bulletin. An approval sheet signed by a majority of the special committee (including the director of the dissertation) must accompany the dissertation. When dissertations are submitted, a standard form containing Rules For the Use of Theses must be prepared and must be included with the manuscript, before the title page. (See Plan A, Thesis Section, for these rules.)

Each graduating doctoral student will pay charges to cover microfilming, copyright and binding of the dissertation. Payment will be made at the Billings and Collection Office.

THE FINAL EXAMINATION

After the acceptance of the dissertation by the special committee and the Dean of the Graduate School, the candidate is given a final oral, or, if the examining committee elects, an oral and a written examination. The examining committee consists of a minimum of five persons appointed by the Dean of the Graduate School, after he has conferred with the Director of Graduate Study for the area. The Director of Graduate Study (or his delegate) serves as chairman of the committee. Other members include the dissertation director, a third representative of the department, a representative of the minor area, and one member of the Graduate Faculty associated with neither the major nor minor areas. (The President of the University and the Dean of the Graduate School are ex officio members of all examining committees.) The final examination includes a defense of the dissertation and may be as comprehensive in the major and minor areas as the committee desires to make it. In all decisions the majority opinion of the committee prevails. If the committee is evenly divided, the candidate fails.

If the candidate fails, the committee may recommend to the Graduate Dean the conditions under which the candidate may have another examination. This examination will be administered by as many of the original committee members as are available, plus new members appointed by the Dean to fill vacancies.

If the student passes this examination, he will be recommended for the degree at the next commencement, provided one academic year has elapsed since the qualifying examination.

COMBINED MEDICAL AND GRADUATE STUDIES

The student who wishes to combine studies toward an M.D. degree and a Ph.D. degree in one of the established programs of the Graduate School must gain admission to both programs. Before applying for admission to the Graduate School the

applicant should consult with the Director of Graduate Study of the graduate area of interest.

Students admitted to combined programs will register both in the College of Medicine and in the Graduate School during each semester in which work applying to both degrees is being taken. Graduate courses (500 level) which are regular parts of the medical curriculum also require dual registration if they are to apply toward the graduate degree. In view of the different grading systems currently employed, instructors of courses requiring dual registration will provide H. P or U grades to the College of Medicine and A, B, C, or E degrees to the Graduate School.

Any student enrolled in the regular medical curriculum will pay the tuition and fees of the College of Medicine. When not enrolled in the regular medical curriculum, he will pay Graduate School in proportion to the amount of graduate work taken.

Requirements for the Degree of Doctor of Education

The requirements for the degree of Doctor of Education are the same as for the degree of Doctor of Philosophy with the following exceptions:

1. No foreign languages are required for the Ed.D. degree.
2. A minimum of 72 credit hours is required beyond the baccalaureate with a distribution providing for:
   a. Completion of at least 21 credit hours within a single area of concentration. (See section on Education for options.)
   b. At least 18 additional credit hours in supporting departments within the College of Education, with a minimum of six hours in each of two departments outside the area of concentration.
   c. At least 24 credit hours in disciplines outside the College which are supportive to the area of concentration.
   d. A minimum of nine credit hours in research tool studies appropriate for this program.
3. Applicants shall declare at least one area outside of the College of Education areas of concentration at the time their special committees are appointed in order to facilitate the appointment of two committee members from outside the College.

The Committee on Graduate Admissions and Standards of the College of Education and the Graduate Dean will evaluate credits and residence to be allowed transfer students. It is understood, however, that the special committee may accept only such courses as contribute to the graduate program of the student.

JOINT-DOCTORAL PROGRAMS WITH OTHER UNIVERSITIES

Doctoral programs in education are offered jointly between the University of Kentucky and the other state universities: Eastern, Morehead, Murray, and Western. These programs permit qualified candidates to complete approximately one year of graduate work above the master's degree at the cooperating university. A minimum of 18 credit hours of course work, the qualifying examination and the dissertation must be completed at the University of Kentucky, and a minimum of one academic year must be spent in full-time residence on the Lexington campus. The work of each candidate is directed by a joint faculty committee from both institutions.

Persons interested in these programs should confer with the Dean of the Graduate School at the cooperating university, or the Coordinator of Graduate Studies in Education at the University of Kentucky. Applications may be filed for review by a joint screening committee. Admission will depend upon academic standing, scores on standardized examinations, and personal references.

There are available joint programs in Musicology and Pharmacology between the University of Kentucky and the University of Louisville. Inquiry should be made to the Director of Graduate Study at the University of Kentucky.

Requirements for the Degree of Doctor of Musical Arts

The requirements for the degree of Doctor of Musical Arts are the same as for the Doctor of Philosophy, with the following exceptions:

1. Only one foreign language, normally French or German, is required for the D.M.A. degree. The candidate must also demonstrate a working knowledge of musical terms in French, German, and Italian prior to the qualifying examination.
2. The applicant for this degree must have at least two years of successful teaching experience.

Further information concerning prerequisites and courses of study can be found in the section entitled Graduate Courses of Study, The Degree of Doctor of Musical Arts.

The Director of Graduate Study of the Department of Music and the Graduate Dean will evaluate credits and residence to be allowed transfer students. It is understood, however, that the special committee may accept only such courses as fit into the graduate program of the student.

Requirements for the Degree of Doctor of Business Administration

The requirements for the degree of Doctor of Business Administration are the same as for the degree of Doctor of Philosophy with the exception that no foreign languages are required for the DBA degree.

The Doctor of Business Administration is designed primarily for students interested in teaching and research. It focuses on administrative science and requires additional work in research methodology, economic theory, and quantitative analysis.

Major and minor fields may be selected from Accounting, Finance, Management and Organizational Behavior, Management Science, and Marketing. Further information concerning prerequisites and courses of study can be found in the Business and Economics section, the Degree of Doctor of Business Administration.

Requirements for the Degree of Specialist in Education

The degree of Specialist in Education is conferred upon a candidate who satisfactorily completes a sixth-year planned program in education under the general requirements of the Graduate School and the following special requirements:

Admission

The student, prior to admission to the program, must (1) have a master's degree, (2) ordinarily have a standing of 3.4 or higher on his graduate work, (3) meet the requirements for a teaching certificate or have credentials appropriate to his field of specialization, and (4) have at least 30 credit hours in courses in education (undergraduate and graduate).

A student must file an application with the Dean of the College of Education. The application will be considered by an admissions committee of the College of Education and each student must be recommended to the Graduate School by the division or department in which he plans to major.

Program

The student must earn a minimum of 30 credit hours of graduate work beyond the master's degree, of which at least 15 must be in courses numbered 600 or above.

The division or department in which the student majors is responsible for helping the student plan a program to meet his needs. The program should contribute to specialization in a field but should not neglect the broader development of the individual.

The student must complete an independent research problem (equal to three but not to exceed six credit hours) and submit a written report, a copy of which is to be filed with the division or department directing the research.

With the approval of the Graduate Dean and of the division or department in which he is to major, the student may transfer a maximum of six hours of residence credit earned beyond the master's degree from an institution which is approved to offer work above the master's level.

Final Examination

The final examination required of all candidates is administered by an examining committee consisting of at least three qualified members recommended by the adviser and the director of graduate study and appointed by the Dean of the Graduate School.

Graduate Students Not Applicants for Degrees

Graduate students who are not working toward advanced degrees are not required to designate major or minor subjects, but may elect their work with a view to the special purposes for which they are in attendance at the University.

Any course of study announced for advanced undergraduates and graduates is open for election by such students under the same conditions as apply to candidates for degrees.

Should a graduate student who has not taken his work with a view to obtaining a degree subsequently desire to become an applicant for a degree, the number of credit hours he is to receive for work already done will be determined at the time he applies for admission as applicant for the degree.

Research Program at Oak Ridge Associated Universities

The University is one of the sponsoring universities of the Oak Ridge Associated Universities located at Oak Ridge, Tennessee. Through this association, the University of Kentucky has available to it the facilities of the National Laboratories in Oak Ridge and of the research staffs of these laboratories. When masters' and doctoral candidates have completed their course work, it is possible by special arrangement for them to go to Oak Ridge to work on their research problems and prepare their theses. In addition, it is possible for staff members of the University to go to Oak Ridge for varying periods, usually for not less than three months, for advanced study in their particular fields.

Students on Oak Ridge Graduate Fellowships receive stipends which vary according to the number of their dependents and the level of work they are doing. Staff members may work in Oak Ridge on stipends commensurate with their present salary and rank.

Information concerning stipends and other matters may be obtained from the office of the Graduate School or from the Chairman of the University Relations Division of the Oak Ridge Associated Universities, Box 117, Oak Ridge, Tennessee 37831.

Southern Regional Training Program in Public Administration

Since 1945 the University of Kentucky, the University of Alabama, and the University of Tennessee have conducted a joint program in public administration leading to a master's degree. Part of the course work is completed at each institution, and three months of successful internship are required. Detailed information concerning the program may be obtained from the Department of Political Science of the University of Kentucky.

Center For Developmental Change

The Center for Developmental Change (CDC) is a special unit which reflects the efforts of the University of Kentucky to define and attack the contemporary problems of social and economic development.

Developmental change is defined as planned and innovated change, directed toward the attainment of chosen goals. The Center undertakes, promotes and stimulates the study of developmental change. It seeks greater understanding of change processes and more widespread dissemination of the knowledge and skills of application. It is concerned with how better to train people to work on development problems.

CDC correlates certain domestic and international research, action, and training programs. Domestic projects are focused on Kentucky and Appalachia, with regional studies of urban and rural problems. The international projects include technical assistance and education support programs, such as training Peace Corps Volunteers for India and establishing an agricultural center in Northeast Thailand.

The Center seeks to introduce ways of learning systematically about the processes of developmental change into the projects and programs of the appropriate units of the University. To encourage the study of developmental change, the Center provides graduate assistantships and coordinates a Ph.D. minor concentration in developmental change.

Advanced Study and Research by Guests of the University

When appropriate resources are available at the time desired, the President of the University, upon the recommendation of the Dean of the Graduate School and the department affected, will welcome advanced scholars as guests of the University, and will grant the privilege of auditing seminars and research courses and of carrying on research in laboratories and libraries. Normally there will be no charge except for laboratory expenses. Negotiations for such arrangements should be conducted in advance through the Graduate Office.

Nonservice Fellowships Administered by the Graduate School

The University has a limited number of nonservice fellowships available to outstanding graduate students. Forms for making application may be obtained from the Graduate School Fellowship Office and must be submitted not later than February 1 of each year, except that the deadline for the summer fellowship is March 1.

Haggin Fellowships: The fellowships, endowed by Margaret Voorhis Haggin in memory of her father George Voorhis, have a stipend of $2,500 per aca-

demic year. Each has a tenure of one academic year and is competitively renewable.

University of Kentucky Research Foundation Fellowships: The University of Kentucky Research Foundation supports fellowships of $2,500 per academic year, which are competitively renewable.

Dissertation Year Fellowships: One academic year fellowships open to doctoral students who have passed the qualifying examination and will be working on the dissertation. Each fellowship has a stipend of $2,900 per academic year and is not renewable.

Patterson Fellowships in Diplomacy and International Commerce: Patterson Fellowships of $2,500 are available from an endowment established by President James K. Patterson, the first president of the University. Eligibility requires an enrollment in graduate programs of Diplomatic History, International Business, International Politics and Comparative Government, or International Economics. The fellowship stipend is $2,500 per academic year and is competitively renewable.

The Dr. Paul I. Murrill Memorial Scholarship: This scholarship was established by Mrs. Paul I. Murrill in memory of her husband, who was a graduate of the University of Kentucky. It pays a variable stipend of approximately $2,500 a year to a student who possesses outstanding qualities of character and aptitude for graduate work. Preference shall be given to scholars in the field of chemistry.

The Robert N. Jeffrey Fellowships: These fellowships are supported by the Jeffrey Memorial Endowment Fund set up by Mrs. Helen Lasby Jeffrey in honor of her husband, Robert N. Jeffrey, who was formerly Plant Physiologist at the Agricultural Experiment Station. These fellowships pay a stipend of $2,400 to $2,800 and are subject to renewal if the progress of the student is satisfactory. They are open to Ph.D. applicants in all areas of the University concerned with tobacco research. The fellows' dissertation research must apply directly to tobacco.

Summer Fellowships: The fellowships are available on a competitive basis for the two summer months. The stipend is $255, $275, and $295 per month for first, intermediate, and terminal-year students, respectively.

All fellowship recipients pay the same fees as are assessed the residents of Kentucky.

Other Fellowships

The George W. Pirtle Fellowship in Geology: A grant of $1000 a year is given by George W. Pirtle to a graduate student in geology upon the recommendation of the faculty of the Department of Geology. The award is made upon the basis of need and promise of future achievement in the geological field. Mr. Pirtle has set up this grant in appreciation of the training he received in the Geology Department. He was the first student to obtain the master's degree from the University with a major in Geology.

J. Stephen Watkins Foundation Fellowship for Civil Engineering: The Watkins Fellowship, contributed by the J. Stephen Watkins Foundation, carries a stipend of $2,400, and has been offered every other year beginning in 1965.

Automotive Safety Foundation Fellowships for Civil Engineering, with stipend of $3,000.

United States Steel Foundation Fellowship for a graduate student in history. Stipend of $2,400 annually for two years.

Office of Civil Defense Fellowships in Nuclear Science and Engineering with a stipend of $2,200.

Research and Teaching Assistantships

Most departments employ part-time teaching and research assistants whose holders pay the same fees as are assessed the residents of Kentucky. The stipends vary with the departments. Information concerning assistantships may be obtained from the various departments.

Miscellaneous Financial Support

Certain additional moneys supportive of the doctoral programs are available. These include funds to cover travel expenses necessary to dissertation research; certain dissertation costs, e.g., obtaining microfilm, reproducing and mailing questionnaires, etc.; travel expenses incurred in presenting papers based on dissertation research at national meetings; and tuition fees for doctoral students who must attend another institution in order to secure credits essential to the student's program.

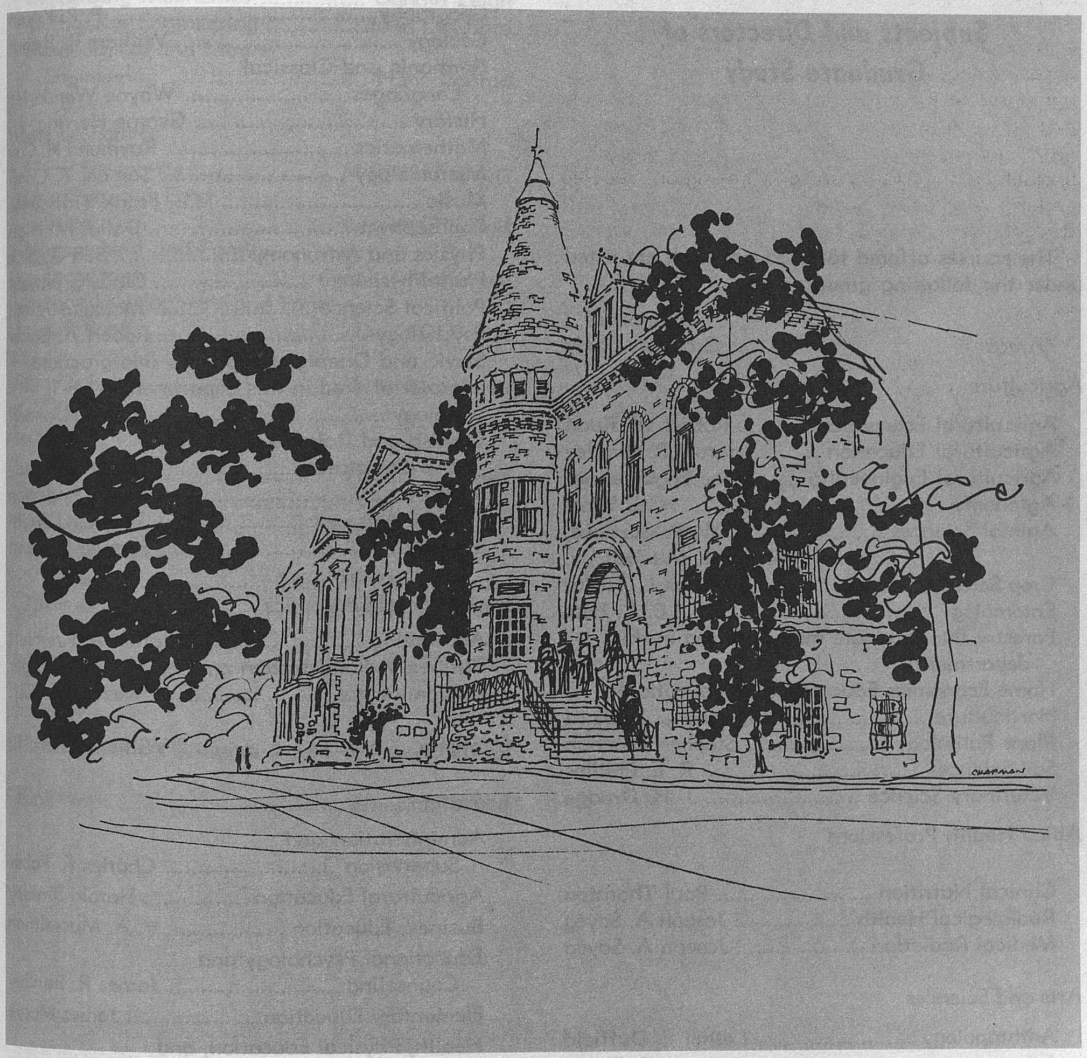
Graduate and Professional Student Association

The Graduate and Professional Student Association (GPSA) was formed in the spring of 1969 to provide a permanent channel for communication between the administration and the graduate and professional students. The Association promotes friendship and the exchange of ideas among stu-

dents of the various disciplines and encourages all graduate and professional students to participate in its activities.

Since its beginning the GPSA has proven itself a responsible organization representing the views of the graduate students of the University. The Association, among other things, has initiated a comprehensive Blue Cross-Blue Shield health insurance plan, obtained a ten percent discount on all purchases at the University Bookstore for teaching and research assistants, established a speaker program, published and distributed an information booklet on the University and Lexington, secured parking privileges for graduate and professional students, circulated a newsletter to keep students abreast of developments in all graduate programs as well as in the Association itself, and inaugurated an annual picnic to bring students and administrators together.

The GPSA is eager to serve all graduate and professional students and welcomes suggestions, criticisms or inquiries from any interested person. Written communications may be addressed to GPSA, P.O. Box 817, University Station, Lexington, Kentucky 40506.



Subjects and Directors of Graduate Study

The courses offered for graduate work are listed under the following groups:

Areas	Directors of Graduate Study
Agriculture	
Agricultural Economics	Robert W. Rudd
Agricultural Education	Harold R. Binkley
Agricultural Engineering	(See Engineering)
Agronomy	A. J. Hiatt
Animal Sciences	W. P. Garrigus, George E. Mitchell, Jr.
Crop Science	Norman L. Taylor
Entomology	B. C. Pass
Forestry	(No graduate major offered in this department)
Home Economics Education	(See Education)
Horticulture	Raymond C. Lockard
Plant Pathology	Stephen Diachun
Soil Sciences	R. E. Phillips
Veterinary Science	J. H. Drudge
Allied Health Professions	
Clinical Nutrition	Paul Thornton
Radiological Health	Joseph A. Sayeg
Medical Radiation	Joseph A. Sayeg
Arts and Sciences	
Anthropology	Lathel F. Duffield
Art	James S. Pierce
Biology	Samuel F. Conti
Botany	Samuel F. Conti
Chemical Physics	Ben Gossick
Chemistry	Robert W. Kiser
Classical Languages	Hubert M. Martin, Jr.
Communications	Robert D. Murphy
Computer Science	Thaddeus B. Curtz
Diplomacy and International Commerce	Vincent Davis
English	Joseph H. Gardner, W. S. Ward, Donald A. Ringe
French Languages and Literatures	Raymond La Charite
Geography	P. P. Karan
Geology	William R. Brown
Germanic and Classical Languages	Wayne Wonderley
History	George Herring, Jr.
Mathematics	Raymond H. Cox
Microbiology	Samuel F. Conti
Music	Frank Traficante
Philosophy	Dallas M. High
Physics and Astronomy	Ben Gossick
Plant Physiology	Claus Grunwald
Political Science	Malcolm Jewell
Psychology	Robert A. Baker
Slavic and Oriental Languages	(No graduate major offered in this department)
Sociology	John O'Donnell
Spanish and Italian Languages and Literatures	Daniel R. Reedy
Statistics	Richard L. Anderson
Theatre Arts	Raymond Smith
Zoology	Samuel F. Conti
Business and Economics	
Accounting	James A. Knoblett
Business Administration	Philip K. Berger
Economics	Richard E. Gift
Dentistry	William R. Proffit
Education	
Administration and Supervision	Charles F. Faber
Agricultural Education	Harold Binkley
Business Education	V. A. Musselman
Educational Psychology and Counseling	James R. Barclay
Elementary Education	James Moore
Health, Physical Education, and Recreation	Donald R. Kirkendall
Higher and Adult Education	Charles F. Elton
Home Economics Education	Marjorie Stewart
Secondary Education	Harry Barnard
Social and Philosophical Studies in Education	David Denton
Special Education	A. Edward Blackhurst

Engineering

Agricultural Engineering ..... Blaine F. Parker
Chemical Engineering ..... Robert B. Grieves
Civil Engineering ..... Don J. Wood
Electrical Engineering ..... Earl L. Steele
Engineering Mechanics ..... Donald Leigh
Mechanical Engineering ..... John Lienhard
Metallurgical and Mining Engineering ..... Hans Conrad

Home Economics

Home Economics ..... Marjorie Stewart
Nutrition and Food Science ..... Leonard Packett
Management and Family Economics ..... Carolyn McKinney
Human Development and Family Relations ..... David C. Payne

Library Science ..... Lawrence Allen

Medicine

Anatomy ..... Harold F. Parks
Biochemistry ..... Fred J. Bollum
Pharmacology ..... Tihamer Z. Csaky
Physiology and Biophysics ..... Fred W. Zechman, Jr.
Toxicology ..... Tihamer Z. Csaky

Nursing ..... Loretta M. Denman

Pharmacy

Pharmaceutical Sciences ..... H. B. Kostenbauder

Social Work ..... Ernest F. Witte

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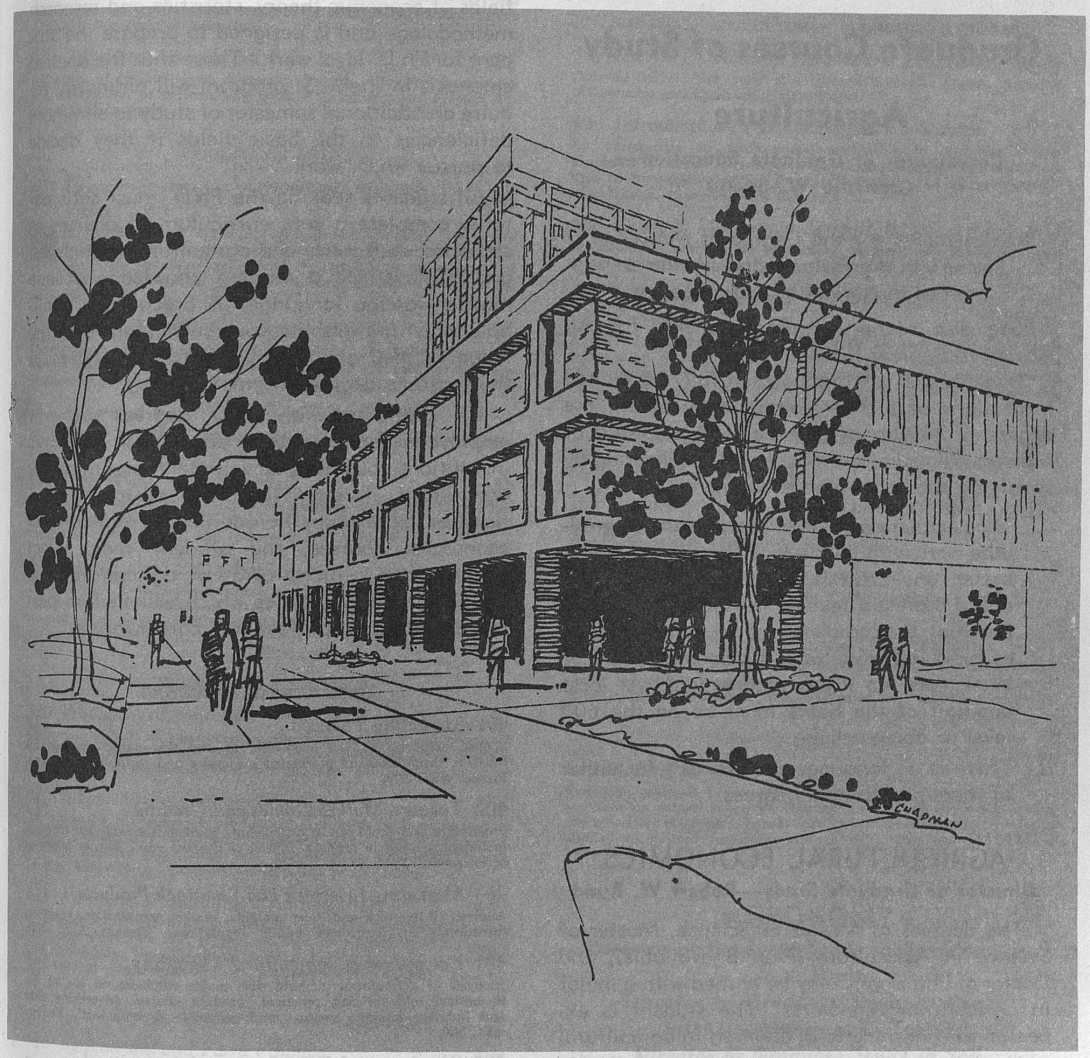

Graduate Courses of Study

Agriculture

Coordinator of Graduate Education—Granville W. Stokes

Requirements for the Degree of Master of Science in Agriculture and Master of Science in Agricultural Engineering

(See also section on Requirements for All Advanced Degrees.)

Students who are graduates of fully accredited institutions of higher learning may obtain the degree of Master of Science in Agriculture or Master of Science in Agricultural Engineering by satisfying the following requirements:

1. The completion of 24 semester hours of graduate work with an average standing of 3.0 or better, and a thesis, or at the option of the major professor (except in Agricultural Engineering), the completion of 36 semester hours of graduate work with a standing of 3.0 or better, and no thesis requirement. At least one-half of the hours must be on the 600 level or above.
2. There is no language requirement for either of these professional degrees.

AGRICULTURAL ECONOMICS

Director of Graduate Study—Robert W. Rudd

The degrees of Master of Science, Master of Science in Agriculture (Plan B available), and Doctor of Philosophy may be earned with a major in agricultural economics. The student is expected to concentrate, in addition to agricultural economics, in economics and subjects relating to research methodology. Those without sufficient background or training are expected to make up deficiencies indicated by the department.

The beginning graduate student is advised to choose between two program emphases, applied or research, according to his career interests. The applied sequence trains the student broadly in subjects that will have a continuing usefulness in business, agricultural program administration, extension, foreign service and the like. It is designed for those who do not plan to undertake Ph.D. programs. The research emphasis in the M.S. program involves more work in the basic fields of economic theory, statistics and research methodology and is designed to prepare the student for Ph.D.-level work. Those with the applied emphasis in the M.S. program will ordinarily require an additional semester of study to eliminate deficiencies in the basic fields if they decide to pursue Ph.D. work.

All students seeking the Ph.D. must satisfactorily complete a core curriculum of courses in statistics, economics and agricultural economics, and demonstrate a reading knowledge of one modern foreign language. A brochure is available which details the core curriculum and the recommended content of the two emphases in the master's degree program.

UK graduates with Ph.D. degrees are now employed in administrative positions in academic institutions, business, government programs for agriculture, foreign technical-assistance positions or extension. In addition to agricultural economics courses, the student may select courses from a broad array of agricultural and social science disciplines which will fit him best for his particular professional career interest.

AGRICULTURAL MARKETING

401 *Marketing Tobacco.* (2)
Special emphasis on the marketing of and the market systems for tobacco. Application of marketing principles and methods to tobacco. Prereq: AEC 300.

402 *Tobacco Market Grades and Grading.* (1)
Procedures and problems in establishing market standards for tobacco, including practice in grading. Prereq or concur: AEC 300, or approval of instructor.

403 *Marketing Livestock and Livestock Products.* (2)
Analysis of livestock and dairy markets; market organization, agencies, institutions, services; and public regulations. Prereq: AEC 300.

501 *Economics of Agricultural Marketing.* (3)
Analysis of agricultural markets with major emphasis on use of the theoretical tools—pricing practices, product choice, advertising firm and industry growth, location and economic development. Prereq: AEC 300.

505 *Structure and Organization of Agricultural Businesses.* (3)
Understanding of the structure and organization of agriculturally related businesses and industries, including cooperatives, and the influence of these on key management decisions by owners and managers of farms, as well as policy and decision-makers in such businesses.

606 *Advanced Agricultural Marketing.* (3)
A critical examination of objectives and results of various types of research in market organization, marketing functions, market management, and price analysis. Prereq: Approval of instructor.

AGRICULTURAL POLICY AND LAND ECONOMICS

540 *Agricultural Policy.* (3)
Historical development of principles underlying agricultural policy; objectives of agricultural policy; appraisal of current and proposed agricultural programs. Prereq: AEC 300.

545 *Land Economics.* (3)
Institutional, technological and physical forces affecting the use of land resources in agriculture. Analysis of problems connected with land tenure, land conservation and transfer of farm real estate. Prereq: AEC 310 or consent of instructor.

640 *Advanced Agricultural Policy.* (3)
Influences of policies upon economic progress, efficiency in resource use, distribution of income, and welfare in agriculture. Prereq: Approval of instructor.

FARM MANAGEMENT

409 *Decision-making in Agricultural Business Firms.* (3)
Analysis of the major types of management problems commonly faced by agricultural business firms, formulation of alternative courses of action with emphasis on sound approaches to solutions and determination of business policy decisions. Prereq: Permission of instructor.

415 *Farm Accounting and Record Analysis.* (3)
Development and analysis of records to farming situations. Interpretation of essential records from a farm manager's viewpoint as a means of improving decision-making. Prereq: AEC 310.

511 *Advanced Farm Management.* (3)
An advanced analysis of management and managing farms. Prereq: AEC 310.

516 *Land Value and Appraisal.* (3)
The capitalization process, and other methods of valuing farm land; appraisal procedures of the Federal Land Banks and other credit institutions. Prereq: AEC 310 or approval of instructor.

518 *Farm Labor Utilization.* (3)
Efficient work method fundamentals as applied to agricultural production, work simplification analysis of specific farm jobs and incentive payment plans for encouraging economic use of farm labor, are studied. Prereq: or concur: AEC 310.

PRODUCTION ECONOMICS

520 *Production Economics.* (3)
Economic analysis of agricultural production. A theoretical treatment of land and capital returns, costs and related functions of agricultural production at an elementary level. Prereq: AEC 310.

620 *Advanced Production Economics I.* (3)
An advanced treatment of production economics with emphasis on flexible product and factor price situations, factor demand functions, multiple product production, and poly-periodic production theory. Prereq: AEC 520 or equivalent and MA 113 or ECO 590.

621 *Advanced Production Economics II.* (3)
A continuation of 620 with emphasis on production function estimation, aggregate production and supply relations, factor distribution theories and implications for agricultural policies and programs. Prereq: AEC 620. Offered even-numbered years. Alternates with AEC 661.

AGRICULTURAL PRICES AND FINANCE

455 *Agricultural and Farm Finance.* (3)
Credit needs of agriculture; problems connected with farm and market agency financing; organization and operation of agricultural credit agencies. Prereq: ECO 260, AEC 310.

550 *Agricultural Prices.* (3)
Price behavior of agricultural products including supply-price relationships and their relation to the general price level. Prereq: ECO 260.

650 *Advanced Agricultural Prices.* (3)
Advanced study of agricultural price behavior by the application of economic theory and statistical analysis. Prereq: Approval of instructor.

ECONOMIC DEVELOPMENT

626 *Agriculture and Economic Development.* (3)
Analytical consideration of the role of agriculture in economic development in relation to over-all development strategy at various stages of growth. Theoretical and policy issues of particular relevance to the agricultural development in underdeveloped agrarian economies with various resource, social, political and economic systems. Prereq: ECO 475 or approval of instructor. (Same as ECO 674.)

GENERAL AGRICULTURAL ECONOMICS COURSES

580 *Special Problems in Agricultural Economics.* (1-3)
Directed independent study of a selected problem. Prereq: Approval of instructor and chairman of department.

590 *Introduction to Mathematical Economics.* (3)
An introduction to mathematical approaches to economic theory. Emphasis on linear models, constrained optimization, and techniques used in comparative statics. Prereq: ECO 361; MA 113; or consent of instructor. (Same as ECO 590.)

660 *Research Methods in Agricultural Economics.* (3)
An analytical examination of research methods and techniques used in agricultural economics. Prereq: Approval of instructor.

661 *Programming Models in Agricultural Economics.* (3)
A study of some programming models useful in Agricultural Economics; includes an examination of the structure of the models themselves, economic interpretation of their components and their use in research in agricultural economics. Prereq: Consent of instructor. Offered odd-numbered years. Alternates with AEC 621.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. Prereq: Consent of adviser and chairman of department. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. Prereq: Consent of adviser and chairman of department. (1-12 credits equivalence.)

770 *Agricultural Economic Seminars.* (0)
Analysis of economic problems which affect agriculture. May be repeated three times.

780 *Special Problems in Agricultural Economics.* (3)
Open to graduate students who have the necessary training and ability to conduct research on a selected problem. Prereq: Approval of chairman of department. May be repeated for a total of nine credits.

RESOURCE ECONOMICS

645 *Natural Resource Economics.* (3)
Economic analysis of resource utilization and development with emphasis on natural resources. Discussion of criteria for public investment, welfare economics, benefit-cost analysis and cost-effectiveness as applied to natural resources. Prereq: ECO 361 and MA 113 or ECO 590.

AGRONOMY

Director of Graduate Study in Agronomy—A. J. Hiatt
Director of Graduate Study in Crop Science—Norman L. Taylor
Director of Graduate Study in Soil Sciences—R. E. Phillips

The Department of Agronomy offers graduate work leading to the Master of Science, Master of Science in Agriculture, and Doctor of Philosophy degrees with majors in Crop Science or Soil Science. Work leading to advanced degrees must conform to the general rules and regula-

tions of the Graduate School, except that a reading knowledge of one modern foreign language is required for the Ph.D. degree. The department permits use of Plan A or Plan B to satisfy the requirements for the M.S. degree.

The Department of Agronomy also participates in an interdepartmental graduate program leading to the Ph.D. degree with a major in plant physiology.

GENERAL COURSES

400 *Senior Seminar.* (1)
The collection, organization, written preparation, and oral delivery of scientific information concerning topics of interest in agronomy. Discussion, one hour. Prereq: Senior standing in Agronomy.

554 *Advanced Crop Science.* (3)
Discussion of physiological aspects associated with crop growth and production with emphasis on plant growth and maturation, dry matter production, and components of yield and yield quality. Prereq: AGR 206 and BOT 501 or consent of instructor.

556 *Seed Technology.* (3)
Advanced study of seed formation, development, viability and longevity; techniques of seed quality germination; principles of producing, processing and storage of varietally pure crop seeds. Lecture, two hours; laboratory, two hours. Prereq: AGR 406.

560 *Soil-Plant Relationships.* (3)
The soil-plant system with emphasis on the soil as an environment for plant roots; nutrient requirements of plants; and nutrient behavior in soils. Prereq: AGR 206 and 366, or consent of instructor.

599 *Special Problems in Agronomy.* (1-4)
May be repeated for a maximum of nine credits. Prereq: Consent of instructor.

620 *Genetic Structure of Populations.* (3)
A discussion of the development, theory and practice of experimental and theoretical population genetics, including the basic dynamics and integrating properties of populations, factors which produce changes in populations and their effects on population structure and evolution. Prereq: An introductory course in genetics and in statistics, and consent of instructor. (Same as BIO 620.)

658 *Advanced Weed Science.* (3)
Taxonomical, ecological, physiological, chemical and biochemical aspects of cultural and chemical weed control, and herbicide toxicity and selectivity. Prereq: AGR 404 or equivalent, one plant physiology course, one biochemistry course or consent of instructor.

666 *Advanced Plant Breeding.* (3)
Advanced study of gene action in commonly used plant breeding procedures, expansions and modifications of existing plant breeding procedures and new approaches to solution of plant breeding problems. Prereq: AGR 406, STA 670, or consent of instructor.

678 *Statistical Genetics.* (3)
Statistical approaches to the analysis of quantitative inheritance; definition and estimation of genetic parameters relating to selection; inbreeding theory; random-mating and inbred populations; testing and planning in genetic experiments. Prereq: STA 674 and BIO 620 or consent of instructor. (Same as STA 678 and BIO 678.)

768 *Residence Credit for Master's Degree.* (0)
(1-6 credits equivalence.) May be repeated once.

769 *Residence Credit for the Doctor's Degree.* (0)
(1 to 12 credits equivalence.) May be repeated indefinitely.

770 *Agronomy Seminar.* (1)
Reports and discussion of problems and investigations of problems in soils, crops and plant pathology. May be repeated for a maximum of four credits.

799 *Research in Agronomy.* (1-4)
May be repeated for a maximum of 12 credits. Prereq: Consent of instructor.

COURSES IN CROP SCIENCE

404 *Weed Science.* (3)
Identification, dissemination, growth, and ecology of weeds; techniques and principles of cultural and chemical weed control. Lecture, two hours; laboratory, three hours. Prereq: AGR 206 or consent of instructor.

406 *Plant Breeding.* (3)
The application of genetic principles to the improvement of crop plants. Methods and techniques used in breeding self-and cross-pollinated species. Release, distribution and the maintenance of genetic purity of improved varieties. Prereq: AGR 206, 360, or consent of instructor.

408 *Tobacco.* (3)
History, botany, pathology, entomology, breeding, and culture of tobacco with special emphasis on burley. Lecture, two hours; laboratory, two hours. Prereq: AGR 206 or consent of instructor.

412 *Grain Crops.* (3)
A study of the grain crops of the world in respect to adaptation, culture and uses. Lecture and recitation, two hours; laboratory, two hours. Prereq: AGR 206 or consent of instructor.

502 *Ecology of Economic Plants.* (3)
Critical study of the response of economic plants to natural and man-modified environment. Two lectures and one two-hour laboratory period each week. Prereq: BOT 101 and AGR 206, or consent of instructor.

510 *Ecology and Utilization of Grasslands.* (4)
Critical study of grassland plants and the biological and physical factors operative in utilization of natural and cultivated grasslands by domestic animals. Lecture, three hours; laboratory, two hours. Prereq: BIO 201 and 203, or consent of instructor.

630 *Experimental Techniques in Plant Physiology.* (3)
Presentation of theory and experimental techniques for the study of chemical constituents by centrifugation, chromatography, spectroscopy and electrometry. Discussion of methods and design to culture, sample and prepare plant material for use in physiological experiments. Two class hours per week; laboratory three hours. Prereq: BOT 501, CHE 232, 233, or consent of instructor. (Same as BIO 630.)

730 *Grassland Research.* (3)
The conduct and interpretation of grassland experiments with emphasis on pasture research and the plant-animal complex. Prereq: Approval of instructor.

732 *Mineral Nutrition of Plants.* (3)
Discussion of accumulation, translocation, and utilization of mineral elements by higher plants. Emphasis will be placed on the relationships between these processes and plant metabolism. Prereq: BOT 701 or BCH 515 or consent of instructor. (Same as BOT 732.) (Same as HOR 732.)

734 *Physiology of Growth and Development.* (3)
A critical evaluation of research in selected aspects of plant growth and development. Emphasis will be on effects of growth environment. Prereq: BOT 701 or consent of instructor. (Same as BOT 734.) (Same as HOR 734.)

736 *Phylogeny of Cultivated Plants.* (3)
Lecture and discussion of concepts and experimental techniques concerned with the origin and phylogeny of cultivated plant species. Lecture, two hours; laboratory, two hours per week. Prereq: AGR 506, BIO 620 or consent of instructor. (Same as HOR 736.)

COURSES IN SOIL SCIENCE

468 *Soil Conservation and Management.* (3)
The application of principles of conservation in planning the use and management of land and associated resources. Prereq: AGR 366 or consent of instructor.

470 *Fertilizers and Soil Fertility.* (3)
Sources and manufacture of fertilizer materials; soil reaction of elements essential for plant growth; effective use of fertilizers for various soil situations. Prereq: AGR 206 and 366 or consent of instructor.

473 *Soil Morphology and Mapping.* (3)
Study of concepts of soil horizons and soil profiles, and the chemical, physical and mineralogical parameters useful in this characterization. Use of soil survey equipment, preparation of soil maps, and development of a land use plan for an assigned area. Prereq: AGR 366, 367 and GLY 140 or consent of instructor.

562 *Forest Soils.* (3)
The physical, chemical and biological properties of soils as they relate to forest tree growth and the forest community. A study of the genesis, morphology, classification and utilization of soils for forestry. Prereq: AGR 366 and approval of instructor. (Same as FOR 562.)

566 *Soil Biology.* (3)
The nature and biochemical activities of soil microflora; their significance in soil genesis and structure and their role in soil fertility. Lecture, two hours; laboratory, two hours. Prereq: AGR 366, MB 200.

575 *Soil Physics.* (4)
Physical properties of soils and their relationship to chemical, mineralogical, and biological soil properties and to plant growth. Lecture and discussions, three hours; laboratory, two hours. Prereq: AGR 366 and approval of instructor.

581 *Chemical Analysis of Soils and Plants.* (4)
Laboratory emphasis on instrumental methods and techniques used in quantitative and qualitative chemical analysis of soil and plant materials and relation of these analyses to physical, chemical and biological systems. Lecture, one hour; discussion, one hour; laboratory, four hours. Prereq: AGR 366 or equivalent, or consent of instructor.

652 *Soil Classification and Geography.* (3)
A critical evaluation of the concepts of soil classification, with particular reference to the current U.S. scheme. Study of geographic locations and the nature of their soil associations as related to gross considerations of soil genesis. Prereq: AGR 573, 581 or consent of instructor. (Same as GEO 652.)

660 *Advanced Soil Biology.* (2)
A critical evaluation of the current research status in selected aspects of soil biology. Prereq: AGR 566 or consent of instructor.

671 *Soil Chemistry.* (4)
A study of the chemical characteristics of the soil and of the more important chemical processes in the soil. Lecture and discussion, three hours; laboratory, two hours. Prereq: AGR 470, 581; CHE 442, or consent of instructor.

675 *Advanced Soil Physics.* (3)
Relation of physical properties of soil to transfer of water, air, plant nutrient ions, and heat in soil and factors affecting such movement. Prereq: AGR 575, 576, MA 214 and consent of instructor.

681 *Mineralogical and Chemical Analysis of Soils.* (4)
Laboratory emphasis on instrumental methods and techniques used in quantitative and qualitative mineralogical and chemical analysis of soils and relation of these analyses to physical, chemical, and biological systems. Lecture, one hour; discussion, one hour; laboratory, four hours. Prereq: AGR 581 or equiv. or consent of instructor. (Same as GLY 681.)

690 *Topics of Soil Chemistry.* (1-4)
The soil chemistry of plant nutrients, with special emphasis on reactions of nitrogen, phosphorus and potassium in the soil. Soil acidity and alkalinity also are studied in detail. May be repeated for a maximum of six credits. Prereq: Consent of instructor.

691 *Topics in Soil Mineralogy.* (1-4)
Selected topics which may include applied mineralogy, surface chemistry of clays, clay mineral morphology, genesis of soil clays, mineralogy of Kentucky soils, and recent advances in mineralogy. May be repeated to a maximum of six credits. Prereq: Consent of instructor.

712 *Advanced Soil Fertility.* (3)
An integration of the effects of soil, climatic and physiological factors on the nutrition and dry matter accumulation of plants. Lecture and discussion, two hours; laboratory, two hours. Prereq: AGR 570 or consent of instructor.

721 *Soil Genesis.* (3)
Critical study of theories and concepts in soil genesis and their relationships to soil morphology and classification. Analysis of soil properties and soil forming processes responsible for the development of unique soil pedons. Prereq: Consent of instructor.

741 *Clay Mineralogy.* (3)
A comprehensive study of the crystal structures of clay minerals commonly found in soils and sediments. Lecture and discussion, two hours; laboratory, two hours. Prereq: GLY 212 and 213, AGR 581, 681 or equivalent or consent of instructor. (Same as GLY 741.)

COURSES IN BOTANY

(May be used for agricultural credit, subject to the approval of adviser).

501 *Plant Physiology.* (3-5)
See course description under Botany.

634 *Cytogenetics.* (4)
See course description under Botany.

701 *Plant Metabolism.* (3)
See course description under Botany.

ANIMAL SCIENCES

Directors of Graduate Study—W. P. Garrigus, George E. Mitchell, Jr.

The degrees of Master of Science, Master of Science in Agriculture and Doctor of Philosophy are available with majors in animal sciences. Masters' degrees are awarded under either Plan A or Plan B. Programs in the department are divided into the disciplinary areas of Animal Foods, Animal Nutrition, and Genetics and Physiology. Special interests in beef cattle, dairy cattle, horses, poultry, sheep, swine, meats, animal behavior, dairy technology and dairy microbiology may be pursued within these areas.

Candidates for the Ph.D. degree are required to have a reading knowledge of one modern foreign language and to declare a minor outside the department. On approval of the student's special committee, a minimum of 12 credits in not more than two departments may be substituted for the minor.

404 *Sheep Science.* (3)
History and importance of the sheep industry; selection, breeding, feeding, and management of sheep for lamb and wool production. Lecture, two hours; laboratory, two hours. Prereq: GEN 106, ASC 280.

406 *Beef Cattle Science.* (3)
Scope and importance of the beef cattle industry; selection, breeding, feeding and management of beef cattle. Lecture, two hours; laboratory, two hours. Prereq: GEN 106, ASC 280.

408 *Swine Science.* (3)
History and importance of the swine industry; selection, breeding, feeding, and management of swine. Lecture, two hours; laboratory, two hours. Prereq: GEN 106, ASC 280.

410 *Horse Sciences.* (3)
Detailed study of nutrition, reproductive physiology, equine psychology, diseases and parasites, and animal breeding programs as these relate to horse production, management and training. Relationships between anatomy, athletic ability and unsoundnesses. Lecture, two hours; laboratory, two hours. Prereq: ASC 202, ASC 280, ASC 360, VS 351.

412 *Advanced Horse Husbandry.* (3)
Housing, facilities, animal management, equine control and transportation, agronomic practices, economics and marketing, records, and legal implications applied to commercial horse production. Advanced training techniques for young horses. Exhibition and evaluation of horses. Lecture, two hours; laboratory two hours. Prereq: ASC 410.

420 *Dairy Cattle Science.* (2-3)
Feeding and management of dairy cattle contributing to profitable production of quality milk. Lecture, two hours; laboratory, two hours. Prereq: GEN 106 and ASC 280 or consent of instructor.

436 *Dairy Processing and Plant Management.* (6)
Methods used for processing milk, butter, ice cream, cheese, and concentrated milks; fundamentals of dairy plant management. Lecture, two hours; laboratory, eight hours. Prereq: ASC 335.

442 *Poultry Science.* (3)
A general study of avian anatomy, physiology, embryology, genetics and nutrition in relation to modern technology and management. Special emphasis on feed formulation, disease prevention, environmental control and product technology. Lecture, two hours; laboratory, two hours. Prereq: GEN 106.

460 *Animal Breeding.* (3)
The application of genetic principles to the improvement of farm animals. Phenotypic and genetic relationships among economic traits as well as modes of inheritance and methods of measuring the traits. The role of inbreeding, outbreeding and selection methods in producing genetically superior population for dairy cattle, poultry, meat animals and horses. (Equivalent of ASC 360 may be substituted.) Prereq: ASC 360.

526 *Reproduction in Dairy Cattle.* (2)
A study of male and female reproductive processes in dairy cattle and the application of artificial breeding to the improvement of dairy herds. Lecture, one hour; laboratory, two hours. Prereq: GEN 106, ASC 360, or consent of instructor.

530 *Animal Food Microbiology.* (4)
Enumeration, identification and classification of microorganisms important in the dairy, meat, poultry and egg industries. Means of entrance, effect of growth and methods of limiting growth of microorganisms in these foods. Lecture, two hours; laboratory, four hours. Prereq: MB 200 or 400 or consent of instructor.

532 *Advanced Animal Food Microbiology.* (5)
Microbial principles as applied to production, processing, handling and distribution of dairy, meat, poultry and egg products. The utilization of microorganisms in the manufacture of food products. Microorganisms and toxins involved in food-born illness. Students will isolate and identify selected microorganisms from foods. Lecture, three hours; laboratory, four hours. Prereq: ASC 530 or equivalent.

534 *Principles of Dairy Technology.* (4)
Chemical and physical characteristics of dairy products; chemical, physical, and physico-chemical principles involved in dairy processing; special methods of analysis. Lecture, one hour; laboratory, six hours. Prereq: MA 113, CHE 236, ASC 335.

562 *Advanced Genetics.* (3)
Concerned chiefly with the physical basis of heredity, mutations, chromosomal aberrations, linkage, genetics and development, and reports on current literature. Prereq: ASC 360 or equivalent.

564 *Milk Secretion.* (3)
Anatomy of the mammary gland, physiology and biochemistry of milk secretion and management factors affecting yield and composition of milk. Prereq: ASC 280, VS 350.

580 *Principles of Animal Nutrition.* (3)
The chemistry and physiology of animal nutrition and the nutritive requirements for growth, fattening, reproduction, lactation, and other body functions. Prereq: CHE 236 or equivalent.

600 *Methods and Techniques in Animal Sciences.* (3)
A study of statistical methods and techniques applicable to animal research including selection of experimental material, allocation techniques, design, analysis and interpretation of results and a critical review of existing investigations. Prereq: STA 670 required and STA 674 desirable.

630 *Advanced Meat Science.* (4)
Advanced meat science with special reference to the histological, chemical, physical and microbiological properties as they relate to meat quality, organoleptic acceptability and processing procedures. Three lecture hours, two laboratory hours per week. Prereq: ASC 304, 306 or equivalent; one course in Histology or Biochemistry or consent of instructor.

660 *Physiology of Reproduction.* (3)
Physiological processes of reproduction in farm animals, gonadal functions, endocrine relationships, fertility, and factors affecting reproductive efficiency. Prereq: VS 350, ASC 460.

662 *Population Genetics.* (3)
Introduction to principles of static and dynamic populations; statistical concepts and tools applied to quantitative inheritance. Prereq: ASC 360, 460 and STA 670 or equivalent.

664 *Advanced Animal Breeding.* (3)
Specialized phases of genetics, selection, mating systems and population parameters applicable to synthesis of breeding programs for animal improvement. Prereq: ASC 360, 460 and STA 670 or equivalent.

680 *Laboratory Methods in Animal Nutrition and Meats.* (4)
The use of laboratory techniques and equipment in the solution of fundamental problems of nutrition and meats. Lecture and recitation, one hour; laboratory, six hours. Prereq or concur: ASC 580.

682 *Nutrient Metabolism.* (5)
Introduction to history, principles and present concepts of ruminant and non-ruminant mineral nutrition. Prereq: One course in introductory nutrition, physiology or biochemistry and consent of instructor.

684 *Advanced Ruminant Nutrition.* (3)
Introduction of principles of ruminant metabolism in the utilization of feedstuffs for meat, milk, and wool production. Prereq: One course in nutrition, physiology, or biochemistry and consent of instructor.

686 *Advanced Non-ruminant Nutrition.* (3)
A study of nutrient utilization as influenced by digestion, absorption and metabolism, with special emphasis on non-ruminant species. Prereq: One course each in Nutrition and Biochemistry.

688 *Equine Nutrition.* (2)
Detailed study of anatomical, physiological and microbiological factors influencing the nutritive requirements of the equine for maintenance, growth, reproduction, lactation and work. Prereq: One course in Nutrition and Physiology or Biochemistry or consent of instructor.

768 *Residence Credit for the Master's Degree.* (0)
(1-6 credits equivalence.) May be repeated once.

769 *Residence Credit for the Doctor's Degree.* (0)
(1-12 credits equivalence.) May be repeated indefinitely.

771 *Animal Science Seminar.* (1)
May be repeated twice for a total of three credits.

780 *Special Problems in Animal Derived Foods.* (1-4)
May be repeated for a maximum of nine credits. Prereq: Consent of graduate adviser.

781 *Special Problems in Genetics or Physiology.* (1-4)
May be repeated to a maximum of nine credits. Prereq: Consent of graduate adviser.

782 *Special Problems in Animal Nutrition.* (1-4)
May be repeated to a maximum of nine credits. Prereq: Consent of graduate adviser.

790 *Research in Animal Derived Foods.* (1-6)
Problems involving original investigation. May be repeated for a total of nine credits. Prereq: Consent of graduate adviser.

791 *Research in Genetics or Physiology.* (1-6)
Problems involving original investigation. May be repeated for a total of nine credits. Prereq: Consent of graduate adviser.

792 *Research in Animal Nutrition.* (1-6)
Problems involving original investigation. May be repeated for a total of nine credits. Prereq: Consent of graduate adviser.

ENTOMOLOGY

Director of Graduate Study—B. C. Pass

The Department of Entomology offers graduate work leading to the Master of Science, Master of Science in Agriculture, and the Doctor of Philosophy degrees. Individual graduate programs are planned by the student in consultation with his adviser and the director of graduate study. Study and research are available in various areas of entomology including applied entomology, behavior, biological control, host plant resistance, insect biology and ecology, insect nutrition, pathology, immature insects, medical and veterinary entomology, physiology, taxonomy, toxicology, and acarology. A reading knowledge of one modern foreign language is required for the Ph.D. degree.

500 *Economic Entomology.* (3)
For those interested in agricultural teaching and extension work. Life history, control, and identification of economic insects of Kentucky are considered.

530 *Applied Entomology.* (3)
Principles of insect damage, populations and distributions. Various types of natural and applied control, including problems of insecticide toxicity, resistance and residues. Prereq: ENT 100.

532 *Medical Entomology.* (4)
Study of arthropod vectors of disease. Structure, collection, identification, control measures and life history studies. Given alternate years. Prereq: ENT 534 or consent of instructor. (Same as ZOO 532.)

542 *Insect Taxonomy.* (4)
Methods and principles of systematic entomology and zoology; characteristics of taxonomic categories; and international rules of zoological nomenclature. Collection, preparation and identification of insect specimens. Lecture, two hours; laboratory, four hours. Prereq: ENT 100, and ZOO 104 or BIO 200-202. (Same as ZOO 542.)

545 *Parasitology.* (4)
Protozoan, helminth and arthropod parasites of man and domestic animals, emphasis on etiology, epidemiology, methods of diagnosis, control measures and life histories. Techniques for host examination and preparation of material for study. Prereq: ZOO 104 or BIO 200-202. (Same as ZOO 545.)

595 *Independent Work.* (2-3)
Special problems for individual students who are capable of pursuing independent investigations in the various areas of entomology. Prereq: ENT 100 and any two of the following: ENT 530, 532, or 650.

602 *Insect Morphology.* (4)
A study of internal and external insect structure, including function, and variation of form. Lecture, two hours; laboratory, four hours. Prereq: ENT 100 and consent of instructor. (Same as ZOO 602.)

606 *Insect Toxicology.* (3)
Toxic action of insecticides; preparation, use, and analysis of insecticides; residues; analytical methods in insect toxicology. Lecture, two hours; laboratory, two hours. Prereq: Consent of instructor.

610 *Insect Ecology and Behavior.* (3)
The biotic and physical factors influencing the distribution, abundance, and behavior of insects and insect populations. Two class hours and two laboratory hours per week. Prereq: Consent of instructor. (Same as ZOO 610.)

612 *Principles of Animal Systematics.* (3)
Theory and practice of animal classification, with study of applications of the International Code of Zoological Nomenclature. Prereq: At least two advanced survey courses in Zoology and/or Entomology, for example, ZOO 530, 570, 598, 611 or ZOO/ENT 620. (Same as ZOO 612.)

620 *General Acarology.* (4)
Introduction to study of mites. Classification, morphology, physiology and ecology of mites important to the medical, veterinary and agricultural fields. Lecture, two hours; laboratory, four hours. Prereq: BIO 200-202, ENT 100, ZOO 104 and consent of instructor. (Same as ZOO 620.)

630 *Insect Physiology.* (4)
Principles of insect physiology, function of organs, circulation, reproduction, respiration, and digestion. Lecture, two hours; laboratory, four hours. Prereq: Consent of instructor. (Same as ZOO 630.)

650 *Advanced Applied Entomology.* (3)
Bionomics of insects; respresentative insecticides, their characteristics, formulation, scope of use, safety factors, and methods of application. Lecture, two hours; laboratory, two hours. Prereq: ENT 100 or 500.

660 *Immature Insects* (4)
Bionomics, structure, and classification of immature stages of insects; practice in their identification. Two class hours, four laboratory hours per week. Prereq: ZOO 570 or ENT 542, or consent of instructor.

670 *Experimental Methods in Entomology.* (4)
The principles and techniques of instrumentation in entomological research with emphasis on problem selection and the collection, evaluation, and presentation of data. Two class hours, four laboratory hours per week.

680 *Biological Control of Insects.* (3)
The history and principles of biological control and of integrated programs for insect control. The use of parasites, predators, pathogens, host resistance, electro-magnetic energy, phenomenes, and their interactions with insecticide control programs will be discussed. Prereq: Consent of instructor.

768 *Residence Credit for the Master's Degree.* (0)
(1-6 credits equivalence.) May be repeated once.

769 *Residence Credit for the Doctor's Degree.* (0)
(1-12 credits equivalence.) May be repeated indefinitely.

780 *Entomological Problems.* (2-3)
Investigations of chosen insect problems, including original work. Discussion and assignment of current insect subjects. May be repeated once for a maximum of six credits. Prereq: ENT 100, 768.

781 *Entomological Seminar.* (1)
Discussion of current research problems in entomology. May be repeated five times for a total of six hours.

FORESTRY

At present no graduate majors are offered in Forestry.

400 *Wood Identification and Properties.* (3)
General anatomy of wood, identification of commercial species of the United States based on gross and miscroscopic features. Properties and uses. Lecture, two hours; laboratory, two hours. Prereq: FOR 100, BIO 200; and approval of instructor.

405 *Mechanics and Physics of Wood.* (3)
Elastic behavior and mechanical properties of wood. Liquid movement, thermal, electrical and accoustical properties of wood. Lecture, two hours; laboratory, two hours. Prereq: FOR 400.

412 *Forest Economics.* (3)
Social and economic values of forests; forest resources and demand for forest products; influencing factors and operation and planning of the forestry economy. Prereq: ECO 260.

415 *Wood Seasoning and Preservation.* (3)
Principles and methods involved in air and kiln drying of wood; kiln design and operation. Agencies causing disintegration of wood, factors affecting penetration and absorption of preservative solutions in wood, wood preservatives and processes, plant equipment design and operation and economic considerations.

420 *Forest Products.* (3)
Sources, processing and utilization of forest products other than lumber.

425 *Forest Photogrammetry.* (3)
Use of aerial photographs in land and topographic mapping, forest type delineation. Lecture, two hours; laboratory, two hours per week. Prereq: FOR 300 and 310.

430 *Forest Wildlife and Range Management.* (3)
Principles and practices governing the management of the forest and adjacent range for wildlife habitat. Problems of grazing domestic animals on forest land. Three class hours per week with occasional extended field trips. Prereq: FOR 350 or approval of instructor.

435 *Forest Tree Physiology.* (3)
The fundamental principles of tree physiology with particular reference to the growth and development of forest species, and consideration of the influence of genetic and environmental factors on physiological processes in forest trees. Prereq: Approval of instructor.

440 *Forest Resources for Recreation.* (3)
Study of resource-oriented recreation in the forest. The recreational development of forest lands and waters and basic recreation management policies and principles. Three class hours per week with occasional extended field trips. Prereq: Full senior standing.

450 *Senior Seminar in Forestry (Proseminar).* (2)
Professional seminar in forestry. Discussion of current issues and the application of current forestry principles to actual practice. Prereq: Full senior standing (Forestry).

460 *Forest Watershed Management.* (3)
Principles and techniques involved in forest watershed management as related to the water resource. The influence of forestry practices on water movement into and through the watershed, water storage, water loss, vegetation and water yields, and water quality. Lecture, two hours; laboratory, two hours per week. Prereq: AGR 366; FOR 350, or permission of instructor.

562 *Forest Soils.* (3)
The physical, chemical, and biological properties of soils as they relate to forest tree growth and the forest community. A study of the genesis, morphology, classification and utilization of soils for forestry. Prereq: AGR 366 and approval of instructor. (Same as AGR 562.)

GENERAL AGRICULTURE

501 *Principles of Cooperative Extension.* (3)
Philosophy, history and development of Cooperative Extension Service; evaluation of instructional techniques; leadership training; and practice in use of extension methods. Open to junior, senior and graduate students.

HORTICULTURE

Director of Graduate Study—
Raymond C. Lockard

The Department of Horticulture offers graduate work leading to the Master of Science in Agriculture degree. Degrees are awarded primarily under Plan A, but they can be awarded under Plan B with prior approval. The study and research program may relate to Pomology, Vegetable Crops, Floriculture, Ornamentals or Landscape Horticulture. Research problems are normally related to the discipline of genetics, physiology or landscape design.

Students interested in working toward a Doctor of Philosophy degree may develop a program that relates to their commodity interest through the interdepartmental Plant Physiology or Crop Science programs. These programs emphasize study and research in one or more of the basic science disciplines.

402 *Pomology: Deciduous Fruits I.* (3)
A detailed study of the care and management of commercial plantings of deciduous fruits (both small and tree). Lecture, two hours; laboratory, two hours. Prereq: A course in botany.

440 *Landscape Construction.* (3)
A study to relate the aesthetics of landscape design to physical problems involving drainage, grading, surfacing, simple structures and materials and the use of specifications for landscape design. Two class hours; two laboratory hours per week.

502 *Pomology: Deciduous Fruits II.* (3)
A course dealing with the theory of plant growth and fruit development in deciduous fruits (both small and tree fruits). Prereq: HOR 402, or consent of instructor.

510 *Vegetable Crops.* (3)
A study of the fundamental principles underlying commercial production of vegetables. Lecture, two hours; laboratory, two hours. Prereq: AGR 366. Offered in fall of odd-numbered years.

512 *Greenhouse Vegetable Crops.* (3)
Principles of vegetable crop production in environmentally controlled growing structures; methods for controlling the environment; vegetable crops adapted to greenhouse production. Lecture, two hours; laboratory, two hours.

515 *Turf Management.* (3)
Types of grasses used for turf; basic and applied principles of turf culture as they relate to the various phases of the turf industry, i.e., ornamental horticulture, landscaping, sod nurseries, golf courses and athletic fields, parks and highways. Lecture, two hours, laboratory, two hours. Prereq: One course in Botany and one course in Soil Science. Offered fall of odd-numbered years.

522 *Landscape Planting Design.* (3)
A detailed study of the use of various plant materials to express the principles of landscape design. Lecture, two hours; laboratory, two hours. Prereq: HOR 331, 527.

524 *Floriculture II.* (3)
A detailed study of specific groups of florists' crops, with particular reference to methods of control of flowering and growth. Lecture, two hours; laboratory, two hours. Prereq: HOR 335.

525 *Plant Propagation.* (3)
A detailed study of the methods of propagating certain horticultural plants. Includes cuttings, grafting, and budding. Lecture, two hours; laboratory, two hours. Prereq: One course in Botany. Offered fall of even-numbered years.

570 *Landscape Design of Park and Recreation Areas.* (3)
A study of standards, principles, and procedures of planning and design for recreational needs with emphasis on resource development for human use. Lecture, one hour; studio, four hours. Prereq: HOR 331 or permission of instructor. (Same as HPR 570.)

732 *Mineral Nutrition of Plants.* (3)
Discussion of accumulation, translocation, and utilization of mineral elements by higher plants. Emphasis will be placed on the relationship between these processes and plant metabolism. Prereq: BOT 701 or BCH 515 or consent of instructor. (Same as BOT 732, AGR 732.)

734 *Physiology of Growth and Development.* (3)
A critical evaluation of research in selected aspects of plant growth and development. Emphasis will be on effects of growth environment. Prereq: BOT 701 or consent of instructor. (Same as BOT 734, AGR 734.)

736 *Phylogeny of Cultivated Plants.* (3)
Lecture and discussion of concepts and experimental techniques concerned with the origin and phylogeny of cultivated plant species. Lecture, two hours; laboratory, two hours per week. Prereq: AGR 506, BIO 620 or consent of instructor. (Same as AGR 736).

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

770 *Seminar.* (1)
May be repeated twice for a total of three credits.

782 *Special Problems in Horticulture.* (1-4)
This course is designed to meet the need for advanced work. May be repeated for a total of 12 credits. Prereq: Approval of instructor.

790 *Research in Horticulture.* (1-4)
May be repeated to a maximum of nine credits. Prereq: Approval of instructor.

PLANT PATHOLOGY

Director of Graduate Study—Stephen Diachun

In the Department of Plant Pathology professors and graduate students are studying plant diseases, their causes and their control. Aspects of diseases being studied include pathotoxins, mycotoxins, fungal lipids, morphogenesis of pathogens, genetics of pathogens, ecology of root pathogens, early events in virus infection, virus-vector relationships, inhibition of virus infection, reproduction and development of nematode populations, inter-relationships among species of plant parasitic nematodes, variability within a species of nematodes, mechanisms of fungicidal action and the metabolic fate of fungicides, genetics of host response, and cytological and physiological changes in infected plants.

Disease-resistant plants are being sought, identified, and selected in populations of tobacco, corn, and forage legumes and grasses; disease-resistant plants are being developed in cooperation with faculty members in the Departments of Agronomy and Horticulture.

Special instruments within the department include the following; centrifuges, ultra-centrifuges, spectrophotometers, electron microscope, microtomes, analytical balance, liquid scintillation counter, analytical ultra centrifuge, autoclaves and sterilizing equipment, autoanalyzers, Clark oxygen electrode apparatus, counter-current distribution apparatus, electrophoresis apparatus, fluorometer, freeze-dry appartus, incubators, Geiger-Meuller counters, micromanipulators, chromatography equipment, particle counter, phase microscopes, microscopes, pH meters, respirometers, tissue culture facilities, photomicrography and darkroom facilities.

M.S. and Ph.D. degrees are offered. For the Ph.D. degree, in addition to the requirements established by the Graduate School, the Department requires mathematics through integral calculus, two semesters of physics, organic chemistry and introductory courses or equivalent in botany, microbiology, entomology and soils. Proficiency in one foreign language is required, normally German, French, or Russian. A formal minor is not required.

541 *Plant Pathology.* (3)
Significance, nature, causes, and methods of control of plant diseases. Lecture and discussion, two hours; laboratory, two hours. Prereq: One semester of Botany or equivalent. (Same as BOT 541.)

543 *Diseases of Plants.* (3)
Symptoms, causes, and control of some of the more common representative plant diseases. Students may select disease problems in their major field of interest. Recitation, one hour; laboratory, four hours. Prereq: PPA 541 or BOT 541; consent of instructor.

545 *Epidemiology and Control of Plant Diseases.* (3)
Principles and practices in epidemiology and control of plant diseases by biological and chemical means. Prereq: PPA 541 or BOT 541.

652 *Plant Pathogenic Fungi.* (3)
An advanced study of plant pathogenic fungi with emphasis on diagnosis and identification of fungus plant diseases and innoculation and infection of plants. Two class hours per week; laboratory, three hours. Prereq: PPA 541 or BOT 541 or consent of instructor.

656 *Virus Diseases of Plants.* (4)
Characteristics and properties of viruses that cause plant diseases; host-virus relationships; identification and control of some important virus diseases; consideration of research methods. Lecture and discussion, two hours; laboratory, four hours. Prereq: PPA 541 or BOT 541, or consent of instructor.

658 *Nematode Diseases of Plants.* (3)
The importance, effects, recognition and control of nematodes that cause plant diseases; physiology of plant parasitic nematodes and their relations with other nematodes and plant pathogens. Lecture, one hour; laboratory, four hours. Prereq: PPA 541 or BOT 541; ZOO 534; or consent of instructor.

660 *Physiology of Plant Diseases.* (3)
Lectures, discussions, and independent reading on biochemical and physiological aspects of plant disease and of disease resistance and immunity in plants. Prereq: PPA 541 or BOT 541 and BCH 511 or BOT 701.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree. (In Biological Sciences)* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Plant Pathology Seminar.* (1)
Reports and discussion of problems and investigations of problems in plant pathology. May be repeated three times for a maximum of four credits.

784 *Special Problems in Plant Pathology.* (1-3)
May be repeated to a maximum of nine credits. Prereq: PPA 541 or BOT 541 or equivalent; consent of instructor.

794 *Research in Plant Pathology.* (1-4)
May be repeated to a maximum of 12 credits. Prereq: PPA 541 or BOT 541, or consent of instructor.

VETERINARY SCIENCE

Director of Graduate Study—J. H. Drudge

The Department of Veterinary Science offers a program leading to the Doctor of Philosophy degree with majors in general pathology, veterinary microbiology, veterinary parasitology and nutritional pathology. Development of research

competency and attainment of scholarly maturity in the bio-medical sciences are the general objectives. The program is designed primarily for students possessing the Doctor of Veterinary Medicine degree. Individuals electing general or nutritional pathology as major areas must be graduate veterinarians. Candidates with a Master of Science in microbiology or parasitology and choosing either of these as major areas may be admitted with faculty approval. Individual programs of study leading to this degree must conform with the general rules and regulations of the Graduate School, except that a reading knowledge of one modern foreign language is required for the Ph.D. degree.

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Veterinary Science Seminar.* (1)
Required of graduate students in Veterinary Science. May be repeated to a maximum of six credits. Prereq: Permission of staff.

781 *Correlative Pathology.* (1-3)
Supervised experience in the use of clinical, gross and histopathological technics in the differential and definitive diagnosis of diseases. May be repeated for a total of nine credits. Prereq: Pathology in D.V.M. curriculum or equivalent and permission of staff.

782 *Nutritional Pathology.* (3)
The pathogenesis and physiopathology of deficiency states in domestic and laboratory animals. Prereq: Pathology in D.V.M. curriculum or equivalent and approval of staff.

783 *Infectious Diseases of Domestic Animals.* (3)
Etiology, pathogenesis, epizootiology, prophylaxis and therapy of selected infectious diseases of domestic animals. Prereq: Microbiology and pathology in D.V.M. curriculum or equivalent and approval of staff.

784 *Advanced Veterinary Immunology.* (2)
Theory and practice of the development and standardization of vaccines, and the evaluation of their potency, safety and efficacy in the prophylaxis of infectious diseases of domestic animals. Prereq: Microbiology in D.V.M. curriculum or equivalent and approval of staff.

785 *Advanced Veterinary Parasitology.* (3)
Experimental methodology and host parasite relationships of the protozoan and helminth parasites of domestic animals. Prereq: Parasitology in D.V.M. curriculum or equivalent and approval of staff.

786 *Advanced Veterinary Pathology.* (3)
Specialized instruction in techniques and interpretations of pathology and pathologic anatomy. Emphasis will be upon evaluation of lesions for understanding the pathogenesis of disease processes in the living animal. Prereq: Pathology in D.V.M. curriculum or equivalent and approval of staff.

787 *Advanced Veterinary Pathology.* (3)
Specialized instruction in techniques and interpretations of pathology and pathologic anatomy. Emphasis will be upon evaluation of lesions for understanding the pathogenesis of disease processes in the living animal. Prereq: Pathology in D.V.M. curriculum or equivalent and approval of staff.

791 *Research in Veterinary Microbiology.* (1-9)
Independent research in veterinary microbiology. May be repeated for a total of 24 credits. Prereq: Permission of staff.

792 *Research in General Veterinary Pathology.* (1-9)
Independent research in veterinary pathology. May be repeated for a total of 24 credits. Prereq: Permission of staff.

793 *Research in Veterinary Parasitology.* (1-9)
Independent research in veterinary parasitology. May be repeated for a total of 24 credits. Prereq: Permission of staff.

794 *Research in Nutritional Pathology.* (1-9)
Independent research in nutritional pathology. May be repeated for a total of 24 credits. Prereq: Permission of staff.

Allied Health Professions

ALLIED HEALTH EDUCATION AND RESEARCH

The Department of Allied Health Education and Research serves as both the repository for and the designer of innovative curricula and experimental programs for the College of Allied Health Professions.

Its faculty, representing a broad spectrum of interests and resources, serves as consultants for our many and diverse interests.

If any place in the College could be designated as a "think tank" for Allied Health Development and planning, this would be it.

660 *Advanced Clinical Practicum in Allied Health.* (1-6)
Offers advanced supervised clinical experience appropriate to the student's specialty. Forty clinical hours for one semester hour credit. Prereq: Graduate standing; consent of the Instructor. May be repeated for a maximum of six credits.

670 *Advanced Seminar in Allied Health.* (1-3)
Content of this course is determined by the clinical department(s) offering the seminar. It includes in-depth consideration of recent research and its application to health care delivery. Prereq: Graduate standing; consent of the instructor. May be repeated for a maximum of six credits.

690 *Research Problems in Allied Health.* (3)
An independent research course for the study of special problems in allied health education. May be repeated to a maximum of 12 credits. Prereq: Graduate standing; consent of instructor.

EDH 500 *Clinical and Laboratory Teaching.* (4)
Includes learning theories, motivational concepts, review of research, developing instructional objectives, human relations in the classroom, teaching methodologies, clinical instruction, performance evaluation and preparation of instructional units. This course is designed primarily for students in Allied Health, Education, Library Science, Home Economics and Social Professions.

EDH 501 *Teaching Internship.* (6-12)
Supervised practice under competent leadership. Observation, instruction, independent study which parallels field experience, and conferences with supervising instructor included. (May be repeated for a total of 12 hours.) This course is designed primarily for students in Allied Health, Education, Library Science, Home Economics and Social Professions. Prereq: EDH 500, or permission of instructor.

CLINICAL NUTRITION

Director of Graduate Study—Paul Thornton

The Master's Degree Program in Clinical Nutrition provides an opportunity for graduate study in the fundamentals of Clinical Nutrition. The curriculum is designed specifically to provide practical experience in nutrition in the treatment of illness and the maintenance of health and to deepen the student's foundation in the sciences fundamental to nutrition. It is intended primarily for those who wish to undertake careers in dietetics and clinical nutrition in university hospitals, large community hospitals, and medical centers; for those who intend to teach in the field of clinical dietetics; and for those who plan careers as members of a research team in clinical nutrition and metabolism.

The program is interdisciplinary in nature. The faculty is drawn from the basic sciences as well as the clinical departments—medicine, pediatrics, community medicine. The University Hospital and its related clinical facilities will be used for clinical instruction. The staff of the department of dietetics will provide professional supervision.

A minimum of 30 credit hours will be required to complete the degree. No language is required.

I. Required Courses

	Crs.
CNU 601 Clinical Nutrition	4
CNU 602 Current Trends in Nutrition	1
CNU 701 Advanced Clinical Nutrition	2
CNU 780, 781, 782 Independent Study	1 ea.
	10

II. Suggested courses to complete the 30-hours' credit. (In consultation with the program director or adviser the student will select certain of the courses listed.)

BCH	501	Biochemistry for Dental Students	6	I
CNU	502	Principles of Human Physiology ,same as PGY 810)	5	II
CH	521	Community Health	3	I, II
MB	610	Bacteriology of Foods	4	I
BSC	772	Topical Seminar in Medical Behavioral Science	1-3	II
SOC	532	Intergroup Relations	3	I,S
EDF	661	Educational Sociology	3	
EDP	548	Educational Psychology	3	I, II, S
EDC	607	Programmed Instruction in the Classroom	3	
Elective			3	

502 *Principles of Human Physiology.* (5)
A basic course in human physiology including the functions and regulations of the major body systems. Prereq: One year of inorganic chemistry; one semester of college anatomy, or one year of college biology. (Same as PGY 810.)

601 *Clinical Nutrition.* (4)
An analysis of the process by which man ingests, assimilates and utilizes all of the constituents of food in health and disease. Relationship of biochemical and physiological factors to the nutrient requirements of the human body. Evaluation of dietary status and rationale of dietary management. Course to be taught by lectures, clinical rounds, conferences and written and oral case studies. Prereq: PGY 502, 503; consent of instructor. BCH 501 to be taken concurrently.

602 *Current Trends in Nutrition.* (1)
A seminar to review the current literature of nutrition; development of techniques for the preparation of abstracts, reviews and bibliographies on current topics. Questions of editing, editorial styles, evaluation and graphic interpretation to be discussed. Course to be taught through seminar sessions, along with reports and some lectures. Prereq: PGY 502, 503; BSC 421 (Statistics). BCH 501 to be taken concurrently.

701 *Advanced Clinical Nutrition.* (2)
A course dealing primarily with the clinical application of the principles of nutrition, to include clinical conferences and case studies. Prereq: CNU 601 or concur.

768 *Residence Credit for Master's Degree in Clinical Nutrition.* (0)
(1-6 credits equivalence.) May be repeated.

780, 781, 782 *Independent Study.* (1 ea.)
Required each semester and summer school by all students enrolled in the Clinical Nutrition program. Topics of interest will be reviewed in depth with appropriate presentation.

CM 601 *Principles of Nutrition in Population Groups.* (2)
Epidemiological aspects of nutrition. Factors affecting adequacy of dietary intake and assessment of nutritional status in population groups. Community programs in social welfare and public health, including city, state, federal and international programs. Field work four weeks. Course will be taught through lectures and discussions. Prereq: BCH 501; BSC 421 (Statistics); PGY 502, 503; SOC 780. Consent of instructor.

CLINICAL PASTORAL COUNSELING

At present there is no graduate program in this area.

501 *Perspectives in Religion and Health.* (3)
An interdisciplinary study of significant religious components in health. Prereq: Consent of instructor.

COMMUNITY HEALTH

Graduate programs for the degree Master of Science in Public Health are undergoing complete revision at this time.

420 *Current Issues in Community Health Education.* (3)
A study of conceptual approaches to diagnosis of health education needs of a community particularly those involving promoting wellness and prevention of illness. Specific *process* approaches to developing effective programs change(s) in state(s) of health are included. Prereq: CH 321 or consent of the department.

481 *Community Health Practice.* (4-8)
To provide the community health specialist an opportunity to observe and practice classroom learned principles and skills in a community. Prereq: CH 321.

500 *Public Health Sanitation.* (3)
A consideration of the cause, prevalence, transmission, and control of preventable diseases.

501 *Public Health.* (3)
A continuation of CH 500. Administrative and organizational approach to disease prevention.

511 *Independent Study in Community Health.* (1-3)
Directed independent library and/or community health study. May be repeated for a maximum of six credit hours. Prereq: Major in Community Health and/or consent of the department chairman.

515 *Communicable Diseases.* (3)
Environmental sanitation and the effects of environment on the control of communicable disease. Prereq: MB 200 or 400 or equivalent.

520 *Mental Hygiene.* (3)
An introduction to mental hygiene including a consideration of the cause, treatment and prevention of mental disorders. Not open to students who have credit in PSY 520.

521 *Community Health.* (3)
An ecological view of community health, a study of the demographic, social, cultural and physical environmental factors that influence a community's state of health. Basic epidemiology and biostatistics are introduced as necessary instruments of community health analysis. Three class hours per week. Prereq: Upper division or graduate standing and consent of instructor.

522 *School and Community Health.* (2)
A course designed to develop an idea of the cooperative nature of school health work and the importance of connecting it with adult health work.

600 *Epidemiology.* (3)
A study of the natural history of disease.

603 *Public Health Records.* (2)
General principles of recording, filing and use of public health data.

604 *Maternal and Child Health.* (2)
A study of the principles of maternal, prenatal, infant and child care.

612 *Public Health Administration.* (3)
A consideration of the principles of public health administration.

613 *Public Health Administration.* (2)
A continuation of CH 612.

618 *Vital Statistics.* (3)
Application of the statistics of population, births, deaths, etc., in Public Health.

619 *Vital Statistics.* (2)
A continuation of CH 618.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

770 *Seminar.* (1)

HEALTH RADIATION SCIENCES

Director of Graduate Study—
Radiological Health—Joseph A. Sayeg
Medical Radiation—Joseph A. Sayeg

Two programs in the Bioradiation Sciences are available leading to the degrees of Master of Science in Radiological Health and Master of Science in Medical Radiation Dosimetry.

Graduates of accredited colleges with an appropriate baccalaureate degree (e.g., Biological Sciences, Physics, Public Health, Mathematics,

Chemistry, etc.) may become candidates for one of these degrees. Physics 260 or its equivalent is a prerequisite for both programs, and Computer Science 220 or its equivalent is also a prerequisite for the program in Medical Radiation Dosimetry.

Both programs are an interdisciplinary type. As such, Plan B is utilized for the graduate work, incorporating specific courses in several departments. There is no language requirement. A core of courses is common to both programs. Additional and special course work is prescribed for each program as degree requirements.

ZOO 540 *General Radiation Biology.* (4)

ZOO 640 *Biological Effects of Radiation.* (3)

PHY 472 *Interaction of Radiation with Matter.* (3)

PHY 535 *Experimental Physics, Atomic and Nuclear.* (2)

RM 545 *Radiation Hazards and Protection.* (2)
An analysis of common radiation hazards encountered in medicine and research, regulations for safe usage of radiation and procedure for safe use of radiation. One class hour, two laboratory hours per week. Prereq: College physics, one year biology.

HRS 710 *Seminar in Bioradiation Science.* (1)
Topics of current interest relating to radiation and its biomedical significance will be discussed. May be repeated for a maximum of four credit hours with approval of instructor. Prereq: Graduate standing in a radiation-related science.

STA 670 *Basic Statistical Analysis.* (4)

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Master of Science in Radiological Health Specialty

ADDITIONAL PROGRAM

CH 600 *Epidemiology.* (3)

CH 612 *Public Health Administration.* (3)

HRS 720 *Advanced Problems in Radiological Health.* (2-4)
Advanced problems in radiological health and related areas in physics, biology or medicine will be analyzed. Two to four class hours per week. Prereq: Completion of formal course work in Radiological Health Specialty program or consent of instructor.

Area Electives (5-7)

13-17

A practicum in Radiological Health will also be required which will consist of approximately 12 weeks of training at, (1) a hospital, (2) a government regulatory agency and, (3) a national laboratory. This will be offered during the summer months after the course work has been completed. No credit hours.

Total 32 (minimum)

Master of Science in Medical Radiation Dosimetry

ADDITIONAL PROGRAM

ANA 511 *Introduction to Anatomy.* (4)

PGY 502 *Principles of Physiology Lectures.* (3)

HRS 715 *Advanced Problems in Radiation Dosimetry.* (2-6)
Advanced problems in Radiation Dosimetry. To be taken concurrently with supervised individual study. Problems in radiation measurement, distribution of energy, computation of dose, and biological and medical effects of an advanced nature will be analyzed, discussed and described in written reports. Problems will require literature search and utilization of advanced analytical techniques. Two to six class hours per week. Prereq: Completion of formal course work in the Medical Radiation Dosimetry program or consent of instructor.

Area Electives. (2-5)
Special instruction in Medical Radiation Dosimetry will continue for six months following completion of formal course work. This instruction will be under the staff of the Department of Radiation Medicine. No credit hours.

Total 31 (minimum)

690 *Research in Radiological Health.* (1-3)
Research in the area of Radiological Health. Prereq: Graduate standing in the Bioradiation Sciences.

695 *Research in Radiation Dosimetry.* (1-3)
Independent directed research on theoretical and practical problems in the measurement of radiation. Prereq: Graduate standing in one of the Bioradiation Sciences.

710 *Seminar in Bioradiation Sciences.* (1)
Topics of current interest relating to radiation and its biomedical significance will be discussed. May be repeated for a maximum of four credit hours with approval of instructor. Prereq: Graduate standing in a radiation-related science.

715 *Advanced Problems in Radiation Dosimetry.* (2-6)
Advanced problems in Radiation Dosimetry. To be taken concurrently with supervised individual study. Problems in radiation measurement, distribution of energy, computation of dose, and biological and medical effects of an advanced nature will be analyzed, discussed, and described in written reports. Problems will require literature search and utilization of advanced analytical techniques. Prereq: Completion of formal course work in medical Radiation Dosimetry program or consent of instructor.

720 *Advanced Problems in Radiological Health.* (2-4)
Advanced problems in Radiological Health and related areas in physics, biology, or medicine will be analyzed. Prereq: Completion of formal course work in Radiological Health Specialty program or consent of instructor.

Arts and Sciences

ANTHROPOLOGY

Director of Graduate Study—Lathel F. Duffield

The Department of Anthropology offers courses and research options leading to the Ph.D. degree in the special areas of Ethnology, Culture History (Ethno-history and Archaeology), and Applied Social Anthropology. The department also offers the M.A., a general degree certifying a broad background in anthropology, plus research competence in the collection and processing of primary data.

All incoming graduate students without the M.A. are treated initially as candidates for this degree, and are expected to take the M.A. comprehensive examination. Students who pass this examination with a high score, and who demonstrate satisfactory research competence, may petition to by-pass the master's thesis. A reading knowledge of one modern foreign language is required for the M.A. degree in anthropology, and a reading knowledge of two is required for the Ph.D.

The following areas are represented in the individual research experience of the anthropology faculty: Southeast Asia, Latin America, Oceania, North Africa, Europe, and North America, including strong competence in rural English-speaking subcultures.

The department participates in interdisciplinary research in the University's Center for Developmental Change and in the Water Resources Institute. The Department of Behavioral Science, College of Medicine, includes anthropologists on its staff, and students with interests in medical anthropology are encouraged to take the behavioral science concentration. Anthropology graduate students with appropriate interests are eligib!e for assistantships in the above fields.

Department standards for admission to graduate work in anthropology include an undergraduate department over-all average of B or better, a satisfactory score on the verbal and quantitative tests of the Graduate Record Examination and three letters of recommendation. Contact the Chairman, Admissions Committee, Department of Anthropology for additional information on departmental requirements and opportunities for financial assistance.

402 *Human Identification.* (2)
This course requires of the student a detailed and systematic knowledge of human anatomy, both of the skeleton and the soft part tissues. The first half of the course will be devoted to the positive identification of all the bones of the human skeleton. This approach involves knowing each bone and its fragments, including the identification by side (left or right). In addition, sex differences and age changes will be mastered as the student's knowledge increases. Finally, the student will be expected to determine the racial origins of skeletal remains from such skull features as the nose, palate, and its teeth, the chin and long bone proportions. One hour lecture, two hours laboratory per week.

428 *Contemporary Cultures and Societies in Southeast Asia* (3)
A descriptive and analytical consideration of representative cultures from insular and mainland Southeast Asia in terms of their social, political, economic and religious organization. The history of the cultural contracts of Southeast Asia with India, China, Europe and the Islamic tradition will be discussed. Prereq: ANT 120, 121 or consent of instructor.

438 *Ethnology of the Near East and North Africa.* (3)
Survey of Islamic, Christian, and Hebraic cultures of the Near East and North Africa, with emphasis on relations between religious traditions and political systems. Prereq: ANT 120 and 121, or consent of instructor.

439 *Circumpolar Peoples.* (3)
Ethnology of Old World and New World peoples of the circumpolar region, with emphasis on its common characteristics. Prehistoric connections between Eurasia and America and historic developments in both will be considered. Prereq: ANT 121 or consent of instructor.

442 *New World Prehistory.* (3)
Survey of the origin and growth of prehistoric American Indian cultures as revealed by archaeological data. Prereq: ANT 120, 121.

490 *Pre-Field Study Seminar.* (3)
Orients students in a specific cultural area where they will conduct field research under faculty supervision and provides training in designing anthoropoligacal research. Prereq: ANT 120, 121, major, and consent of instructor.

500 *Physical Anthropolgy.* (4)
A lecture-laboratory course on the biological nature of man. The fields of the primates, fossil man, races, race mixture, constitutional anthropology and human growth with supplementary laboratory exercises will be covered. Prereq: ANT 120 or three hours in any other biological science.

510 *History of Anthropological Theory.* (3)
Description and analysis of significant anthropological ideas in their historical context; the growth of the theoretical concepts in physical anthropology, archaeology and ethnology. Prereq: Consent of instructor.

512 *Compartive Civilizations.* (3)
Comparison of complex societies of the past and present, stressing similarities and differences in their historical development and cultural achievements.

514 *Descriptive Linguistics: Phonetics.* (3)
Articulatory description of speech sounds; practice in recognition and control. Prereq: Consent of instructor. (Same as ENG 514.)

515 *Descriptive Linguistics: Phonemics.* (3)
An investigation of speech-sounds and systems of speech-sounds. Also, attention to both speech and writing as communication systems. (Same as ENG 515.)

516 *Descriptive Linguistics: Morphemics.* (3)
An explanation of some of the ways speech-sounds are put together in patterns so as to form languages. Prereq: Consent of instructor. (Same as ENG 516.)

521 *Ethnology of the New World.* (3)
Cultures and physical types of the American Indians during and after white settlement. (Northwestern North America is not included.)

522 *North Pacific Coast Cultures.* (3)
Ethnology of the maritime peoples of western North America and Northeast Asia. Cultural connections between America and Asia will be stressed. Prereq: ANT 121.

523 *Ethnology of Oceania.* (3)
A survey of the various cultures to be found on the islands of the Pacific Ocean. Both aboriginal and modern acculturated societies will be considered. Prereq: ANT 120, 121.

524 *Mythology.* (3)
The unwritten literature of primitive peoples. Themes, diffusion, style, literary devices, and function of myths.

525 *Applied Anthropology.* (3)
Application of anthropological methods to contemporary practical problems such as acculturation, colonial administration, intercultural education, and race relations. Prereq: ANT 121.

526 *Culture and Personality.* (3)
The cultural basis of personality. Personal character considered as the result of culturally fostered patterns. The ideal personality in several selected societies. Prereq: SOC 101. (Same as SOC 526.)

527 *Culture Change.* (3)
Internal change and contact change in cultures; agents and conditions promoting change; an analysis of innovation, dissemination, integration, diffusion, acculturation, and related concepts. Prereq: ANT 121.

529 *Survey of Medical Anthropology.* (3)
A cross-cultural survey of behavioral factors in the recognition, prevention and treatment of disease in primitive, folk, and modern cultures, with an emphasis on the solution of world health problems. Topics to be covered include non-western medical systems, health behavior as a projective system, transcultural medicine and psychiatry, and health behavior and culture change. Prereq: ANT 120, 121. (Same as BSC 529.)

530 *Contemporary Latin American Cultures.* (3)
Detailed survey of societies and cultures of contemporary Latin America, utilizing contribution from anthropological research. Prereq: consent of instructor.

531 *Cultures and Societies of Sub-Saharan Africa.* (3)
A survey of indigenous societies and cultures of Africa south of the Sahara, with special attention to their adaptation to colonialism and post-colonial national development. Prereq: ANT 121, or consent of instructor.

533 *Social Anthropology.* (3)
History and theory of social anthropology with special emphasis on the comparative approach to analysis of structure, function, and change in social and cultural systems. Prereq: Consent of instructor; SOC 101. (Same as SOC 533.)

534 *The Southern Appalachians: A Sociological Interpretation.* (3)
A sociological interpretation of the Southern Appalachians, emphasizing the great diversity—social, cultural, economic—in the various parts of this area by study of the major institutions, value orientations, and social and cultural changes affecting both the whole area and its sections. Prereq: SOC 101. (Same as SOC 534 in College of Agriculture.)

536 *European Peasantries.* (3)
Comparison of peasant populations and their modernization, with emphasis upon the dynamics of cultural stability and change encountered in relationships between national elites and peasantries in various countries. Prereq: ANT 510 and Junior classification.

541 *Archaeological Theory and Method.* (3)
The concepts and aims of archaeology, its history as a scientific discipline and its present role in the social sciences. Attention to basic principles in field work and to recent advances.

542 *North American Archaeology.* (3)
Origin and growth of prehistoric American Indian cultures north of Mexico as revealed by archaeological data.

546 *Prehistoric Meso-America and Peru.* (3)
An intensive study of the native American civilizations, their origins, development, and achievements.

547 *Cultures of the Southwestern United States.* (3)
Development of sedentary and nomadic Indian peoples, from earliest times to the present. Emphasis on Puebloan, Mogollon, and Hohokam archaeology and continuity with modern Indians.

548 *European and Near Eastern Archaeology.* (3)
Prehistoric cultural development in Europe and the Near East, from the earliest times to the beginning of civilization. Prereq: ANT 120 and 121, or consent of instructor.

550 *Field Studies in Anthropology.* (1-6)
Field research as a part of a long-range anthropological research program. Provides student with an initial experience conducting research under faculty supervision. May be repeated for a maximum of 12 credits. (Three hours to full-time laboratory.) Prereq: At least one semester of the appropriate language of the area of research and consent of instructor, in addition to ANT 120, 121.

555 *Eastern North American Archaeology.* (3)
Detailed analysis of prehistoric cultures of eastern United States with emphasis on interpretation of prehistory in Ohio River Valley. Prereq: ANT 120, 121, and 442 or consent of instructor.

560 *Ethnographic Principles and Practice.* (3)
Exposition of the principles of ethnographic data collection, and practice in the acquisition and use of censuses, genealogies, personal histories, maps, specialized recordings, specimen collections, and other materials. Prereq: ANT 510.

561 *Anthropology: Man and His Works.* (3)
Survey of the major fields of anthropology, physical, prehistory, and ethnology and a guide to source material. Designed for students not contemplating further work in anthropology.

575 *Prehistory of Eastern Asia.* (3)
Prehistoric cultures of the East Asian mainland from the Old Stone Age to the beginnings of Chinese civilization, and their diffusion to Japan, Australia, and Oceania. Prereq: ANT 120 and 121, or consent of instructor.

581 *Independent Work in Anthropology.* (1-4)
Prereq: Major and a standing of 3.0 in the dept. May be repeated to a maximum of 12 credits.

582 *Tuitorial Seminar.* (2)
Anthropological methods and theory. May be repeated to a maximum of eight credits. Prereq: Major in anthropology.

585 *Field Laboratory in Archeological Research.* (3-6)
Practical supervised training in field in archaeological research methods and techniques, problem analysis, field laboratory procedures, recording methods. Lab, 20 to 40 hours per week. May be repeated to a maximum of 12 credits. Prereq: ANT 541 and consent of instructor.

601 *Proseminar in Anathropology.* (3)
Survey of contemporary anthropology and its constituent subfields, with emphasis upon its core concepts. Prereq: Graduate standing.

602 *Contemporary Anthropological Theory Seminar.* (3)
Systematic survey of significant theories current in anthropology, the primary concepts employed, and important contributors to anthropological theory. Emphasizes distinctive characteristics of the discipline. Prereq: ANT 601.

610 *History of Anthropology.* (3)
Traces the development of anthropology in historical perspective, with particular attention to major theorists. Prereq: ANT 601 or consent of instructor.

614 *Field Methods in Linguistics.* (3)
Analysis of a language by working directly with a native speaker. Prereq: ANT (ENG) 514 or 515, and ANT (ENG) 516.

641 *Middle and South America Seminar.* (3)
Current trends in change and modernization in Latin America. Deals with social, economic, ideological and political aspects of contemporary Latin American culture. Prereq: ANT 601 or consent of instructor.

648 *Seminar on Southeast Asian Cultures and Societies.* (3)
A seminar in Southeast Asian culture and societies with emphasis on the contemporary, political, economic, religious and social scene. Particular emphasis will be placed upon the exploration and understanding of current problems in the region through consideration of its pre-history, physical habitats, and the influence of the Hindu, Chinese, Islamic and European cultures. Prereq: ANT 428, GEO 552, or consent of instructor, in addition to ANT 601.

658 *Seminar on African Societies.* (3)
Analysis of differing sociocultural factors in sub-Saharan Africa and their influence upon patterns of modernization, nationalism, and changing tribal structures. Prereq: ANT 601; ANT 431 or consent of instructor.

661 *Seminar on Near Eastern Cultures.* (3)
Analysis of social and cultural factors resulting in differing patterns of change, modernization, nationalism in Islamic countries and Israel. Prereq: ANT 601; ANT 438 or consent of instructor.

670 *Seminar on Role Theory.* (3)
An exploration of differences and similarities in the utilization of the concept of role in Sociology, Anthropology and Psychology. Emphasis is placed on the potentiality of role as unifying concept in the behavioral sciences. Prereq: SOC 101. Consent of instructor. (Same as BSC 670 and SOC 670.)

690 *Advanced Pre-Field Study Seminar.* (3)
Orients graduate students on a special cultural area where they will conduct research under faculty supervision; provides training in anthropological research design. Prereq: ANT 601, requisite language skills, and consent of instructor.

727 *Seminar on Socio-Cultural Change.* (3)
A seminar for advanced students. Emphasizes economic, religious, political, technological, psychological, etc. factors in change, and social and cultural patterns and processes of change. Prereq: SOC 101; ANT 527 or SOC 518, or permission of instructor. (Same as SOC 727.)

730 *Seminar in Comparative Religious Systems.* (3)
A seminar on principles in the comparative study of religious behavior and religious institutions and principles of change in religion as a cultural form. Deals mainly with religions of non-literate peoples. Prereq: Consent of instructor.

731 *Seminar in Comparative Social Organization.* (2)
A seminar for advanced students. Emphasizes principles in the comparative study of social systems; the role of kinship, age, sex, locality, and voluntary associations in determining relationships between individuals and between groups in non-literate and literate societies. May be repeated once. Prereq: SOC 101. (Same as SOC 731.)

741 *Seminar in Regional Archaeology.* (3)
Intensive examination of archaeology from selected regions, emphasizing cultural reconstruction, time-space organizations, and hypothesis testing. Prereq: ANT 541.

742 *Advanced Seminar in Culture History.* (3)
Consideration of evolutionist, diffusionist, environmentalist, and other general theories of cultural casuality, and their applicability to available historical and archaeological data. Prereq: ANT 601 and 602 or consent of instructor.

750 *Graduate Field Study in Anthropology.* (1-6)
Field research as part of a long-range anthropological research program for graduate interns training under direct faculty supervision. Provides student with experience conducting scientific research as research team member. Report required. Laboratory, three hours to full time. Prereq: Appropriate language fluency; preparatory area study plus consent of instructor in addition to ANT 601.

764 *Topical Seminar in Psychological Anthropology.* (3)
Advanced study of topics of current interest in psychological anthropology; e.g., language and cognition, psychological concomitants of rapid culture change; and transcultural psychiatry. Prereq: ANT 526 or PSY 544, or permission of instructor. (Same as BSC 764.)

765 *Research Problems in Medical Anthropology.* (3)
(1) History and theory of medical anthropology; (2) Research design, field work, analysis of data, and report writing. Two class hours per week, three laboratory hours per week. Prereq: Graduate status in Anthropology, Sociology or Psychology, and a concentration or minor in Medical Behavioral Science. (Same as BSC 765.)

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Seminar.* (2)
Intensive work in particular fields of anthropology. All students during a given semester will be assigned related phases of the same problem. Designed primarily for students working toward a master's degree in anthropology. May be repeated once.

790 *Research Problems in Anthropology.* (3)
Intensive study in the fields of Physical Anthropology, Archaeology and Ethnology with qualified staff members. Term papers required. May be repeated three times.

ART

Director of Graduate Study—James S. Pierce

The Department of Art requires as prerequisite to the Master of Arts degree undergraduate work equivalent to that offered in the department for its art majors. Work toward the master's degree may be undertaken in two areas: (1) art history and criticism, and (2) art education.

Students admitted to the program in art history are expected to have completed course work equivalent to an undergraduate major in art history. Work toward the master's degree is undertaken under Plan A (See Requirements for the Degrees of Master of Arts and Master of Sciences, Plan A), with a total of 24 hours' work, completion of the thesis and the language requirement. It is required that the student offer either course work or substantial proof of ability to use more than one foreign language.

The program for the master's degree in art education is undertaken under Plan A with a thesis based on substantial research, or theory in art education. No courses required for certification in a 48-hour area of concentration may be admitted as course work relevant to the master's degree in art education.

Requirements for the Degree of Master of Fine Arts

Application for admission to graduate work leading to the degree, Master of Fine Arts, must be accompanied by a portfolio of creative work or photographs, or transparencies of such work. In no case will this requirement be waived. Un-

dergraduate art work must be substantially equal in quality, scope, and number of hours to the undergraduate major at the University of Kentucky.

The degree, Master of Fine Arts (M.F.A.), will be awarded on the completion of 45 hours of graduate courses. Of this, 36 hours must be in studio and closely related work; six hours must be in art history, and three hours must be in the Graduate Studio Seminar (A-S 793), which must be taken for three semesters.

The student will designate his major area, with the advice of a senior professor, at the outset of his graduate work and will carry at least 12 hours in that area under the guidance of one professor selected as thesis adviser. Up to nine hours in relevant work outside the department may be elected by the student in consultation with his adviser. A foreign language will not be required.

The degree, Master of Fine Arts, will be awarded not solely on the basis of work in formal courses, but also on the basis of creative work resulting in a satisfactory thesis exhibition, and the preparation of a written and photographic record in proper form for submission to the Graduate School. A-S 767 (Studio Thesis Project) to a total of six credits will be required for the preparation of the thesis. Work toward the thesis exhibition will begin at a time determined by the department.

Candidates for the M.F.A. degree who hold an M.A. degree in studio work from another school will be required to complete a year's residence and 18 credits of graduate work at the University, including two semesters of Graduate Studio Seminar (A-S 793) and all other requirements for the degree.

GENERAL COURSE

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

ART EDUCATION

575 *Art in Elementary Schools* (3)
Study of perceptual and aesthetic awareness in children. Methods and materials appropriate to the teaching of art in the elementary school. Prereq: Major in Art Education.

577 *Art in Secondary Schools.* (3)
Art for teachers in secondary schools. The literature of art education. Courses of study. Teaching materials. Lectures, conferences, and reports.

579 *Seminar in Art Education* (2)
A relationship of current philosophies of art education and aesthetics; a consolidation of art education ideas with a formation of criteria for making value judgments; a development of a vocabulary consistent with education and art. Prereq: Major in Art Education.

670 *School and Community Art.* (3)
Analyses of the social function of art; organization of school and community programs in art; case studies of existing programs. Emphasis on relation of school programs to community needs. Prereq: A-H 371, A-E 575 or 577; SOC 220; EDC 732 or EDF 661; or consent of the instructor.

ART-HISTORY

505 *Roman Art: 5th Century BC to 4th Century AD.* (3)
Painting, sculpture, and architecture of the Roman Empire from the Etruscans through the Age of Constantine. Prereq: A-H 200, 201, 300.

506 *Greek Art.* (3)
The development of architecture, sculpture, painting and minor arts of Classical Greece. Greece from its beginning to the end of the Hellenistic period. Prereq: A-H 200 or approval of Department.

530 *Medieval Art of Italy and Sicily.* (3)
While emphasizing the architectural developments and the mural and mosaic decoration, much attention given to the small scale major arts of stone and metal sculpture, ivory carving, gold and enamel work and manuscript illumination from the 4th to the 14th Centuries. Prereq: A-H 334.

550 *Italian Renaissance Painting:* 1350-1550. (3)
Painting in Italy from the time of Giotto and Duccio to Mannerism. Painting in Tuscany, Umbria, Rome, and the creation of Venetian painting and the spread of Mannerist tendencies.

551 *Italian Renaissance Architecture:* 15th and 16th Centuries. (3)
The history of architecture in Italy from Brunelleschi to Palladio. Prereq: A-H 201, 355, or permission of instructor.

555 *Italian Renaissance Sculpture.* (3)
A concentrated study of Renaissance Sculpture in Italy from 1400-1600; from the beginnings of the "new Humanism" to Michelangelo, tracing the philosophical, social, artistic and historical influences upon the major sculptors of this era. Prereq: A-H 201, 355 or permission of instructor.

565 *Roman Baroque Art.* (3)
The arts in Rome from the beginning of the 17th through early 18th Centuries; the diffusion of Roman Baroque forms in Central and Northern Italy. Prereq: Either A-H 355 or A-H 365 or permission of instructor.

570 *19th Century Architecture: Neo-Classicism to the Chicago School.* (3)
European and American architecture from Ledoux to Louis Sullivan. Prereq: A-H 201, 370, or permission of the instructor.

576 *Art in America.* (2)
A survey of American architecture, sculpture, painting, illustration, handicrafts, industrial design, etc., from colonial times to the present.

580 *French Painting: The Nineteenth Century.* (3)
The history of French painting from David to Cezanne. Prereq: A-H 201, 370 or permission of instructor.

590 *The History of Western Graphic Arts.* (3)
The origin in the 15th Century and the subsequent developments in the Relief and Intaglio methods of printmaking, principally in Italy, Germany, and the Netherlands; the significant artists contributing to the extension of the medium as a fine art with the highest creative possibilities; the later invention and various developments in the Planographic method. Prereq: A-H 201 and two of the following: A-H 350, A-H 355, A-H 365, A-H 370.

591 *Seminar in Art History.* (2)
An intensive study of a particular medium, area, period, or style in art history, with special emphasis on interpretation of sources and the handling of visual and bibliographical materials. Required of majors in the History of Art. Required of all candidates for M.A. Degree in Art History. Prereq: Two courses in art history at the 300 level.

592 *Aesthetics.* (3)
Problems of method in aesthetics; major types of aesthetic theory. Aesthetic materials of the arts, in literature, music, and the space arts. Form and types of form. Meaning in the arts. Interrelations of the arts. (Same as PHI 592.)

593 *Seminar in Art.* (1)
Current problems in art; correlations of theory and practice; discussions and reports. For seniors and graduates majoring in art. The seminar is prerequisite to the comprehensive examination. May be repeated three times for a maximum of four credits.

594 *Criticism of Art.* (3)
History and theory of criticism in the Visual Arts. A survey of major types of critical theory, historical and contemporary. Required of majors in art history; open to majors in philosophy, literature, and the arts.

599 *Independent Work: Art History.* (3)
Individual research: history, criticism, aesthetics, etc. May be repeated two times for a maximum of nine credits. Prereq: Major and a standing of 3.0 in the department.

600 *Studies in Ancient Art.* (3)
Special studies—Ancient Art to emphasize the material and stylistic factors in the development of art, and the relevant cultural factors within a given area or period. Prereq: Graduate standing and consent of department.

630 *Studies in Medieval Art.* (3)
Intensive study of specific topics in Western European art between Constantine and Giotto, roughly 300-1200 A.D., according to the special interests and needs of individual students. May be repeated for a total of six hours. Prereq: Graduate standing and consent of department.

650 *Studies in Italian Renaissance Art.* (3)
Special studies in the Art of Italy between 1300 and 1600, with emphasis on the material, stylistic factors in the development of art, and the relevant cultural factors within a given area or period. Prereq: Graduate standing and consent of department.

670 *Studies in Modern Art.* (3)
Special studies in selected topics in 19th and 20th Century European and American art. Prereq: Graduate standing and consent of department.

781 *Problems in Art History and Criticism.* (3)
Sustained individual research and interpretation in history, criticism, aesthetics. May be repeated two times for a maximum of nine credits. Prereq: 12 hours in art history and criticism and the consent of the instructor.

ART-STUDIO

502 *Advanced Drawing.* (3)
Introduction and exploration into experimental materials and media. Relation of traditional and contemporary drawing attitudes to other areas investigated. Independent projects encouraged. Nine laboratory hours per week. Prereq: A-S 302.

510 *Advanced Painting.* (3)
Individual development in creative painting. May be repeated to a maximum of nine credits. Prereq: A-S 311.

525 *Advanced Printmaking.* (3)
Individual development in creative printmaking. Media and procedures within the general areas of lithography, intaglio, relief, and serigraphy will be chosen or devised as a means of creative expression, and/or new processes of printmaking will be devised. Nine hours per week. Prereq: A-S 320, 325. May be repeated for a total of nine credits.

540 *Textiles: Advanced Weaving.* (3)
Woven and non-woven techniques combined in creating fabrics in relation to architectural demands. Aesthetic exploration in depth of materials, color and texture. Nine laboratory hours per week. Prereq: A-S 340, 342.

555 *Advanced Casting.* (3)
Furthering of technical competence with the introduction of bronze alloying. Development of a professional and personal point of view toward cast sculpture will be stressed. Independent projects of architectural scale will be encouraged. Nine laboratory hours per week. Prereq: A-S 356.

560 *Advanced Welding.* (3)
All types of welding in all metals. A course for the expert welder showing great promise as a sculptor. Personal, individual directions encouraged with professional quality work expected. Nine laboratory hours per week. Prereq: A-S 255, 360, 361.

565 *Advanced Wood Sculpture.* (3)
Independent projects at professional level expected. Combination of wood and other materials to be investigated. New industrial products and methods will be utilized. Nine laboratory hours per week. Prereq: A-S 366.

570 *Theory of Glazes and Refractories.* (3)
Theory and application in calculation of low and high fire glazes and clay bodies. Studying the properties of raw materials, and exploring the possibilities of various firing ranges. Original development of clay and glazes is encouraged and results analyzed. Nine laboratory hours per week. Prereq: A-S 371.

571 *Advanced Problems in Ceramics.* (3)
In addition to doing advanced wheel problems, students concentrate on the creation of "new" functional forms and the problems of one-man production methods. Personal development of clay and glazes is encouraged. Nine laboratory hours per week. May be repeated twice to a total of nine hours. Prereq: A-S 570.

595 *Independent Work: Painting, Printmaking.* (3)
Individual work in drawing, painting, and printmaking. May be repeated twice for a maximum of nine credits. Prereq: Major and a standing of 3.0 in the department.

596 *Workshop.* (1-6)
Summer workshops in sculpture or ceramics dealing with advanced problems. Prereq: Consent of instructor.

597 *Independent Work: Advanced Sculpture and Other Three-Dimensional Media.* (3)
May be repeated two times for a maximum of nine credits. Individual research and experimental work. Prereq: Major and a standing of 3.0 in the Department; any course in the 330 sequence, and consent of instructor.

610 *Traditional and Experimental Media in Painting.* (3)
A survey of historical and contemporary procedures and materials with sustained problems in mural and easel painting. Preparation of grounds and consideration of permanency in pigments, vehicles and supports. Prereq: Three credits in advanced painting; consent of instructor.

767 *M.F.A. Studio Thesis Project.* (1-6)
Independent research and preparation for the M.F.A. thesis exhibition. For the student working in a highly technical medium or process, the preparation of a correlated written thesis under close guidance will be the outcome. The student will be expected to know the standard forms for photographic records and the preparation of a professional portfolio. May be repeated for a total of six credits. Prereq: Normally taken during final semester for graduate study.

793 *Graduate Studio Seminar.* (1)
A seminar especially for graduate students in the studio area, in all areas of concentration. Lectures, discussion and criticism will focus on current formal and aesthetic problems in the arts. Emphasis will be placed on the integration of concepts arising in the different fields in the visual arts. Required of M.F.A. candidates for three semesters. May be repeated for a total of three credits. Prereq: Graduate standing in the Department.

798 *Problems in Sculpture, Ceramics and Design.* (3)
Sustained individual problems and experimental work in the technical and theoretical problems of design. May be repeated two times for a maximum of nine credits. Prereq: Twelve credits in uppor division studio work and consent of the instructor.

799 *Problems in Painting and Printmaking.* (3)
Sustained individual problems in drawing, painting and printmaking. May be repeated two times for a maximum of nine credits. Prereq: Twelve credits of upper division studio work and consent of the instructor.

Thomas Hunt Morgan School of Biological Sciences

Coordinator of Graduate Study—Samuel F. Conti

The Thomas Hunt Morgan School of Biological Sciences provides a program in biology leading to the degree of Doctor of Philosophy. The

program draws upon the various courses and faculty members in the biological sciences. The purpose of this graduate program is to train participants as well-rounded biologists familiar with the main branches of the biological sciences and the auxiliary fields of mathematics, physics, and chemistry. Only one modern foreign language is required.

A student who receives his degree under this program also will be sufficiently well-trained in one of the major branches of biology to be able to conduct research in that special field, as well as broadly enough trained to participate in the teaching program of a department of biology. Students will be expected to have a background of course work in the principal areas of biology, calculus and organic chemistry before starting their doctoral program.

Major work under the biological sciences program would be arranged to suit the preparation, needs and interests of the individual student. The work could be, for example in genetics and cytogenetics, ecology and evolution, vertebrate zoology, invertebrate zoology, entomology, developmental biology, histology, parasitology, plant physiology, plant morphogenesis, algalogy, systematic botany, mycology, cellular biology, radiation biology, ultra structure, etc.

Laboratory facilities and equipment are excellent for doctoral work in all branches of biology. A very good biology library containing over 10,000 volumes, and including many important American and foreign periodicals is available and is supplemented by over 200,000 volumes concerned with biology in the libraries of the College of Agriculture, the College of Medicine and the Departments of Chemistry, Physics, and Geology.

For appropriate courses see the listings in the various areas of biology.

Additional graduate programs offered within the Thomas Hunt Morgan School of Biological Sciences are Master of Arts or Science Degree programs in Botany and Zoology, and a Master of Science and Ph.D. program in Microbiology. Faculty within the School also are active participants in several other graduate programs including the University-wide graduate program in Plant Physiology.

BIOLOGY

404 *Principles of Genetics.* (3)
A study of inheritance dealing with physical and chemical aspects of the genetic material and their relationship to the expression of the phenotype. Prereq: One year of Biology or equivalent.

450 *Introductory Ecology.* (4)
A non-laboratory course in basic ecology taught jointly by Botany and Zoology Departments. Will stress the ecosystem approach to understanding the interrelationships between organisms and their environment including current environmental problems. Lecture, three hours; recitation, one hour. Prereq: One course in introductory Biology.

620 *Genetic Structure of Populations.* (3)
A discussion of the development, theory and practice of experimental and theoretical population genetics, including the basic dynamics and integrating properties of populations, factors which produce changes in populations and their effects on population structure and evolution. Prereq: An introductory course in genetics and in statistics, and consent of instructor. (Same as AGR 620.)

630 *Experimental Techniques in Plant Physiology.* (3)
Presentation of theory and experimental techniques for the study of chemical constituents by centrifugation, chromatography, spectroscopy and electrometry. Discussion of methods and design to culture, sample and prepare plant material for use in physiological experiements. Two class hours per week; three laboratory hours per week. Prereq: BOT 501, CHE 232, 233 or consent of instructor. (Same as AGR 630.)

678 *Statistical Genetics.* (3)
Statistical approaches to the analysis of quantitative inheritance; definition and estimation of genetic parameters relating to selection; inbreeding theory; random-mating and inbred populations; testing and planning in genetic experiments. Prereq: STA 674 and BIO 620 or consent of instructor. (Same as STA 678 and AGR 678).

760 *Developmental Genetics.* (3)
Discussion of metabolism, phenogenesis, immunogenicity, and molecular evolution as relates to gene action and its modification in basic development and physiological processes of higher organisms. Prereq: Adequate background in genetics and Biochemistry and/or consent of instructor.

768 *Residence Credit for Master's Degree.* (0)
(1 to 6 credits equivalence). May be repeated to a maximum of six credits.

769 *Residence Credit for Doctor's Degree.* (0)
(1 to 12 credits equivalence.) May be repeated indefinitely.

770 *Seminar in Genetics.* (1)
Review of current literature in genetics; presentation of papers on research in progress or on assigned topics; reports on meetings of scientific societies. Required of all graduate students in Genetics. May be repeated to a maximum of 10 credits. Prereq: ASC 562 or BOT 532 or consent of instructor.

771 *Seminar in Plant Physiology.* (1)
Reports and discussions on various topics in Plant Physiology. May be repeated for a maximum of eight credits.

BOTANY

Director of Graduate Study—Samuel F. Conti

Graduates of accredited colleges with a bachelor's degree in Botany or Biological Sciences who satisfy the requirements of the graduate school may apply for admission to the graduate program for work leading to degrees of Master of Science or Master of Arts in Botany, or a Doctor of Philosophy in Biology (see Thomas Hunt Morgan School of Biological Sciences). Plan A is ordinarily required for the master's degree but Plan B is permitted under certain circumstances. Two semesters of a limited, but meaningful teaching experience are required of all degree

candidates. The teaching experience is designed to complement the formal studies and the precise nature of this experience is subject to approval by the student.

A reading knowledge of one foreign language is required for the master's degree.

Fields of study within the program include algology, plant anatomy, cytology, and morphogenesis, mycology, plant ecology, plant physiology and systematics.

400 *Fundamentals of Biology for Secondary School Teachers.* (4)
A course designed to aid the teacher in the selection of subject matter and in the presentation of modern biology to high school students. Lectures, discussions, laboratories, ten hours per week. Prereq: Employment as high school teacher. (Same as ZOO 400.)

402 *Advanced Topics in Biology for Secondary School Teachers.* (4)
A treatment of selected topics from the point of view of modern developments designed to aid the high school teacher to keep abreast of changes in theory and practice; to increase his knowledge of subject matter, and to provide better motivation for his students. Lectures, discussions, and demonstrations, eight hours per week. Prereq: Employment as high school teacher and consent of instructor. (Same as ZOO 402.)

403 *Economic Botany.* (3)
Study of Ethnobotany and the domestication of plants. Plants as sources of food, medicines and other plant products. Two class hours per week; two laboratory hours per week. Prereq: Introductory course in Biology or consent of instructor.

501 *Plant Physiology.* (3-5)
Basic principles of plant physiology; the physiological processes of green plants and the effect of the environment on these processes. Lecture, three hours; Laboratory, two two-hour periods during regular session. Prereq: Six credits in Botany or Biology and two semesters of inorganic chemistry.

506 *Special Problems.* (1-3)
Independent work in some phase of advanced Botany. May be repeated three times for a maximum of 12 credits. Prereq: Consent of instructor.

507 *Algology.* (4)
A survey of the physiology, structure, life histories, genetics and relationships of the various groups comprising the algae, with the main emphasis upon the fresh-water green algae. Two hours of lecture and two two-hour laboratories per week. Prereq: Six credits in Biology.

513 *Plant Autecology.* (4)
The effect of physical and biotic factors on plants and environment. Physiological, morphological and anatomical adaptions of plants to the physical factors of the environment are emphasized. Some of the laboratory exercises are carried out in the field. Three one-hour lectures and one two-hour laboratory per week. Prereq: BIO 450 or consent of instructor.

515 *Seminar.* (1)
Readings and reports on special topics. Required of all senior botany majors. May be repeated once.

521 *Anatomy of Vascular Plants.* (4)
The nature and origin of primary and secondary tissues and their distribution in plant organs; the use of anatomical information in phylogeny, pathology, ecology and other research areas. Two lectures and two two-hour laboratory periods per week. Prereq: Two semesters of Biology or consent of instructor.

524 *Mycology.* (4)
The structure, life history, and physiology of the fungi. Three lectures and one laboratory period per week. Prereq: One course in Biology.

528 *Plant Cytology.* (4)
The structure of plant cells; mitosis and meiosis. Lectures, three hours and two hours of laboratory per week. Prereq: Six credits in the Biological Sciences.

530 *Introduction to Heredity.* (3)
The principles of heredity and their physical basis. Prereq: Three credits in the Biological Sciences.

541 *Plant Pathology.* (3)
Significance, nature, causes, and methods of control of plant diseases. Lecture and discussion, two hours; laboratory, two hours. Prereq: One semester of Botany or equivalent. (Same as PPA 541.)

551 *Taxonomy of Vascular Plants.* (4)
A study of the principles and practices of taxonomy and a detailed consideration of the families of vascular plants. Two lectures and two two-hour laboratories per week, including field trips. Prereq: Two semesters of Biology or consent of instructor.

560 *Plant Microtechnique.* (3)
The principal methods used in the preservation and preparation of plant materials for microscopic examination; basic microscopy; histochemistry; techniques for measurement and illustration. Six hours of laboratory per week. Prereq: BOT 125.

600 *Plant Morphogenesis.* (5)
Culture of isolated plant organs in test tubes containing synthetic media. Study the effect of Auxins, Vitamins, amino acids and many other chemicals on the physiology and development of single cells, tissues and organs. Two lectures and three two-hour laboratories per week. Prereq: BOT 501, 521 or 560 or consent of instructor.

620 *Topics in Modern Botany.* (1-3)
A course for students in the biological and related sciences to be taught on various topics by specialists in their fields. Designed to give the student the most up-to-date information on the various topics. May be repeated three times for credit, but each time the course is taken, it must be under a different instructor. The type of course should be indicated by parentheses, i.e., (Systematic Botany), (Cytogenetics), (Morphogenesis), (Mycology), (Algal Physiology), etc. Prereq: Consent of instructor.

626 *Experimental Mycology.* (4)
A study of the genetics, physiology and morphogenetic systems in the fungi. Lecture, two hours per week; laboratory, two two-hour periods per week. Prereq: BOT 524 and consent of instructor.

634 *Cytogenetics.* (4)
Cytological and genetic evidence for the chromosome theory. Chromosome aberrations and their importance in heredity and evolution. Prereq: BOT 528 and 530 or equivalent.

701 *Plant Metabolism.* (3)
Various aspects of plant metabolism including photosynthesis, respiration, nitrogen and protein metabolism; enzyme kinetics; and relation of molecular structure of cell components to function. Lecture, two hours; laboratory, two hours per week. Prereq: CHE 236 or 232, BOT 501, or consent of instructor.

732 *Mineral Nutrition of Plants.* (3)
Discussion of accumulation, translocation, and utilization of mineral elements by higher plants. Emphasis will be placed on the relationship between these processes and plant metabolism. Prereq: BOT 701 or BCH 515 or consent of instructor. (Same as AGR 732 and HOR 732.)

734 *Physiology of Growth and Development.* (3)
A critical evaluation of research in selected aspects of plant growth and development. Emphasis will be on effects of growth environment. Prereq: BOT 701 or consent of instructor. (Same as AGR 734 and HOR 734.)

735 *Biosystematics.* (3)
Principles in the application of data from the fields of ecology, genetics, cytology, morphology, phytogeography, and physiology to the solution of taxonomic problems. Prereq: BOT 551, 530.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Seminar.* (1)
Reports and discussions on various topics in botany. One hour. May be repeated five times for a total of six hours.

790 *Research in Botany.* (1-6)
May be repeated indefinitely, at the discretion of the department. Type of research to be enclosed in parentheses, e.g., (Plant Morphology), (Mycology), (Systematic Botany), (Cytogenetics), etc.

MICROBIOLOGY

Director of Graduate Study—Samuel F. Conti

The graduate program in Microbiology offers the Master of Science degree in the various fields of morphology and physiology of microorganisms, immunology and serology, and medical and public health microbiology. Areas of research specialization include Microbial Biochemistry, and Bioenergetics, Virology, Ecology, Microbial Genetics, Taxonomy, Gnotobiotics (germ-free animal research), and Microbial Uutrastructure. A minimum of one foreign language is required for Ph.D. candidates.

Plan B is permitted with departmental approval. All graduate students including those under Plan B are required to engage in graduate-level research. A reading knowledge of one foreign language is required for the master's degree.

400 *General Bacteriology.* (4)
Microorganisms; their morphology, classification, physiology, relation to certain fermentations, to food, to soil fertility, and to disease. Lecture and recitation, two hours; laboratory, four hours. Prereq: CHE 104 or 112.

410 *Applied Bacteriology.* (2)
A course in bacteriological analysis to supplement courses 200 and 400. Laboratory, four hours. Prereq: MB 200 or 400; or 102 and CHE 112.

500 *Pathogenic Bacteriology.* (4)
Human and animal pathogenic microorganisms, especially their morphological, cultural, and pathogenic properties. Lecture, two hours; laboratory, four hours. Prereq: MB 200 or 400 or 102 and CHE 112.

512 *Growth and Death of Bacteria.* (4)
Physiological aspects of bacterial growth and death; Chemotherapy and disinfection. Two class hours per week; laboratory, four hours per week. Prereq: MB 102 or 200, CHE 232, consent of instructor.

520 *Metabolism of Microorganisms.* (4)
Chemical changes produced by microorganisms; properties of their enzymes; the physiology of their growth. Lecture or conference, two hours; laboratory, four hours. Prereq: CHE 232; reading knowledge of German or French.

550 *Immunology and Serology.* (5)
The theories and mechanisms of infection and immunity; preparation, standardization, and uses of biological products; serology. Lecture, two hours; laboratory, six hours. Prereq: MB 500.

610 *Bacteriology of Foods.* (4)
Dairy and miscellaneous food products; food preservation; food poisoning. Standard methods for official food and public health laboratories. Lecture, two hours; laboratory, four hours. Prereq: MB 200 or 400; or 102 and CHE 112.

620 *Bacteriology of Water and Sewage.* (4)
Microbiology of water; methods of purification. Sewage disposal methods. Operation of swimming pools. Standard and other methods for examination. Lecture, two hours; laboratory, four hours. Prereq: MB 200 or 400; or 102 and CHE 112.

660 *Electron Microscopy.* (3)
Theory, operation and uses of the magnetic electron microscope and the vacuum unit for metal shadow casting. Lecture, one hour; laboratory, four hours. Prereq: PHY 232, 242.

670 *Viruses and Rickettsiae.* (4)
Natures, activities, and methods of laboratory cultivation of viruses and rickettsiae; their relation to bacteria, plants, and animals. Lecture, two hours; laboratory, four hours. Prereq: MB 550.

700 *History of Bacteriology.* (2)
Conference, two hours. Prereq: MB 550.

712 *Bacterial Anatomy, Taxonomy and Nomenclature.* (3)
Study of anatomical structure of various groups of bacteria, theories of staining, principles of taxonomy, code of nomenclature of bacteria and viruses. Cytochemical procedures used in laboratory. Lecture and conference, two hours; laboratory, two hours. Prereq: MB 550; recommended MB 660, CHE 232.

714 *Microbial Genetics.* (4)
The nature and action of genetic material in microorganisms. Lecture and conference, two hours; laboratory, four hours. Prereq: Basic courses in genetics and microbiology; CHE 232.

722 *Metabolism of Microorganisms.* (4)
Continuation of MB 520. Lecture or conference, two hours; laboratory, four hours. Prereq: MB 520.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Seminar.* (0-1)
Review of current literature in microbiology; presentation of papers on work in progress in the department or on assigned topics; reports on meetings of national and instructional scientific and professional societies and symposia. Required of all graduate students. Two hours. May be repeated to a maximum of 10 credits.

790 *Research in Bacteriology.* (3-6)
Laboratory, ten hours. May be repeated to a maximum of 12 credits.

795 *Research in Bacteriology.* (3-6)
Laboratory, ten hours. May be repeated to a maximum of 24 credits. Prereq: Master's degree or equivalent.

PLANT PHYSIOLOGY

Director of Graduate Study—Claus Brunwald

The interdepartmental graduate program in Plant Physiology offers a plan of study leading to the degree of Doctor of Philosophy. Faculty members of the program are plant physiologists from the Thomas Hunt Morgan School of Biological Science in the College of Arts and Sciences and the Department of Agronomy, Horticulture and Plant Pathology in the College of Agriculture. Course offerings in plant physiology are listed under the Department of Agronomy, Horticulture, Plant Pathology, and the Thomas Hunt Morgan School of Biological Sciences. Work leading to the Doctor of Philosophy degree must conform to the general rules and regulations of the Graduate School. Reading proficiency in one foreign language is required, normally German, Russian, or French. A formal minor is not re-

quired. Contact the Director, N-212F, Agricultural Science Center for additional information.

BIO 630 *Experimental Techniques in Plant Physiology.* (3)
Presentation of theory and experimental techniques for the study of chemical constituents by centrifugation, chromatography, spectroscopy and electrometry. Discussion of methods and design to culture, sample and prepare plant material for use in physiological experiments. Two class hours per week; three laboratory hours per week. (Same as AGR 630.) Prereq: BOT 501, CHE 232, 233 or consent of instructor.

BIO 768 *Residence Credit for Master's Degree.* (0)
(1 to 6 credits equivalence). May be repeated to a maximum of six credits equivalence.

BIO 769 *Residence Credit for Doctor's Degree.* (0)
(1 to 12 credits equivalence.) May be repeated indefinitely.

BIO 771 *Seminar in Plant Physiology.* (1)
Reports and discussions on various topics in Plant Physiology. May be repeated for a maximum of eight credits.

ZOOLOGY

Director of Graduate Study—Samuel F. Conti

Graduates of accredited colleges with a bachelor's degree in Zoology or Biological Sciences who satisfy the requirements of the graduate school may apply for admission to the graduate program for work leading to degrees of Master of Science or Master of Arts in Zoology according to Plan A or Plan B or a Doctor of Philosophy in Biology. (See the Thomas Hunt Morgan School of Biological Sciences.) Almost all fields of study encompassed by Zoology are available to students in the program.

A reading knowledge of one foreign language is required for the master's degree.

400 *Fundamentals of Biology for Secondary School Teachers.* (4)
A course designed to aid the teacher in the selection of subject matter and in the presentation of modern biology to high school students. Lectures, discussions, laboratories, ten hours (600 minutes) per week. Prereq: Employment as high school teacher. (Same as BOT 400.)

402 *Advanced Topics in Biology for Secondary School Teachers.* (4)
A treatment of selected topics from the point of view of modern developments designed to aid the high school teacher to keep abreast of changes in theory and practice; to increase his knowledge of subject matter, and to provide better motivation for his students. Lectures, discussions, and demonstrations, eight hours (400 minutes) per week. Prereq: Employment as high school teacher and consent of instructor. (Same as BOT 402.)

502 *Principles of Physiology Lectures.* (3)
A comprehensive discussion of Physiology using advanced texts and library reading; includes function as related to major body systems. Prereq: One year Physics and Organic Chemistry. (Same as PGY 502.)

503 *Principles of Physiology.* (5)
A comprehensive discussion of physiology using advanced texts and library reading; includes function as related to major body systems and laboratory experience with major experimental techniques. Prereq: One year Physics and Organic Chemistry. (Same as PGY 503).

504 *Heredity.* (4)
Lectures and recitations on principles of heredity, variation and eugenics. Prereq: ZOO 104, or BIO 200-202.

506 *Embryology.* (5)
A general course in ontogeny. Studies in maturation, fertilization, cleavage, organogenesis and anomalies of development with laboratory work based on the chick and pig. Three lectures and two two-hour laboratories per week. Prereq: BIO 200-202, CHE 112.

508 *Evolution.* (3)
An advanced lecture course on some of the fundamental principles of organic evolution. Prereq: ZOO 104, or BIO 200-202.

509 *Zoology Seminar.* (1)
Reports on: technical papers in scientific journals, book reviews, recent developments in Zoology, scientific meetings. Required of all majors in Zoology. May be repeated to a maximum of four credits.

510 *Independent Work.* (3)
Special problems for individual students who are capable of pursuing independent investigations. May be repeated to a maximum of 12 credits. Prereq: Major and a standing of 3.0 in the department.

512 *Physiology of Development.* (3)
A review of theories of differentiation and a consideration of the genetic environment, and correlative physiological factors in differentiation. Lectures, assigned readings and literature reports. Prereq: ZOO 506.

513 *General Histology.* (4)
A course in the technique of preparation of animal tissues, for microscopic study. Practice in imbedding, staining, sectioning, mounting, and identification of tissues. Prereq: ZOO 104, or BIO 200-202; CHE 112.

521 *Limnology.* (4)
Detailed analysis of fresh water environment with special emphasis upon biological productivity. Two hours lecture, four hours field and laboratory. Prereq: CHE 110, 112, PHY 211, 213; ZOO 104, or BIO 200-202; consent of instructor.

528 *General Entomology.* (4)
Introduction to the Class Insecta. Morphology, physiology, development, systematics, and ecology of insects; procedures and techniques of insect identification; preparation of insect collections for research purposes. Lecture, two hours. Prereq: ZOO 104, or BIO 200-202; three additional credits in ZOO 570 or 502.

530 *Vertebrate Zoology.* (4)
An intensive survey of the vertebrate classes, with emphasis on morphology, classification, phylogeny, trends in evolution, and adaptations. Two lectures and two laboratory periods per week. Prereq: ZOO 104, or BIO 200-202.

532 *Medical Entomology.* (4)
Study of arthropod vectors of disease. Structure, collection, identification, control measures and life history studies. Given alternate years. Prereq: ZOO 545 or consent of instructor. (Same as ENT 532.)

540 *General Radiation Biology.* (4)
A basic course devoted to a study of radiation techniques and research and their application in the various fields of biology. Lectures devoted to basic background and health hazard aspects followed by more comprehensive treatment of biological aspects. Laboratory devoted to use of radiosotopes and techniques of their measurement using various radiation detectors and counters. Lectures, two hours per week; laboratory, four hours. Prereq: Two years of biological sciences, one year of chemistry, and consent of instructor. (Same as RM 540.)

542 *Insect Taxonomy.* (4)
Methods and principles of systematic entomology and zoology; characteristics of taxonomic categories; and international rules of zoological nomenclature. Collection, preparation and identification of insect specimens. Given alternate years. Lecture, two hours; laboratory, four hours. (Same as ENT 542.) Prereq: ENT 100, ZOO 104, or BIO 200-202.

544 *Protozoology.* (4)
A comprehensive study of the Phylum Protozoa emphasizing current concepts of classification, phylogeny and evolution, ultrastructure, reproduction, nutrition, growth and motile behavior. The laboratory

involves collection, identification, cultivation and physiology of Protozoa with extensive observation and analysis of cellular function. Lecture, two hours; laboratory, four hours. Prereq: ZOO 104, or BIO 200-202, CHE 230-232, MA 113, 211, PHY 231, 232, and at least eight hours in Zoology.

545 *Parasitology.* (4)
Protozoan, helminth and arthropod parasites of man and domestic animals, emphasis on etiology, epidemiology, methods of diagnosis, control measures, and life histories. Techniques for host examination and preparation of material for study. Prereq: ZOO 104 or BIO 200-202. (Same as ENT 545.)

546 *Helminthology.* (4)
The etiology, epidemiology, pathology, diagnosis, prophylaxis and control of trematode, cestode and nematode parasites of vertebrates, with special emphasis on those of veterinary and medical importance. Given alternate years. Prereq: ZOO 534 or consent of instructor.

547 *Ichthyology.* (4)
Taxonomy of the fishes with life-histories and biology of types. Fish structure and physiology, habits, ecology. Fish-culture and economic Ichthyology; care of fishes, aquaria, etc. Elements of fresh-water fishery administration. Given alternate years. Prereq: ZOO 104, or BIO 200-202.

548 *Herpetology.* (4)
Designed to acquaint the student with the amphibians and reptiles of eastern North America, their classification, adaptations and natural history. Lecture, two hours; laboratory, four hours per week. Given alternate years. Prereq: ZOO 104, or BIO 200-202.

549 *Ornithology.* (4)
A study of the life-histories, habits, identification, structure, adaptations, and physiology of birds. Special emphasis upon migrations, songs, nests and economic importance of our native birds. Lecture; field excursions; laboratory studies. Given alternate years. Prereq: ZOO 104, or BIO 200-202.

550 *Comparative Physiology.* (5)
Physiological mechanisms by which animals cope with different environmental stresses. Osmoregulation, respiration, temperature regulation and tolerance, sensory reception, circulation, etc. Prereq: One year college chemistry, ZOO 570, one year college physics or consent of instructor.

551 *Mammalogy.* (4)
Designed to acquaint the student with the mammals of eastern North America, their classification, adaptations and natural history. Lecture, two hours; laboratory, four hours per week. Given alternate years. Prereq: ZOO 104, or BIO 200-202.

560 *Embryology and Morphology of Vertebrates.* (3)
An integrated study of the comparative embryology, histology and gross anatomy of vertebrates, stressing the adaptive significance of evolutionary change, the functional significance of morphological organization and basic ontogenetic concepts. Prereq: One year of general biology or consent of instructor.

561 *Laboratory Studies of the Embryology and Morphology of Vertebrates.* (2)
Companion laboratory to ZOO 560. Four laboratory hours per week. Prereq: One year of general biology, concurrent enrollment in ZOO 560 or consent of instructor.

562 *Embryology and Morphology of Vertebrates.* (3)
An integrated study of the comparative embryology, histology and gross anatomy of vertebrates, stressing the adaptive significance of evolutionary change, the functional significance of morphological organization and basic ontogenetic concepts. Prereq: One year of general biology, ZOO 560 or consent of instructor.

563 *Laboratory Studies of the Embryology and Morphology of Vertebrates.* (2)
Companion laboratory to ZOO 562. Four laboratory hours per week. Prereq: One year of general biology, ZOO 560, concurrent enrollment in ZOO 562 or consent of instructor.

570 *Invertebrate Zoology.* (4)
An intensive survey of the invertebrate phyla, including morphology, classification, phylogeny, general trends in the evolution of organ systems, and adaptations to varied modes of existence. Two lectures and two laboratory periods per week. Prereq: ZOO 104, or BIO 200-202.

602 *Insect Morphology.* (4)
A study of internal and external insect structure, including function, and variation of form. Lecture, two hours; laboratory, four hours. Prereq: ENT 100 and consent of instructor. (Same as ENT 602.)

604 *Advanced Animal Ecology.* (3)
Selected topics from recent studies on the energy flow concept of ecology, population ecology and community ecology. Prereq: ZOO 502 or BOT 513, one year physics, organic chemistry, one year mathematics; calculus and statistics recommended.

610 *Insect Ecology and Behavior.* (3)
The biotic and physical factors influencing the distribution, abundance, and behavior of insects and insect populations. Two class hours and two laboratory hours per week. Prereq: Consent of instructor. (Same as ENT 610.)

611 *Speciation.* (3)
Mechanisms of Evolution. A discussion of modern theories and problems concerning the formation of animal species.

612 *Principles of Animal Systematics.* (3)
Theory and practice of animal classification, with study of applications of the International Code of Zoological Nomenclature. (Same as ENT 612.) Prereq: At least two advanced survey courses in Zoology and/or Entomology, for example, ZOO 530, 570, 544, 611 or ZOO/ENT 620.

615 *Seminar in Animal Navigation.* (2)
Discussions of the original literature on home range, homing ability and migration of animals. Prereq: Some reading knowledge of German.

617 *Advanced Microtechnique.* (3)
Special methods in histological technique for students of Zoology, Pathology or Anatomy.

620 *General Acarology.* (4)
Introduction to study of mites. Classification, morphology, physiology and ecology of mites important to the medical, veterinary and agricultural fields. Lecture, two hours; laboratory, four hours. Prereq: ZOO 104, or BIO 200-202; ENT 100 and consent of instructor. (Same as ENT 620.)

630 *Insect Physiology.* (4)
Principles of insect physiology, function of organs, circulation, reproduction, respiration, and digestion. Lecture, 2 hours; lab, 4 hours. Prereq: Consent of instructor. (Same as ENT 630.)

640 *Biological Effects of Radiation.* (3)
A consideration of the action of ionizing radiation and ultraviolet light at progressively higher levels of organization. Recent experiments and current theoretical concepts will be emphasized. Prereq: ZOO 540, or two years Chemistry, Physics and Biological Sciences and consent of instructor. (Same as RM 640.)

642 *Vertebrate Natural History.* (4)
Behavior of vertebrate animals in their natural habitats as related to shelter, food, reproduction, and other aspects of survival. Adaptations contributing to behavioral patterns will be considered. Two lectures and two laboratory periods per week. Given in alternate years. Prereq: ZOO 530, 502.

660 *Special Topics in Endocrinology.* (2)
A lecture-seminar course designed to explore in depth certain areas not covered in the introductory course. Usually invertebrate endocrinology, plant hormones, and physiology of reproduction will be covered. Prereq: ZOO 560 or equivalent.

709 *Graduate Seminar in Zoology.* (1)
Discussions of current research in Zoology. Prereq: Graduate standing in biological sciences.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

790 *Research in Zoology.* (1-6)
Independent research work under direction, with conferences on objectives, principles, materials, methods, analysis of data and conclusion. Progress reports required at intervals. May be repeated indefinitely, at discretion of department. Type of research to be enclosed in parenthes, e.g., (Genetics), (Ecology), (Embryology). Prereq: Undergraduate degree in biological sciences.

CHEMICAL PHYSICS

Director of Graduate Study—Ben Gossick

The Department of Chemistry and the Department of Physics and Astronomy jointly provide a program in chemical physics leading to the degree of Doctor of Philosophy. Chemical physics in an overlapping area of the fields of chemistry and physics and, because of its relevance to such fields as Astrophysics, Thermonuclear physics, and Biophysics, it currently enjoys a position of considerable esteem at a number of institutions. Experience shows that most exciting progress is made when members of the traditional fields of chemistry and of physics join together to form an operating unit of wide scope without the sacrifice of depth in the specialized areas. Students of either department are encouraged to follow a broader and richer curriculum by crossing departmental boundaries, both in the selection of courses and in the pursuit of independent research. Students and faculty frequently meet for informal seminars in chemical physics, encouraging exchange of information in the following research components of the chemical physics program: atomic and molecular theory, atomic and molecular processes, solid state theory and experiments, surface state physics, X-ray crystallography, and mass spectroscopy. Course offerings in chemistry and in physics, including the special offerings in chemical physics (CHE 755 or PHY 755, Topics in Chemical Physics) are listed under the Department of Chemistry and the Department of Physics and Astronomy.

CHEMISTRY

Director of Graduate Study—Robert W. Kiser

The Department of Chemistry offers the Master of Science and the Doctor of Philosophy degrees. Normally only Plan A is accepted for the Master of Science degree. Students may major in areas of chemistry such as analytical, chemical physics, inorganic, organic, physical, and radio-nuclear. All candidates for the Ph.D. degree are required to serve as a teaching assistant for one semester.

A satisfactory reading knowledge of German is required for the M.S. and Ph.D. degrees. For the Ph.D. degree a satisfactory reading knowledge of an additional foreign language such as French or Russian is required.

All new graduate students must take proficiency examinations in analytical, inorganic, organic, and physical chemistry. The results of these examinations are used as a guide in establishing the student's program of courses.

440 *Physical Chemistry.* (3)
The fundamental principles of physical chemistry are studied with emphasis upon the application of these in the correlation of natural phenomena. Prereq: CHE 108 or 112, and 115; MA 213; PHY 242.

441 *Physical Chemistry Laboratory.* (2)
Laboratory studies in physical Chemistry to accompany CHE 440. Laboratory, six hours. Prereq or concur: CHE 440.

442 *Physical Chemistry.* (3)
A continuation of CHE 440. Prereq: CHE 440.

443 *Physical Chemistry Laboratory.* (3)
Laboratory studies in physical chemistry to accompany CHE 442 with emphasis upon the proper treatment of data. Laboratory, six hours; recitation, one hour. Prereq or concur: CHE 442.

444 *Physical Chemistry.* (3)
For students in Agriculture and in the Biological Sciences. Prereq: CHE 108 or 112, and 115; MA 113; PHY 213.

510 *Advanced Inorganic Chemistry.* (3)
A course dealing with the concepts of inorganic chemistry with emphasis on atomic structure, periodicity, nomenclature, bonding, chemistry of the non-transition elements and acid-base theories. Prereq: CHE 112 or 226.

512 *Inorganic Chemistry Laboratory.* (3)
Preparative techniques of inorganic chemistry to include: the use of liquefied gases, aqueous and non-aqueous solutions, anhydrous and oxygen-free systems, and the handling of highly reactive materials. Lecture, one hour; laboratory, six hours per week. Prereq: CHE 510.

520 *Radiochemistry.* (3)
An introduction to the use of radionuclides in chemistry. Topics include principles of radioactive decay, use of tracers, activation analysis, interactions of radiations with matter and hot-atom chemistry. Lecture and laboratory, five hours. Prereq: CHE 112 or 226.

522 *Instrumental Analysis.* (4)
The theory and application of instrumental methods of analysis. Lecture, two hours; laboratory, six hours. Prereq: CHE 442.

532 *Qualitative Organic Analysis.* (3)
A systematic study of the separation and identification of organic compounds. Lecture, one hour; laboratory, six hours. Prereq: CHE 233.

538 *Principles of Organic Chemistry.* (3)
A general survey of the field of organic chemistry. Prereq: CHE 232.

547 *Advanced Physical Chemistry I.* (3)
An introduction to quantum chemistry and spectroscopy, emphasizing applications to chemical bonding, atomic and molecular spectroscopy, and magnetic resonance. Lecture, three hours. Prereq: CHE 442, MA 214.

548 *Advanced Physical Chemistry II.* (3)
Fundamental principles of classical physical chemistry, including the kinetic theory, thermodynamics, statistical thermodynamics, and chemical kinetics. Prereq: CHE 440.

550 *Physiological Chemistry.* (4)
A study of the chemistry of living processes. Lecture, three hours; laboratory, three hours. Prereq: CHE 226, 231 and 232.

552 *Physiological Chemistry.* (4)
A continuation of CHE 550. Prereq: CHE 550.

572 *Seminar.* (1)
Reports and discussions on recent research and current chemical literature.

582 *Chemical Literature.* (1)
Training in the use of chemical literature. Prereq: Junior or senior standing.

610 *Chemistry of the Transition Metals.* (3)
A detailed treatment of the chemistry of the transition elements, lanthanides and actinides, including the structure of coordination complexes, bonding, reaction mechanisms and preparations. Prereq: CHE 510.

612 *Inorganic Chemistry of the Non-Metals.* (3)
A detailed treatment of the inorganic chemistry of the non-metals. Topics include theories of bonding, spectral characteristics, reaction mechanisms, preparations, physical methods of characterization and structure determination, and applications. Prereq: CHE 510.

616 *Nuclear Chemistry.* (3)
An advanced study of nuclear chemistry and topics related to nuclear and radiochemistry. Prereq: CHE 443 and 520.

625 *Optical Methods of Analysis.* (3)
An intensive study of the theory and applications of each of the following methods: emission spectroscopy, absorption spectrophotometry, colorimetry, refractometry, and polarimetry. Laboratory, six hours. Prereq: CHE 522.

626 *Advanced Analytical Chemistry.* (3)
An advanced study of the theory and practice of quantitative analysis.

633, 635 *Advanced Organic Chemistry.* (3 ea.)
Fundamental organic chemistry as interpreted by modern theory. Prereq: CHE 538.

640 *Electrochemistry.* (2)
Adsorption and potential distribution at the electrode surface. Mechanism and kinetics of electrode processes. Kinetic interpretation of such phenomena as reversibility and overvoltage. Prereq: CHE 442 or 548.

645 *Chemical Thermodynamics.* (3)
Principles and applications of chemical thermodynamics. Prereq: CHE 442.

646 *Chemical Kinetics.* (3)
Studies of chemical reactions from the standpoint of velocity and mechanism. Prereq: CHE 442.

647 *Quantum Chemistry.* (3)
An introduction to quantum mechanics with emphasis on the aspects closely related to chemistry. Prereq: CHE 547.

710 *Topics in Inorganic Chemistry.* (2)
Discussion of topics of recent interest in inorganic chemistry, including physical methods, syntheses, and structural theories. May be repeated to a maximum of six credits. Prereq: CHE 610 or 612.

714 *Non-Aqueous Solutions.* (2)
A study of non-aqueous systems and of reactions in non-aqueous systems. Prereq: CHE 443.

720 *Electrochemical Methods of Analysis.* (3)
Classification of methods. Inherent and practical limits of sensitivity. Polarographic, voltametric and pluse methods. Lecture and laboratory, seven hours. Prereq: CHE 522 and 640.

726 *Topics in Analytical Chemistry.* (1-3)
Selected topics which may include spectrometric methods of analysis, nuclear magnetic resonance, mass spectrometry, x-ray diffraction, microscopy, electroanalytical chemistry, use of computers in analytical chemistry. May be repeated to a maximum of six credits. Prereq: CHE 522.

736 *Topics in Organic Chemistry.* (2-4)
Selected topics which may include heterocyclic organic compounds, natural and synthetic dyes, carbohydrates, nitrogen compounds, and recent advances in the field of organic chemistry. Lecture, two to four hours. May be repeated to a maximum of 12 credits.

743 *Molecular Structure.* (3)
Applications of quantum theory to chemical problems, theories of chemical bonding, structure and spectra of molecules. Prereq: CHE 547.

744 *Statistical Thermodynamics.* (3)
The study of chemical thermodynamics from the viewpoint of the statistical treatment of systems rather than from the empirical classical approach. Prereq: CHE 645.

746 *Topics in Physical Chemistry.* (2-4)
Selected topics which may include photochemistry, structure of crystals, molecular spectra, nature of the chemical bonds, and other recent advances in the field of physical chemistry. Lecture, two to four hours. Prereq: CHE 442. May be repeated to a total of 12 credits.

747 *Advanced Quantum Chemistry.* (3)
An advanced treatment of quantum chemistry with emphasis on the methods and procedures used in its applications. Prereq: CHE 647.

755 *Topics in Chemical Physics*
(Subtitle required). (3)
An introduction to current research areas in chemical physics. Topics may include theory of atomic spectra, atomic and molecular processes, molecular theory, electrons and phonons in crystals, and optical properties of metals. Lecture, two or three hours. May be repeated to a total of 12 credits. Prereq: Consent of instructor. (Same as PHY 755).

768 *Residence Credit for the Master's Degree.* (0)
(1 to 6 credits equivalence.) May be repeated.

769 *Residence Credit for the Doctor's Degree.* (0)
(1 to 12 credits equivalence.) May be repeated indefinitely.

776 *Graduate Seminar.* (1)
Reports and discussions on recent research and current literature. Required of all graduate students.

780 *Individual Work in Chemistry.* (1-5)
Selected library and laboratory problems in conformance with the student's interest will be attacked and pursued under the direction of a suitable staff member who is proficient in the area under investigation.

790 *Research in Chemistry.* (1-5)
Work may be taken in the following fields, subject to the approval of the Departmental Graduate Committee: Analytical Chemistry, Inorganic Chemistry, Organic Chemistry, Radiochemistry, or Physical Chemistry. May be repeated indefinitely.

CLASSICAL LANGUAGES AND LITERATURES

Director of Graduate Study—
Hubert M. Martin, Jr.

The study of classic Greek and Latin is based upon a long tradition of the liberal arts curriculum at the University of Kentucky. Graduate studies in ancient civilization, language and linguistics culminate in the M.A. degree in Classics according to Plan A or B. A reading knowledge of one foreign language is required.

Entrance requirements include a strong undergraduate major and satisfactory GRE score. Individual graduate programs are planned by the director of graduate study and adviser in consultation with the student.

The department offers a limited number of teaching assistantships. Those who hold appointments are not required to pay out-of-state fees. Additional information about graduate study is available from the department on request.

LATIN

425 *Latin Literature in Translation.* (3)
Extensive reading in the most important works. Discussion of the significance of the works in their own and later times to the present. No knowledge of Latin necessary. Graduate students within the Department of Classics hereafter will be *unable* to take the course for graduate credit.

501 *Lucretius and Epicureanism.* (3)
A study of the *De Rerum Natura* in terms of its Greek background and the poet's own milieu. Prereq: CLA 202 or equivalent.

503 *Cicero.* (3)
A study of the orator's political and social views as expressed in his letters and philosophical works. Prereq: CLA 202 or equivalent.

504 *Roman Satire.* (3)
A study of the genre as exemplified in the works of Horace and Juvenal. Emphasis on textual analysis with lectures and class discussions on the poet's literary mileu. Prereq: CLA 202 or equivalent.

505 *Virgil and the Roman Epic.* (3)
A study of the poet's work with particular emphasis on the epic form in Latin literature. Prereq: CLA 202 or equivalent.

511, 512 *Studies in Roman Philology.* (3 ea.)
Courses to meet the needs of students in various areas of Roman philology, e.g., in Latin literature, in Roman civilization, in Latin linguistics, etc. Prereq: Consent of instructor.

530 *The Teaching of Latin.* (3)
The place of Latin and the classical humanities in general education. Objectives, materials, and methods. The reading approach to learning Latin. Evaluation of textbooks and other materials. Prereq: Senior standing.

603 *Studies in Latin Literature of the Republic.* (3)
Intensive study of an author, a literary form, or a problem in the period of the Roman Republic. Considerable attention to secondary sources; students will write papers and present oral reports in class. May be repeated once.

604 *Studies in Latin Literature of the Empire.* (3)
Intensive study of an author, a literary form, or a problem in the period of the Roman Empire. Considerable attention to secondary sources; students will write papers and present oral reports in class. May be repeated once.

GREEK

424 *Greek Literature in Translation.* (3)
Extensive reading in the most important works. Discussion of the significance of the works in their own and later times to the present. No knowledge of Greek necessary. Graduate students within the Department of Classics hereafter will be *unable* to take the course for graduate credit.

556 *Greek Dramatic Literature.* (3)
A study of Greek drama through selected plays of the major tragic and comic writers. Emphasis on textual analysis with lectures and class discussions on the authors' literary milieu. Prereq: CLA 252 or equivalent.

557 *Greek Historical Literature.* (3)
A study of the Greek historiographical tradition as exemplified in Herodotus, Thucydides and other Greek historians. Emphasis on textual analysis with lectures and class discussions on the authors' literary milieu. Prereq: CLA 252 or equivalent.

561, 562 *Studies in Greek Philology.* (3 ea.)
Courses to meet the needs of students in various areas of Greek Philology, e.g., in Greek literature, in Greek civilization, in Greek linguistics, etc. Prereq: Consent of instructor.

601 *Studies in Greek Literature I.* (3)
Intensive study of an author, a literary form or a problem in the period from Homer through the 5th century B.C. Considerable attention will be focused on secondary sources; students will write papers and present oral reports in class. May be repeated once.

602 *Studies in Greek Literature II.* (3)
Intensive study of an author, a literary form or a problem in the period from the 4th century B.C. through the 3rd century A.D. Considerable attention will be focused on secondary sources; students will write papers and present oral reports in class. May be repeated once.

CLASSICS IN GENERAL

580 *Independent Work in Classics.* (3)
Courses to meet the needs of the student will be arranged in various areas. Prereq: Major standing of 3.0 in department or consent of instructor. May be repeated to a maximum of 12 credits.

600 *Bibliography of Classical Scholarship.* (3)
An introduction to the bibliography of classical scholarship and to research methods. Prereq: Reading knowledge of Greek and Latin and of German or French or consent of instructor.

605 *Comparative Greek and Latin Grammar.* (3)
Studies or research in comparative linguistics, historical syntax, semantics, and other aspects of linguistics in the Greek and Latin area. Prereq: Necessary command of the languages involved.

768 *Residence Credit for Master's Degree.* (0)
May be repeated to a maximum of six credits equivalence. (1-6 credits equivalence.)

COMMUNICATIONS

Director of Graduate Study—Robert D. Murphy

The School offers a program leading to the Master of Arts degree which is designed to serve the needs of students with varied goals and backgrounds. Goals may include teaching, research, professional work on the media, or a combination of these. The program is open to students with previous work in journalism, radio-television-films, speech, or other academic areas. Students with no previous work in a communications area will be required to take from five to ten hours of undergraduate work without graduate credit.

From 15 to 24 of the required hours of graduate credit will be taken in communications courses. A minimum of 12 credits in 600 level or higher communications courses, including CMO 651 and CMO 665, are required.

Students can elect, with approval of their adviser, to work under Plan A or Plan B as described in this bulletin. Plan A consists of 24 hours of course work plus a thesis. Included are 12 hours of communications core work and related courses in communications and other areas of the University. Students electing to follow Plan B take 30 hours of course work consisting of 12 hours of communications core, plus three to twelve hours of communications options and six to fifteen hours of options in another area of the University. Eighteen of the minimum 30 credits must be in 600 level or higher courses.

Near the end of their last semester students who follow Plan A will take an oral comprehensive examination covering their course work and their thesis. Students who follow Plan B will take a written comprehensive examination followed by an oral.

COMMUNICATIONS

550 *Introduction to Communications Research.* (3)
To introduce undergraduate students to the philosophy of research—particularly as it applies to communications; and to study the principal types of communications research so that the student will be able to do simple projects and interpret research findings in his field.

551 *The Communications Process.* (3)
Considers the communications process and effects of communications on the individual. Draws upon research in these areas from the fields of communication, political science, psychology, sociology, and journalism.

553 *Mass Communication and Social Issues.* (3)
A course devoted to the examination of criticism of the mass media and an evaluation of the relationship of mass communication to contemporary social issues.

554 *Seminar in Communications.* (2)
Intensive study of a communication topic in professional, theoretical, and research (methodology) areas. Three class hours per week. May be repeated to a maximum of six credits.

605 *Introduction to Information Science.* (3)
Introduction to major areas of information science and technology. Consideration is given to the nature of information science and technology as a field of study, the analysis and design of information systems, basic computer systems, and specific components of information storage and retrieval systems. (Same as LS 605.)

607 *Evaluating and Communicating Information.* (3)
A study of the communications systems with which students will work, of the effect of the communications systems on public decisions, and of the means by which students work efficiently with communications systems.

608 *Mass Communications and Society.* (3)
A study of the ways in which the communications media play their roles in contemporary society with special attention to the major functions, rights, and responsibilities of media and individuals.

614 *Information Storage and Retrieval Systems.* (3)
Investigates the flow of information through information storage and retrieval system; abstracting, indexing, file organization, storage, search strategy, dissemination of information and its utilization. Consideration will also be given to special problems of vocabulary control, semantic and syntactic controls, determination of user requirements and the evaluation of in system performance. Prereq: LS 605, or consent of instructor. (Same as LS 614.)

615 *Information Systems Design.* (3)
Principles and problems of information systems: systems analysis applied to information systems. Design of information systems with particular attention to equipment, training of personnel and evaluation. Prereq: LS 614.

651 *Communications Theory.* (3)
Major theories of the communications process and review of experiments and field studies on communications. Readings, discussion, and student experiments testing theoretical propositions about communications. Prereq: Course in statistics or in design of social research.

665 *Communications Research Methods.* (3)
The scientific method. Communications research as a part of social science research. Study and practice of advanced behavioral research techniques which apply to communications. Prereq: A behavioral research course and permission of instructor.

705 *Seminar: Information Sciences.* (3)
An investigation of the parameters of the information sciences from an interdisciplinary approach. Investigation and analysis of the literature of communications, management science, cybernetics, information theory to identify the similarities and differences. From this investigation, both qualitative and quantitative concepts of the directions of information science will be derived. Prereq: LS 605 or consent of instructor. (Same as LS 705.)

730 *Seminar in Mass Media and Public Policy.* (2)
The role of mass communications media in making public policy and the effects of public policies on the mass media. One subject area will be investigated each semester; typical topics are: a) political campaign communications; b) censorship; c) controversial public issues; d) rights; e) international and world agreements. Prereq: Graduate standing.

781 *Directed Study in Communication.* (1-6)
To provide advanced students with an opportunity for independent work to be conducted in regular consultation with the instructor. May be repeated for a total of six credits. (To be used for independent work.) Prereq: Consent of instructor.

JOURNALISM

501 *News Reporting.* (3)
A reporting course which emphasizes special fields of information, news gathering, and news evaluation.

503 *Copyreading and Editing.* (3)
Instruction and practice in newspaper deskwork. Preparation of local, state, telegraph, and radio news and features; picture editing, and page make-up. Lecture, one hour; laboratory, four hours. Prereq: JOU 501.

507 *Feature Writing.* (3)
Instruction and practice in writing features. Lectures, readings, and reports directed toward discovering, gathering, organizing, writing, and marketing feature articles. Prereq: Senior standing or consent of instructor.

509 *Magazine Article Writing.* (3)
Lectures, personal conferences, and practice in writing and submitting material for publication in magazines; study of the markets for this material; free-lance article writing. Prereq: Senior or graduate standign, or consent of instructor.

511 *Editorial Writing.* (2)
A study of editorials, editorial columns, and editorial pages. Publication of copy encouraged.

513 *Supervision of High School Publications.* (1-3)
A study of the problems that confront the adviser of the high school newspaper or magazine. Open to advisers or prospective advisers with consent of the instructor.

531 *Law of the Press.* (2)
A study of the special laws of libel, copyright, and regulatory provisions that pertain to the press.

535 *History of Journalism.* (3)
A study of the rise and development of American journalism and newspapers. Prereq: Senior standing.

537 *Seminar in Public Opinion.* (3)
A detailed examination of techniques developed and used by the press in influencing public opinion. Specific cases studied. Latter part of course devoted to the preparation of newspaper campaigns dealing with current problems of society. Prereq: Senior or graduate standing.

539 *Reporting Public Affairs.* (3)
Instruction and practice in reporting the news originating in courts and other public institutions. Prereq: JOU 501 and senior standing.

541 *Public Relations.* (3)
Lectures and practice dealing with the aims and methods of writing news and special articles for public relations programs of business, schools, colleges, libraries, and of social service organizations.

561 *Newspaper and Magazine Advertising.* (3)
Relation of newspapers and magazines with advertisers with emphasis upon the preparation of local display and national advertising. Prereq: Consent of instructor.

563 *Advertising Procedures.* (3)
Study of organizations and functions of advertising institutions and of product analysis, and research, consumer motivation, production methods, copy and layout. Lecture, two hours; laboratory, two hours. Prereq: JOU 561.

575 *Typography.* (2)
Instruction and practice in typographic composition. Use of type faces in news editing. Study of typography in the make-up of American newspapers. Laboratory, four hours. Prereq: Consent of instructor.

581 *Introduction to Press Photography.* (3)
Use of cameras, printers, enlargers, and laboratory equipment in modern press photography, and a study of selected readings on photographic methods and skills. Prereq: Consent of instructor.

599 *Advanced Writing for the Mass Media.* (3)
A course designed to provide communications majors advanced training in reporting and writing articles on current events, public issues, personalities, culture and entertainment for newspapers, magazines and the broadcast media. Twice weekly seminars; laboratory and independent work by students as needed to complete assignments; individual consultation between instructor and students. Prereq: Consent of instructor required.

SPEECH

500 *Speech Analysis and Perception.* (3)
Physics of sound; acoustic and structural properties of speech and their relationship to speech perception; analysis of speech intensity, fundamental frequency, wave composition, and time (rate, duration, and transitional change). (Same as EDS 500).

581 *Communication Processes in Discussion.* (3)
A study of the communication processes in small group discussions; emphasis on empirical research findings concerning leadership, interpersonal relations and the logical and psychological aspects of group problem-solving.

582 *Persuasion.* (3)
The principles and methods of persuasion. Of particular benefit to teachers, lawyers, business majors, and other persons whose work is concerned with motivating human conduct.

583 *Studies in Argumentation.* (3)
A study of the theories of argumentation and debate as derived from rhetorical, philosophical and psychological sources; critical examination of representative examples of oral argument.

584 *Teaching of Speech.* (3)
An analysis of the field of speech education as related to the teacher of speech.

585 *American Public Address to 1865.* (3)
An historical and critical study of public discussion in the United States, from the Colonial Period to 1865, through the analysis of major speakers, speeches, and debates. Prereq: Permission of instructor.

586 *American Public Address since 1865.* (3)
An historical and critical study of public address in the United States from 1865 to the present. Prereq: Permission of instructor.

588 *Oral Interpretation of Drama.* (3)
The cutting and adapting of the three-act play for oral presentation.

687 *Studies in Ancient and Medieval Rhetoric.* (3)
A comparative and critical study of the major treatises on the art of speaking, from the time of Aristotle to the Renaissance, with attention to the rhetorical practice, criticism, and pedagogy of the succeeding periods. Prereq: Permission of instructor.

688 *Studies in Renaissance and Modern Rhetoric.* (3)
A comparative and critical study of the major contributions to the body of rhetorical theory from the Renaissance to the present. Prereq: Permission of instructor.

780 *Directed Studies.* (3)
Independent work devoted to study and research on specific subjects and problems according to the interests and needs of individual students. May be repeated twice for a maximum of nine credits.

782 *Special Topics in Speech.* (3)
Study and research on specific topics and problems according to the interests and needs of individual students. Normally offered as an independent work course.

TELECOMMUNICATIONS

421 *Television Production.* (2)
Translation of ideas into television programs. Students prepare, produce, and direct different program types designed to illustrate the process of solving problems of creative work in television. Lecture, one hour; laboratory, four hours per week. Prereq: TEL 312.

432 *Film Production.* (2)
Integration of visual images with emphasis on idea presentation, form, and structure for motion pictures. Lecture, one hour; laboratory, four hours per week. Prereq: TEL 312.

500 *Program and Audience Analysis.* (3)
Course designed to assist students to develop criteria for analyzing structure and content of programs, for analyzing audience size and composition, for analyzing the relationship of audience, program, and the American system. Lecture, two hours per week; laboratory, two hours per week.

501 *Telecommunications Regulations.* (3)
A study of the governmental regulations of telecommunications by the FCC, and other federal, state and local agencies; licensing, libel and slander, copyrights, illegal practices, self regulation.

505 *Telecommunications Program Policies.* (2)
The determination of program policies, program scheduling, and program planning for a community. Prereq: TEL 500.

507 *The Public Affairs Program.* (2)
The role of broadcasting in politics, public affairs, education, and the arts. A consideration of the factors which determine the form, function, and method used by documentaries, interviews, newscasts, and their program forms. Lecture, two hours per week; laboratory, two hours per week. Prereq: TEL 500.

510 *Broadcast Advertising.* (3)
The data and techniques of radio and television advertising, including problems of coverage and circulation, spot campaigns, testing, time buying, the agency, measuring broadcast effectiveness, merchandising radio and television advertising and time selling.

530 *Pro-Seminar in Radio and Television.* (2)
Discussion and reports on current broadcasting highlights and problems. Required of all seniors.

COMPUTER SCIENCE

Director of Graduate Study—T. B. Curtz

The Department of Computer Science grants the M.S. degree.

In order to be admitted, candidates who meet the University requirements must present the Calculus and the knowledge of a higher level programming language such as FORTRAN, COBOL, PLI or ALGOL. In addition, to enter the program without being required to take additional undergraduate training, the candidate is expected to have completed four of the following at the undergraduate level:

An assembly language programming course.
A course in discrete mathematics or data structures.
A course in linear algebra.
A course in logic or logical design.
A course in numerical analysis.
A course in probability or statistics.

Students who enter the program having undergraduate credit for fewer than four of the listed items will be required to take appropriate steps to establish competence in a minimum of four.

The Master's degree is offered under both Plans A and B. However, generally the Department encourages the use of Plan A. Students are required to establish competence in one modern foreign language and to complete at least two thirds of their course work in courses within

the Department which must include the CS Problem Seminar.

An oral or written comprehensive examination is required of all candidates.

420 *Algorithmic Languages and Compilers.* (3)
This course acquaints the student with the formal description of procedure-oriented languages and the techniques useful in the translation of these languages into computer programs. Prereq: CS 250.

421 *Elementary Numerical Methods.* (3)
Outline of capabilities and limitations of the computer. Number representation. Propagation of errors through basic arithmetical operations. Applications of analysis to error-estimation. Linear and non-linear equation solving. Matrix eigenvalues. (Same as MA 421.) Prereq: MA 214 or equivalent.

440 *Information Processing Systems.* (3)
An introduction to structure of information sets covering syntactic or semantic relations. The generation, development and processing of structures and their interrelationships, machine instructions and storage hierarchies. Prereq: CS 250.

445 *Computing and the Humanities.* (3)
An introduction to the use and significance of computing for those who are interested in how to use a computer, but who are not necessarily interested in how to program it. The course will cover the history and social implications of computing but will concentrate more heavily on what results have been and can be obtained in the humanities through the use of well-planned digital computation.

450 *Introduction to Coding Theory.* (3)
An introduction to the principles, techniques and development of algebraic coding theory, with particular emphasis on its use and applicability in Computer Science. Prereq: CS 150 and linear algebra or consent of instructor.

472 *Seminar.* (2)
Weekly report on current research papers. Discussion of new advances in computer science. May be repeated to a maximum of 6 credits. Prereq: CS 250 or 440 or consent of instructor.

482 *Discrete Methods and Models in Applied Mathematics.* (3)
Probability on finite sample spaces, combinatorial mathematics, finite Markov chains, linear programming, theory games. Prereq: MA 214 or equivalent. (Same as STA 482, MA 482.)

510 *Discrete Computer Mathematics.* (3)
The course covers basic material and selected topics in Combinatorial Mathematics. This includes inversion formulas, generating functions and recursions, combinatorial identities, partitions, enumeration theorems and block designs. Prereq: CS 340 or consent of instructor.

525 *Analog and Hybrid Computer Techniques.* (3)
Application of analog and hybrid computers in the solution of integro-differential-difference equations. Interfacing of analog and digital devices.

530 *Computational Methods.* (3)
A study of computational methods from the user's standpoint rather than from the designer's. Prereq: MA/CS 421 or instructor's consent, plus ability to program a digital computer.

538 *Elementary Numerical Analysis.* (3)
Interpolation. Gaussian quadrature, orthogonal polynomials. Richardson process. Numerical treatment of ordinary differential equations and intermediate linear algebra. Linear difference equations. (Same as MA 538.) Prereq: MA 421.

540 *System Simulation.* (3)
Computer simulation techniques including building and utilizing deterministic and stochastic models for digital and analog computers. Prereq: CS 150 or CS 221, or equivalent and a course in statistics.

560 *Non-Numerical Applications of Computers.* (3)
Introduction to and training in using digital computers to solve non-numerical problems. Prereq: CS 440 or equivalent.

570 *Computers and Programming Systems.* (3)
Advanced concepts in software design, development, and implementation including priority, executive, and real time computer systems. Prereq: CS 420.

575 *Formal Language Theory.* (3)
A study of various types of formal grammars and the languages they generate; phrase-structure grammars; context-sensitive, context-free, and regular grammars. Recognition of languages by various types of automata: Turing machines, pushdown automata, and finite automata. Decidability and undecidability of questions concerning languages. Prereq: Basic knowledge of computer programming or consent of instructor.

605 *Advanced Information Processing.* (3)
Linked allocation, doubly-linked lists, trees, multi-linked structures, dynamic storage allocation, list processing languages, processing of game trees. Prereq: 440, 510 or equivalent.

612 *Independent Work in Computer Science.* (1-3)
Reading course for graduate students in Computer Science. May be repeated to a maximum of 9 credits. Prereq: Over-all standing of 3.0, and consent of instructor.

620 *Numerical Approximation and Curve-Fitting.* (3)
Design of computer programs to approximate given functions to within a specified tolerance according to a specified norm. Curve-and-surface-fitting, spline approximation. Smoothing. Optimization techniques. Prereq: CS/MA 538.

631 *Error Analysis and Certification.* (3)
Effects of inexact data and/or computer arithmetic on the accuracy of the computed solution to a problem. Design of acceptance tests on the basis of which a computer program may be certified as meeting its specifications. Prereq: CS/MA 538.

680 *Seminar in Computer Science.* (2)
May be repeated to a total of 6 credits.

685 *Special Topics in Computer Science.* (3)
To be selected by staff. May be repeated to a maximum of 9 hours.

690 *Advanced Programming Systems I.* (3)
Programming topics including list processing and recursion. Non-sequential processing including time-sharing system. Prereq: CS 570 or equivalent.

768 *Residence Credit for Master's Degree.* (0)
May be repeated. (1-6 credits equivalence.)

DIPLOMACY AND INTERNATIONAL COMMERCE

Director of the Patterson School—
Vincent Davis

The Patterson School of Diplomacy and International Commerce offers an interdisciplinary master's degree and serves in an advisory capacity with respect to the Ph.D. programs in international studies within the four departments primarily related to the Patterson School. Those primary departments are Business Administration, Economics, History and Political Science.

The M.A. degree program can be tailored with considerable flexibility to meet the career needs of any particular student. This program is especially useful for the student desiring a career in any of the non-academic fields in foreign affairs, such as international banking, international business, international journalism (foreign correspondent), or service with governmental agencies (such as the U.S. Department of State) or international organizations (such as the United Nations) in foreign affairs.

At least half of the 30 minimum hours for the M.A. degree must ordinarily be in one of the four primary departments. Each student is expected, in the absence of special circumstances, to take a methodology course in his field of concentration (such as Business Administration 636, Economics 660 or 661 or 662, History 606, or Political Science 671, depending in part on past training). Most students can expect to complete the 30 minimum hours for the M.A. degree in one full school year (12 hours in each of two semesters) plus a summer session, or plus the following (third) semester if more than the 30 minimum hours are desired.

To assure the interdisciplinary character of the degree, the M.A. candidate is expected to take 12 to 15 hours distributed in at least two departments outside his major departmental concentration. Courses acceptable to the program include those dealing with interstate and cultural relations, foreign policy, and national and regional development processes. Enough flexibility is allowed so that a student may concentrate his work in a specific geographical area such as Latin America, Asia, Europe, etc., or prepare himself more broadly in certain topical or functional aspects of international affairs.

The student must pass a written examination covering work in three subfields of study, with these subfields to be defined for any particular student and in consultation with the student by the Patterson School Director of Graduate Study.

The Patterson School M.A. candidate must meet the basic Graduate School requirement for a reading knowledge of a modern foreign language, except that the candidate may request that the Director of the Patterson School, in consultation with other appropriate faculty members, allow the substitution of another research skill (such as statistics, other methodologies or relevant techniques) in lieu of the language requirement, with adequate competence to be determined by procedures established by the Director.

Students planning to continue their studies beyond the M.A. may apply for admission to one of the appropriate Ph.D. programs at the University of Kentucky (or elsewhere). If at the University of Kentucky, the most likely departmental doctoral programs include those in Political Science, History, International Economics and Economic Development, and International Business and Commerce. These doctoral programs are fully described under the appropriate headings elsewhere in this **Bulletin.** However, since the doctoral programs have their own varying requirements, it is to be expected that in many cases the Patterson School's interdisciplinary M.A. will require that the student take longer to complete his course work for the Ph.D. than if he had enrolled directly in one of the departmental doctoral programs upon entering Graduate School. The additional work required is likely to be heaviest with respect to business administration, where the first year of graduate study is largely prescribed, and in economics, where certain methodology and service courses need to be completed early in the program. In all instances the extra time required will also depend on the nature of a student's undergraduate preparation.

A number of non-service Patterson School Fellowships are available from the income from the bequest of James K. Patterson, the first President of the University.

Application forms for admission and for fellowship assistance should be requested from the Dean of the Graduate School and returned to the Dean of the Graduate School.

It is useful if advance carbon copies or photocopies of all such application materials can be sent directly to the Director of the Patterson School (Patterson Office Tower, University of Kentucky). The Director of the Patterson School strongly encourages all applicants to take the Graduate Record Examination (Verbal and Quantitative, plus the Advanced Examination in the major undergraduate field) in time for the GRE scores to be submitted as part of the application procedure. In addition, the Director of the Patterson School encourages each applicant to submit a brief statement (two or three pages, at most) to the Director explaining his or her special interest in the Patterson School program in terms of his or her career goals, and further encourages each applicant to request three academic letters of reference to be mailed directly to the Director of the Patterson School.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

ENGLISH

Directors of Graduate Study—Joseph H. Gardner, W. S. Ward, Donald A. Ringe

The Department of English offers programs leading to the M.A. and to the Ph.D. degrees. The master's degree may be obtained either by Plan A or Plan B, as defined in this bulletin. With the consent of the Dean of the Graduate School and the Director of Graduate Studies in English, the student may undertake a program leading to the master's degree provided that he has

(1) completed the equivalent of a University of Kentucky undergraduate major in English and,

(2) fulfilled the admission requirements of the Graduate School. An applicant who fails to meet the first qualification may be admitted with the understanding that his program must include some advanced undergraduate work in English in addition to the courses normally required for the M.A. A reading knowledge of one foreign language is required for the master's degree.

Each student will be evaluated on his merits before he is officially admitted to the doctoral program by the English graduate faculty. Students who receive their master's degrees from the University of Kentucky will be judged on their course grades, on the recommendations of their instructors, their Graduate Record Examination scores, and their performance in a diagnostic preliminary examination. Students who have received their master's degrees elsewhere will be evaluated on their course grades after the equivalent of one semester's full-time graduate work at the University of Kentucky, instructor's recommendations, GRE scores, and performance in the preliminary examination.

There is no specific requirement in a minor area, but such work may be required by a student's Special Committee if it appears to be essential to the major research or concentration interest. A Ph.D. candidate normally offers German and French for his language requirement, but substitutions may be authorized according to the procedure described in this bulletin.

A detailed statement of departmental requirements is available on request.

414 *Introduction to Modern English Linguistics.* (3)
A study of phonemics, morphemics, and syntax. Special attention will be given in laboratory sessions to practical applications. Prereq: Junior standing.

421 *Chaucer.* (3)
Extensive readings in the principal works of Chaucer, with particular attention to the *Canterbury Tales.*

425 *Shakespeare Survey.* (3)
A study of ten to twelve of the major plays of Shakespeare, including comedies, tragedies, and histories. The student may receive credit for this course and for either ENG 526 or ENG 527, but not both; and only one of these three courses may count toward fulfillment of the requirements for the English major.

428 *Milton.* (3)
Extensive readings in Milton's poetry and prose.

440 *The English Novel I.* (3)
A study of the English novel and its backgrounds from the beginnings through Jane Austen. Emphasis on the major figures of the 18th century: Defoe, Richardson, Fielding, Smollett, and Sterne.

441 *The English Novel II.* (3)
A study of the English novel and its backgrounds from Scott and the early Victorians through Hardy and the Age of Transition. Such novelists as the Brontes, Dickens, Thackeray, Trollope, George Eliot, Meredith, and Collins will be studied.

442 *The English Novel III.* (3)
A study of the English novel and its backgrounds from Conrad and the Age of Transition to the present. Emphasis on the major figures of the Pre-World War II era: such as Joyce, Lawrence, Forster, and Virginia Woolf.

454 *American Novel Before 1900.* (3)
An analytical and historical survey of the American novel from Charles Brockden Brown to the early Dreiser. Novelists such as Cooper, Hawthorne, Melville, Twain, Howells, James and Crane will be studied.

455 *Modern American Novel.* (3)
An analytical and historical survey of the American novel from Wharton to Mailer. Novelists such as Dreiser, Anderson, Lewis, Fitzgerald, Hemingway, Faulkner, Steinbeck, Updike and Bellow will be studied.

473 *General Introduction to Folklore.* (3)
An introduction—on a world-wide scope—to the types of folklore. Emphasis upon folklore as a cultural phenomenon in its own right and upon its relations to literary types. The development of the science of folklore.

474 *American Folklore.* (3)
A study of the major materials in American folklore. The use of this material in other forms. Experience in actual collecting and in the cataloging of materials.

490 *English Drama I.* (3)
A study of English drama, exclusive of Shakespeare, from the beginnings to the closing of the theatres. Works by such authors as Lyly, Kyd, Marlowe, Jonson, Webster and Ford will be studied.

491 *English Drama II.* (3)
A study of major plays from the Restoration to the 20th Century. Works by such writers as Dryden, Congreve, Wycherly, Goldsmith, Sheridan, Bulwer, Pinero, Wilde and Shaw will be studied.

500 Level Courses: Many courses on the 500 level are basically survey courses, whose purpose is to give an intensive overview of the literature and literary history of the period as a whole.

501 *Workshop in Imaginative Writing.* (3)
For advanced students. This course assumes that the student has already acquired competence as a writer. Prereq: ENG 207 and consent of instructor. With consent of instructor, may be repeated once for a total of six credits.

509 *Composition for Teachers.* (3)
The basic studies helpful to high school teachers of composition. The teaching of grammar, punctuation, usage, etc., and of theme planning, correction, and revision. Students are required to do quite a bit of writing.

510 *American English.* (3)
The varieties of Modern American English: geographical and social dialects, levels of usage, sources of the vocabulary, and spelling. Prereq: ENG 414.

512 *Modern English Grammar.* (3)
Contemporary approaches to grammatical analysis: the interrelationships of phonology, morphology, and syntax. Prereq ENG 414.

514 *Descriptive Linguistics: Phonetics.* (3)
Articulatory description of speech sounds; practice in recognition and control. Prereq: Consent of instructor. (Same as ANT 514.)

515 *Descriptive Linguistics: Phonemics.* (3)
An investigation of speech-sounds and systems of speech-sounds. Also attention to both speech and writing as communication systems. Prereq: Consent of instructor. (Same as ANT 515.)

516 *Descriptive Linguistics: Morphemics.* (3)
An explanation of some of the ways speech sounds are put together in patterns so as to form languages. Prereq: ENG 515; consent of instructor. (Same as ANT 516.)

518 *History of the English Language.* (3)
A survey tracing the development of modern standard English from its Indo-European origin. Emphasis will be placed on the history of sounds, inflections, and vocabulary and on the varying concepts of "correctness."

519 *Introduction to Old English.* (3)
An introduction to Old English language and culture. Chief emphasis is on *Beowulf;* some works will be read in translation.

520 *Middle English Literature.* (3)
A survey of Middle English literature, exclusive of Chaucer. Major writers such as the Pearl-Poet and Langland; major genres such as the romance.

522 *English Renaissance: 1500-1600.* (3)
Literature of the English Renaissance exclusive of the drama. Foreign sources of the English Renaissance. Major writers such as More, Ascham, Wyatt, Sidney, Spenser, Raleigh, and Marlowe.

523 *English Renaissance: 1600-1660.* (3)
Selected non-dramatic works of such writers as Bacon, Donne, Ben Jonson, George Herbert, Izaak Walton, Herrick, Sir Thomas Browne, Vaughan and Traherne.

526 *Shakespeare: The Comedies.* (3)
Shakespeare's comedies will be studied in detail.

527 *Shakespeare: The Tragedies.* (3)
Shakespeare's tragedies will be studied in detail.

530 *The Restoration and Early 18th Century: 1660-1730.* (3)
A survey of the rise of Classicism with emphasis on the works of Dryden, Pope, Swift, Addison and Steele.

531 *The Later 18th Century: 1730-1780.* (3)
A survey of the transition from Classicism to Romanticism with emphasis on the works of Boswell, Johnson, Gray, Goldsmith and Cowper.

535 *The Romantic Movement:* 1780-1815. (3)
A study of the poetry and prose of the first half of the romantic movement. The emphasis is on the poetry of Blake, Wordsworth, and Coleridge.

536 *The Romantic Movement:* 1815-1830. (3)
A study of the poetry and prose of the second half of the romantic movement. The emphasis is on the poetry of Keats, Shelley, and Byron.

538 *Victorian Period: 1830-1860.* (3)
A survey of the major essayists and poets of the early Victorian period. Such authors as Mill, Carlyle, Browning, Tennyson, Arnold and Newman will be considered both analytically and historically.

539 *Victorian Period: 1860-1900.* (3)
Survey of the major figures and movements of the late Victorian period: Ruskin, Pater, Hopkins; the Pre-Raphaelites, Darwinism, Imperialism, Aestheticism, and Decadence.

541 *Contemporary British Novel.* (3)
A study of the content and technique of representative post-World War II novels, with some attention to background, especially Conrad. Selections from Waugh, Greene, Cary, Golding, Murdoch, Spark, Wilson, Burgess and others.

542 *Twentieth Century British Literature.* (3)
British literature of the 20th century, with particular attention to the poetry, to literary movements, and to critical theory.

550 *American Literature before 1800.* (3)
A survey of the poets, diarists, polemicists, historians and political writers from Bradstreet to Franklin, with emphasis on the intellectual life of Colonial New England and Revolutionary America.

551 *American Literature: 1800-1860.* (3)
A survey of American Romanticism, including such writers as Irving, Bryant, Cooper, Emerson, Thoreau, Poe, Hawthorne, Melville, and Whitman.

552 *American Literature: 1860-1900.* (3)
A survey of American writing from DeForest and Dickinson to the early Dreiser, with emphasis on the rise of Realism (Twain, Howells, James) and Naturalism (Norris, Crane), and related developments such as Western Humor and Local Color.

553 *American Literature since 1900.* (3)
A survey of 20th Century writing to about 1940. Emphasis on major writers of fiction and poetry and on such developments as Imagism, the New Realism, and the Lost Generation.

560 *Comparative Literature I.* (3)
A study of Greek and Latin literature from Homer to the Middle Ages.

561 *Comparative Literature II.* (3)
Study in English of major works of continental European Literature. Late medieval period to mid-Seventeenth Century.

562 *Comparative Literature III.* (3)
Study in English of major works of continental European literature written in modern languages, especially French, German, Spanish, Italian, Russian, mid-Seventeenth Century to end of Nineteenth Century.

563 *Comparative Literature IV.* (3)
Masterpieces and examples of twentieth-century Western World literature, with emphasis on the emergence of new forms and techniques invented to express the complexity of modern life. The course will study novels, poems, and plays in their traditional development and in experimental and divergent forms.

566 *Modern Drama.* (3)
Continental, British and American dramatic literature from Ibsen to the present. Authors such as the following are studied: Shaw, O'Neill, Brecht, and Beckett.

568 *History of Literary Criticism I.* (3)
Literary criticism in the Western World from Plato through the 19th Century. Includes such critics as Plato, Aristotle, Horace, Longinus, Sidney, Dryden, Johnson, Coleridge, A. W. Schlegel, Arnold, Sainte Beuve, and Pater.

569 *History of Literary Criticism II.* (3)
The theory and practice of literary criticism in the twentieth century. An examination of various approaches to the act of criticism as exemplified in such representative critics as Babbitt, Eliot, Richards, Ransom, Burke, Blackmur, Trilling, Crane, Frye and Brooks.

572 *Studies in English for High School Teachers.* (1-3)
Specialized topics in language, literature, and composition designed to increase the high school teacher's knowledge of subject matter, to aid him in meeting major problems in the curriculum, and to enlarge his understanding of new developments and approaches to the teaching of high school English. May be repeated to a total of six credits. Prereq: Employment as a high school teacher.

Pro-seminars: The purpose of the pro-seminar courses (600 level) is to impart through lectures and discussion both the facts of literary history and the techniques of literary analysis. They are, therefore, designed to go beyond the mere information level to techniques of contemporary literary criticism and scholarship.

600 *Bibliography and Methods of Research.* (3)
Studies in enumerative bibliography and in the methods and materials of scholarly and critical investigation. Required of M.A. students in English.

620 *Studies in Middle English Literature.* (3)
A study in depth of selected writers and movements.

621 *Studies in Chaucer.* (3)
A study in depth of selected works of Chaucer, especially *Troilus,* in relation to aspects of the medieval literary tradition.

622 *Studies in English Literature: 1500-1600.* (3)
Comprehensive study of broad topics, normally limited to an intensive survey of the literature and scholarship of the period as a whole.

623 *Studies in English Literature: 1600-1660.* (3)
Comprehensive study of broad topics, normally limited to an intensive survey of the literature and scholarship of the period as a whole.

625 *Studies in Renaissance Drama Exclusive of Shakespeare.* (3)
A study in depth of selected writers.

628 *Studies in Milton.* (3)
A study of all of Milton's poetry and of his more important prose; readings from contemporary thinkers; studies in thought currents of the time and Milton's relation to them.

630 *Studies in English Literature: 1660-1720.* (3)
Comprehensive study of broad topics, normally limited to an intensive survey of the literature and scholarship of the period as a whole.

631 *Studies in English Literature: 1720-1780.* (3)
Comprehensive study of broad topics, normally limited to an intensive survey of the literature and scholarship of the period as a whole.

635 *Studies in Literature:* 1780-1815. (3)
A study in depth of selected writers and movements.

636 *Studies in Literature:* 1815-1830. (3)
A study in depth of selected writers and movements.

638 *Studies in English Literature: 1830-1860.* (3)
Comprehensive study of broad topics, normally limited to an intensive survey of the literature and scholarship of the period as a whole.

639 *Studies in English Literature: 1860-1900.* (3)
Comprehensive study of broad topics, normally limited to an intensive survey of the literature and scholarship of the period as a whole.

651 *Studies in American Literature Before 1860.* (3)
A study in depth of selected writers and movements.

652 *Studies in American Literature: 1860-1900.* (3)
A study in depth of selected writers and movements.

653 *Studies in American Literature since 1900.* (3)
A study in depth of selected writers and movements.

660 *Modern Critical Theory.* (3)
Examination of the theories supporting the modern versions of Genre, Genetic, and Formalist Criticism.

673 *Studies in Folklore.* (3)
A study in depth of selected topics such as the development of literary genres out of oral folklore.

682 *Studies in Fiction.* (3)
A study in depth of selected types of fiction.

683 *Studies in Drama.* (3)
A study in depth of selected types of drama.

684 *Studies in Poetry.* (3)
A study in depth of selected types of poetry.

Seminars: Seminars (700 level courses) are designed to help the student develop, under close guidance and supervision, his ability to define problems of literary significance and to complete critical and scholarly studies in connection with such problems. The emphasis in the courses is on critical and scholarly methods and procedures rather than on content.

720 *Seminar in Medieval Literature.* (3)
Recent topics: Medieval Fiction; Chaucer and the Gothic Mind. May be repeated to a maximum of six credits.

722 *Seminar in 16th Century Literature.* (3)
Recent topics: Spenser; Elizabethan Drama. May be repeated to a maximum of six credits.

723 *Seminar in 17th Century Literature.* (3)
Recent topics: Donne; Herbert; Milton. May be repeated to a maximum of six credits.

726 *Seminar in Shakespeare.* (3)
Seminar in Shakespeare. May be repeated to a maximum of six credits.

730 *Seminar in 18th Century Literature.* (3)
Recent topics: Neoclassic Satire. May be repeated to a maximum of six credits.

735 *Seminar in Romantic Literature.* (3)
Recent topics: Keats; Wordsworth. May be repeated to a maximum of six credits.

738 *Seminar in Victorian Literature.* (3)
Seminar in Victorian Literature; may be repeated to a maximum of six credits.

740 *Seminar in 20th Century British Literature.* (3)
Seminar in 20th Century British Literature; may be repeated to a maximum of six credits.

750 *Seminar in Colonial Literature.* (3)
Seminar in Colonial Literature; may be repeated to a maximum of six credits.

751 *Seminar in American Literature: 1800-1860.* (3)
Seminar in American literature 1800-1860; recent topics: Emerson and Melville; Hawthorne. May be repeated to a maximum of six credits.

752 *Seminar in American Literature: 1860-1900.* (3)
Seminar in American literature 1860-1900; recent topics: Whitman and Dickinson. May be repeated to a maximum of six credits.

753 *Seminar in American Literature since 1900.* (3)
Seminar in American literature since 1900; recent topics: Faulkner, Wolfe, and Warren. May be repeated to a maximum of six credits.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

771 *Seminar in Special Topics.* (3)
Seminar in Special topics; includes *genres* and subject matters such as Symbolism which cover more than one period of literature. Recent topic: Symbolism and Allegory. May be repeated to a maximum of six credits.

774 *Seminar in Comparative Literature.* (3)
Intensive study and research centering upon the relationship between English or American literature and that of some other country. May be repeated once for a total of six credits.

780 *Directed Studies.* (1-3)
Independent work devoted to study and research on specific subjects and problems according to the interests and needs of individual students. May be repeated for a total of nine credits. Permission of chairman required.

FRENCH LANGUAGE AND LITERATURE

Director of Graduate Study—
Raymond C. La Charite

The Department of French Language and Literature offers graduate programs leading to the M.A. and Ph.D. degrees in French language and literature.

Requirements for the M.A. degree in French: The department offers the M.A. degree according to Plan B only. Candidates must demonstrate a reading knowledge of another foreign language and pass a written, comprehensive examination

in six of the following areas: medieval, 16th, 17th, 18th, 19th, 20th-Century French literature, and linguistics. The M.A. examination will be given every November, April, and July. Application for the examination should be made to the Director of Graduate Studies no later than 10 days prior to the date of examination.

Requirements for the Ph.D. degree in French: Applicants for the Ph.D. degree are required to complete at least two years of residence work beyond the M.A. In addition to their program of study in the department, candidates must demonstrate a reading knowledge of two other Romance languages (Latin included) or of one other Romance language and German or Russian.

Candidates for the Ph.D. degree are required to pass written examinations, followed by an oral examination, to be held after the papers have been read and graded. Candidates will be examined on their choice of three of the four following areas:

1. medieval or 16th-Century French literature
2. the 17th Century or the 18th Century
3. the 19th Century or the 20th Century
4. linguistics.

The candidate's dissertation, submitted in accordance with the regulations of the Graduate School of Arts and Sciences, must be within one of the three areas chosen for the qualifying examination.

The Ph.D. written examinations are given three times a year: 1) September 15-30, 2) January 15-31, and 3) March 20 to April 5. Application for the examination should be made to the Director of Graduate Studies no later than 10 days prior to the date of examination.

For further information concerning the M.A. and Ph.D. programs in French, consult the Director of Graduate Studies.

All courses listed below are offered on a rotating basis and no later than every sixth semester.

407 *French Phonetics.* (3)
Phonetics and phonemics, theory and practice. Advanced corrective pronunciation drill on an individual basis, primarily in the laboratory. Three class hours, one laboratory hour. Prereq: FR 202 or equivalent.

412 *Advanced French Conversation.* (2)
A study of intonation and elocution in French. Three minute speeches in French will be prepared for each recitation. Will not count toward a French major. Prereq: FR 306 or equivalent.

415 *Masterpieces of French Literature in Translation.* (3)
A study of outstanding works of French poetry and prose to the end of the nineteenth century, with particular emphasis on movements in the seventeenth and nineteenth centuries. No knowledge of French required. Not open to French majors.

417 *Linguistic Survey of French.* (3)
The place of French and its dialects among the languages of the world, and an introduction to current linguistic theories as they bear on the structure and development of French. Prereq: FR 204, 205, or consent of instructor.

423 *French Literature in Translation: Twentieth Century.* (3)
A study of selected prose and poetry (in English translation), representative of the major trends in modern French literature. No knowledge of French required. Not open to French majors.

435 *A Survey of French Literature of the Middle Ages.** (3)
Readings in modern translation with some analysis of original texts. Prereq: FR 204 and 205.

436 *A Survey of French Literature of the Renaissance.** (3)
A study of the French Renaissance and its artistic expression from Marot to Montaigne. Prereq: FR 204 and 205.

437 *A Survey in French Literature of the Seventeenth Century.** (3)
A study of the representative writers of the seventeenth century and the major literary movements. Prereq: FR 204 and 205.

438 *A Survey of French Literature of the Eighteenth Century.** (3)
A study of the representative writers of the eighteenth century and the major literary movements. Prereq: FR 204 and 205.

439 *A Survey of French Literature of the Nineteenth Century.** (3)
A study of the representative writers of the nineteenth century and the major literary movements. Prereq: FR 204 and 205.

440 *A Survey of French Literature of the Twentieth Century.** (3)
A study of the representative writers of the twentieth century and the major literary movements. Prereq: FR 204 and 205.

450 *French Civilization in the Twentieth Century.* (3)
A survey of French culture in the twentieth century with emphasis on the period following World War II. Conducted in French. Prereq: Two courses beyond FR 202.

460 *Masterpieces of the French Novel.*** (3)
A critical and historical study of the development of the French novel from the seventeenth century to the present. Offered every third semester. Prereq: A minimum of one course from the 435-440 sequence.

461 *Masterpieces of French Drama.*** (3)
A critical and historical study of the development of French drama from the seventeenth century to the present. Offered every third semester. Prereq: A minimum of one course from the 435-440 sequence.

462 *Masterpieces of French Poetry.*** (3)
A critical and historical study of the development of French poetry from Villon to the present. Offered every third semester. Prereq: A minimum of one course from the 435-440 sequence.

506 *Advanced French Composition.* (3)
The course aims to present vocabulary and structures necessary in critical writing but not common to conversational French as well as to encourage logical thinking. Short weekly papers will be written and discussed in class. Reading material will be kept to a minimum and will serve as a subject matter for essay work.

* FR 435, 437, 439 will normally be offered in the fall; FR 436, 438, 440, in the spring.

** FR 460 (spring 1972, fall 1973), 461 (fall 1972, spring 1974), 462 (spring 1973, fall 1974).

507 *French Stylistics.* (3)
Objective analysis of style, individual and period, as well as introduction to stylistic theory and methodology.

516 *Introduction to Old French.* (3)
An introduction to the study of early French, especially of the eleventh through the thirteenth centuries. Emphasis will be on understanding the language, with readings from selected literary works and discussion of Old French phonology and grammar. Prereq: FR 204, 205.

517 *Introduction to the Phonological Structure of French.* (3)
A study of the sound system and its functioning in the morphological system of French from the point of view of current phonological theory, with special attention to "classical" phonemics and to generative grammar.

553 *The Teaching of Modern Foreign Languages.* (3)
A course for teachers and prospective teachers of French, Spanish, or German. (Required of graduate students in French.)

603 *The Development of the French Language.* (3)
A history of the phonology and grammar of French from the origins to the present, with analysis and study of appropriate documents, literary and otherwise, to illustrate these developments, along with some introduction to the basic concepts of historical linguistics. Prereq: FR 516.

607 *Syntactic Structure of French.* (3)
An introduction to the study of French syntax in the light of current theoretical models.

610 *Romance Philology.* (3)
A study of the historical development of the various Romance languages with reading of texts chiefly from the medieval period. Special attention will be given to historical phonology and morphology. Prereq: FR 603 or equivalent.

611 *Old Provençal.* (3)
An introduction to the study of Provençal, especially of the eleventh through the thirteenth centuries. Emphasis will be on understanding the language, with readings from selected literary works. Discussion of Provençal phonology and grammar.

612 *The Old French Chanson de Geste.* (3)
A study of the medieval French epic, with special emphasis on works of the twelfth century and with readings from the three major Cycles and from the Crusade Cycle. Detailed discussion of theories of the origins and development of the genre. Prereq: FR 516.

613 *Courtly Love and the Courtly Romance.* (3)
The origins of the genre: *romans antiques,* the matière de Bretagne. Readings from the *Trisan,* Marie de France, Chrétien de Troyes, and the *Lancelot-Graal.* Prereq: FR 516.

614 *The Satirical Tradition.* (3)
Realist currents in the medieval tradition: *fabliaux, dits, Roman de Renart, Les Quinze joies de mariage, Les Cent Nouvelles Nouvelles.* Prereq: FR 516.

615 *The Medieval French Drama.* (3)
The ecclesiastic origins of the drama, semi-liturgical drama, miracle plays of the twelfth and thirteenth centuries, secular works and the jongleurs, late farces and the development of the mystery play. Prereq: FR 516.

616 *Didactic Literature of the Middle Ages.* (3)
The development of allegory as a mode of expression, its adaptation to didactic ends and particularly to those of courtly love, with concentration in the *Roman de la Rose* of Guillaume de Lorris. The development of scholastic method and its encroachment upon the domain of allegory; its triumph over the latter in the continuation of the *Rose* by Jean de Meung, with consideration of other "scientific" works of encyclopaedic tendencies.

617 *Middle French Lyric.* (3)
The new *ars poetica:* Machaut and Deschamps. Later lyric developments; Christine de Pisan, Charles d'Orleans, Villon, *les Grands rhétoriqueurs.* Prereq: Graduate standing.

618 *Memorialists and Historians of the French Middle Ages.* (3)
Historians and biographers of the Crusades, the Hundred Years War, and the Burgundian conflict. Prereq: Graduate standing.

619 *The Early Lyric.* (3)
Old Provençal and Old French lyrics, from Guillaume IX d'Aquitaine to Rutebeuf. Prereq: FR 516 and consent of instructor.

621 *Rabelais.* (3)
Intensive study of Rabelais and his novels.

622 *Montaigne.* (3)
Intensive study of Montaigne and the *Essais.*

623 *French Renaissance Poetry I.* (3)
A study of the theory and practice of the major movements and poets of the first half of the sixteenth century: the Rhétoriqueurs, the poets of François I's generation, the Lyons poets, and the poets of the Pléiade (Du Bellay and Ronsard). Prereq: Graduate standing.

624 *French Renaissance Poetry II.* (3)
A study of the theory and practice of the major movements and poets of the second half of the sixteenth century: the poets of the Pléiade (including Ronsard) and the religious and baroque poets from Du Bartas to Malherbe. Prereq: Graduate standing.

625 *The Conteurs of the French Renaissance.* (3)
A critical examination of the genre and the works of its many practitioners, with particular emphasis on the tales of Bonaventure des Périers, Marguerite de Navarre, and Noë du Fail. Prereq: Graduate standing.

626 *Non-Fictional Prose Writers of the French Renaissance.* (3)
A stylistic and thematic analysis of the major humanists, historians, writers of memoirs, and religious and political writers of the period: Amyot, Bèze, Bodin, Calvin, Du Vair, La Boétie, La Noue, Mornay, Montluc, Pasquier, etc. Prereq: Graduate standing.

630 *Corneille.* (3)
Intensive study of Corneille's comic and tragic plays with emphasis on values of his time and recent criticism. Prereq: Graduate standing.

631 *Racine.* (3)
Intensive study of Racine's plays with emphasis on values of his time and recent criticism. Prereq: Graduate standing.

632 *Molière.* (3)
Intensive study of Moliere's plays with emphasis on Molière as a mirror of the society of his time and as a reformer. Prereq: Graduate standing.

633 *Seventeenth-Century French Prose.* (3)
A study of the main currents of French Prose in the seventeenth century with special emphasis on the novel.

634 *Pre-Classical French Drama.* (3)
A study of the French theater from Jodelle to Racine's contemporaries, exclusive of Corneille, Racine and Molière.

635 *History of Ideas in Seventeenth-Century French Literature.* (3)
From Montaigne to Gassendi, including the French moralists.

636 *Seventeenth-Century Non-Dramatic Poetry.* (3)
From Malherbe to Boileau and La Fontaine. Prereq: Graduate standing.

640 *Voltaire.* (3)
Intensive study of Voltaire and his literary and philosophical works. Prereq: Graduate standing.

641 *Diderot.* (3)
Intensive study of Diderot and his literary, aesthetic, and philosophical works. Prereq: Graduate standing.

642 *Rousseau.* (3)
Intensive study of Rousseau and his fictional and non-fictional works. Prereq: Graduate standing.

643 *The Eighteenth-Century French Novel.* (3)
A critical analysis of the novels of Lesage, Marivaux, L'abbé Prévost, Bernardin de Saint-Pierre, Restif de la Bretonne and Choderlos de Laclos.

644 *Eighteenth-Century French Theater.* (3)
A study of its development and critical examination of the plays of Lesage, Voltaire, Sedaine, Diderot, with special emphasis on Marivaux and Beaumarchais. Prereq: Graduate standing.

645 *History of Ideas in the Eighteenth Century.* (3)
Critical examination of the major philosophical, social, and political currents of the period. Prereq: Graduate standing.

651 *French Romanticism I: Prose.* (3)
A study of the Romantic novel and story from Chateaubriand to Villiers de L'Isle-Adam. Prereq: Consent of instructor.

652 *French Romanticism II: Poetry and Theater.* (3)
A comprehensive review of French Romantic verse from Lamartine to Verlaine with some attention given to Romantic theater. Prereq: Consent of instructor.

653 *Baudelaire, Rimbaud, Mallarmé.* (3)
Representative works from three major poets of the late nineteenth century. Prereq: Consent of instructor.

654 *The French Realist Novel.* (3)
The novels of Balzac, Stendhal and the Goncourt brothers: structure, themes, style. Prereq: Consent of instructor.

655 *Flaubert.* (3)
Intensive study of the prose writings of Gustave Flaubert. Prereq: Consent of instructor.

656 *The French Naturalist Novel.* (3)
Emphasis is on the novels of Zola, Huysmans, Ceard and Maupassant. Prereq: Consent of instructor.

661 *Twentieth-Century Prose I: The Early Decades.* (3)
A study of the major French writers in the period until 1930, with special emphasis on Gide, Proust, and Romains. Prereq: Graduate standing.

662 *Twentieth-Century Prose II: The Literature of Commitment.* (3)
A study of this movement, from Péguy to Sartre, with special emphasis on the novelists of the 1930's (exclusive of Malraux).

663 *Malraux.* (3)
Intensive study of the life and writings of André Malraux. Prereq: Graduate standing.

664 *French Existentialist Literature.* (3)
A study of the novels, plays, and other literary writings centering on the works of Sartre, Camus, and de Beauvoir. Prereq: Graduate standing.

665 *Major Intellectual Currents in Modern French Literature.* (3)
An examination of the intellectual preoccupations of French writers (exclusive of existentialism) from Bergson and Valéry to the present. Prereq: Graduate standing.

666 *The French Theater Since World War I.* (3)
A study of the works of the major "traditionalists" including Claudel, Cocteau, Giraudoux, Montherlant, Anouilh. Prereq: Graduate standing.

667 *Contemporary Poetry.* (3)
A critical study of the major modern French poets.

668 *Proust.* (3)
Intensive study of the works of Marcel Proust, with special emphasis on *A la recherche du temps perdu.* Prereq: Graduate standing.

669 *Surrealism.* (3)
Examination of the movement and close analysis of the works of its most outstanding figures. Prereq: Graduate standing.

670 *Theater of the Absurd.* (3)
Study of avant-garde French theater from its beginnings to the present, including such writers as Jarry, Apollinaire, Vildrac, Vitrac, Adamov, Ionesco, Beckett, Genet. Prereq: Graduate standing.

671 *The New Novel.* (3)
Examination of the development of the new novel and critical analysis of the works of such writers as Butor, Le Clézio, Robbe-Grillet, Sarraute, Simon. Prereq: Graduate standing.

714 *Seminar in the History of the French Language.* (3)
Intensive study of a particular aspect of the development of Modern French. Prereq: FR 603 or equivalent.

715 *Seminar in Medieval French Studies.* (3)
Special and intensive study of a single problem in Medieval French literature or of paleography and the editing of Old French texts. Prereq: Any two graduate courses in Medieval literature.

716 *Seminar in French Literature of the Renaissance.* (3)
Special and intensive study of a particular aspect of French Renaissance literature, according to the needs of the students enrolled. Prereq: Any two graduate Renaissance courses.

717 *Seminar in Seventeenth-Century French Literature.* (3)
Intensive study of a special problem in seventeenth-century French literature. Prereq: Consent of instructor.

718 *Seminar in Eighteenth-Century French Literature.* (3)
Special and intensive study of a single problem in eighteenth-century French literature. Prereq: Any two graduate eighteenth-century courses.

719 *Seminar in Nineenth-Century French Literature.* (3)
Intensive study of a special topic in nineteenth century French literature. Prereq: Consent of instructor.

720 *Seminar in Twentieth-Century French Literature.* (3)
Special and intensive study of a single problem in twentieth-century French literature.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

780 *Special Studies in French.* (3)
Selected studies and investigations in the French language and literature, permitting the student to work in areas of special interest, and providing opportunity for original endeavor. May be repeated once. Prereq: Consent of instructor.

GEOGRAPHY

Director of Graduate Study—P. P. Karan

The Department of Geography offers both M.A. and Ph.D. programs. The emphasis is on the doctoral program which provides a research-oriented professional training. The research training and skills of the individual graduate students are developed within the framework of research seminars and courses given by the faculty. This framework is based on the following specific research clusters of the discipline:

Theoretical Geography—The philosophy of social science; theory construction; study of contemporary geographic theory; regional theory.

Cultural Geography—Functional dynamics of urban systems; social and behavioral aspects of cities; urban and rural settlement patterns; migration and diffusion processes; population; ethnic geography; cultural resources; cultural regions.

Remote Sensing—Problems of acquiring and interpreting data from remote sensors, including air photo interpretation, in the analysis of the physical environment and patterns of human activity.

Transportation Geography—Spatial structure of transportation and circulation systems; commodity flow and linkage analysis; transportation and modernization processes.

Applied Cartography—Map transformation, mapping spatial perception and behavior.

Political Geography—Studies of regional and national power settings; boundary problems; territorial behavior and perception; quantitative methods for analysis of political processes and structures; spatial aspects of administrative systems and urban politics.

Applied Geography—The application of geographic theory to the location of public services; regional development problems in underdeveloped areas; regional problems in resource use and management; regional planning; spatial and ecological dimensions of development in regions undergoing "modernization."

The topical fields emphasizing dynamic spatial patterns, processes, behavior, and relationships receive particular attention in regional geographic specializations in North America, Appalachia, the Indian Subcontinent, Southeast Asia, Western Australia. A student may elect to specialize in the geography of a specific region only if faculty members have research experience in that region.

Applicants for the Ph.D. in geography must conform to the general requirements of the Graduate School as set forth in the first part of this Bulletin. Although there is no specific course work required in the Ph.D., the program consists of (1) core courses (Geo 602, 700, 702, 707 and 710) in the theory and methodology of geography, (2) seminars, independent study and directed research in one of the specific research clusters noted above, (3) successful examination in one modern foreign language, and (4) a dissertation based on original research. Each doctoral candidate, in consultation with the Director of graduate program and the Special Committee, maps a program designed to meet the professional academic goals.

Graduate students are expected to share with the faculty an enthusiasm for geographic learning and inquiry. The program emphasizes informality in student-faculty relationships, flexibility in designing training programs for individual students, and the importance of competent empirical application of research skills.

Applicants for the M.A. degree in geography follow a broadly based program which consists of (1) recommended courses (GEO 601, 707, and 710), (2) elective courses in geography and cognate disciplines according to the student's academic goals and career objectives, and (3) the completion of a Master's Thesis. At the discretion of the faculty a non-theis degree (Plan B requiring six additional credits) may be permitted. The M.A. student may not take more than six hours of course work below the 600 level. Except for methodological seminars, students are not required to take specific courses. Program is tailored to meet each student's particular needs and requirements, and many interdisciplinary topics may be chosen for study.

All graduate students are expected to demonstrate competence in basic research skills and tools, in critical analysis, scientific writing, and accurate verbalization as part of the degree requirement. During initial phases of graduate work, a strong emphasis is placed upon acquiring competence in the fields of bibliographic techniques, cartographic analysis, and the application of field and quantitative techniques to geographic problems.

501 *Intermediate Field Studies.* (3)
An intensive study of a particular geographic area with emphasis on such specific skills as filling in a base map and observing and recording data for map composition and report. May be repeated once.

505 *Cartography.* (3)
A course in the construction and interpretation of maps. Prereq: GEO 151.

520 *Geography of the United States and Canada.* (3)
A dynamic regional study of the cultural, economic, and physical characteristics of the various areas of Canada and the United States, including Hawaii and Alaska. Prereq: One geography course.

522 *Geography of Kentucky.* (3)
A study of how the people of Kentucky adjust themselves to the location, surface, climate, and other natural resources of their state. Prereq: One geography course.

524 *Geography of Latin America.* (3)
A study of countries and geographic regions of Mexico, Central America, and South America. Prereq: One geography course.

526 *Geography of Europe.* (3)
A study of Western Europe's major geographic regions, climate, soil, terrain, mineral, and biotic factors. Population problems, economic adjustments, and political significance of resources. Prereq: One geography course.

528 *Geography of Asia.* (3)
A regional study of the countries of Asia including European U.S.S.R., China, Japan, and India. Role of the Orient in the international landscape. Prereq: One geography course.

530 *Geography of South Asia.* (3)
A regional study of India, Pakistan, and the Himalayan Kingdoms with emphasis on politico-geographic, and socio-economic problems of the countries in the region. Prereq: GEO 151, 152, or 255, or consent of instructor.

532 *Geography of Southeast Asia.* (3)
A study of the Southeast Asia region (between India-Pakistan to the west; China to the north; and Australia to the south) focusing on the politico-geographic, socio-economic, and resource potential problems of its countries. Prereq: GEO 151, 152, or 255, or consent of instructor.

534 *Geography of Australia and the Pacific Islands.* (3)
A study of the geographic problems and adjustments of the peoples and countries of the Pacific area. Reference to the strategic nature of the location. Prereq: One geography course.

536 *Geography of Africa.* (3)
A study of Africa as a complete continent and not as an example of European imperialist policy; as a series of geographic regions. Prereq: One course in geography.

540 *Geography of Urban Areas.* (3)
A study of the location and growth of cities and urban areas in relation to environmental factors. Prereq: GEO 255 or permission of instructor.

542 *Political Geography.* (3)
A study of politico-geographic phenomena in their areal context, such as the analysis of boundaries, geographical patterns resulting from the application of governmental authority, the political viability of state units, and the spatial (territorial) variations and interrelationships of political activities and systems.

544 *Population Geography.* (3)
An analysis of population distributions, locational arrangements of growth, densities, and migration flows; spatial relationships between population variables and social, economic, and environmental factors.

550 *Geography of Natural Resources.* (3)
A study of the distribution and management of particular resources, resource development problems in specific regions, estimation of resource availability, tools for determining economic efficiency, the influence of institutional contraints of resource development, and the role of perception and attitudes in decision making related to man's use of natural resources. Prereq: GEO 255.

551 *Climatology.* (3)
A study of the elements and controls of climate and of world climatic patterns. Prereq: GEO 151 or consent of instructor.

560 *Independent Work in Geography.* (3)
Individual research involving such problems as: (a) Materials and methods in teaching geography; (b) the Historical Evolution of Geography; (c) map reading and interpretation; (d) special area studies; (e) other topics may be elected by consent of instructor. May be repeated once. Prereq: Major and a standing of 3.0 in the department.

565 *Topics in Geography.* (3)
Discussion, readings, and papers focusing on relevant topics in geography directed by a staff member having specific competence for the topics under study. Current research developments in particular geographic subfields will be stressed. Prereq: Consent of instructor.

601 *Advanced Field Studies.* (3)
Field study and preparation of a report which shall include both manuscript and graphic material. This field study will be based upon the work done in the field of GEO 501, but will be carried forward to include the more difficult problems of preparation of graphic materials, map composition, and manuscript preparation, such as later can be used in thesis preparation and publication. Prereq: GEO 151, 505 and 501 for Geography students or consent of instructor for students offering field experience in allied subjects, such as Geology. May be repeated once.

602 *Seminar in Theoretical Geography.* (3)
A systematic review of the theoretical nature and character of geographic patterns with the use of mathematics. Application of geometry, primarily topology, to probe the geographic concept of spatial relation, spatial arrangements and spatial processes. Prereq: MA 521 or equivalent.

605 *Applied Cartography.* (3)
An analysis of cartographic presentation including mapping of areal relationships, and studies of the ways in which designs and scales of maps can influence the portrayal of geographical patterns and associations.

625 *Regional Theory.* (3)
The concept of regional structure and its application to geographic problems, modes, linkages, circulation and regions. Methods of regional research and analysis in geography. Prereq: GEO 255 or equivalent, or consent of the instructor.

630 *Regional Study of Special Areas.* (3)
The application of the methods of regional interpretation to special areas such as the U.S.S.R., Mediterranean Basin, Caribbean Region, Mexico, Central Europe, etc. May be repeated once. Prereq: A prior major or minor in Geography or consent of instructor.

635 *Fundamentals of Remote Sensing of Environment.* (3)
A systematic study of the application of remote sensors in geographic investigation with particular reference to integrated landscape analysis, land use classification, cluster analysis, and multisensor survey of physical environments. Prereq: GEO 505 or equivalent, or consent of the instructor.

640 *Transportation Geography.* (3)
Conceptual and descriptive study of transport facilities and patterns of movement with special reference to the influence of geographic factors in the creation, transformation, and maintenance of transportation forms and functions; the bearings of transportation on urban and regional development and on industrial location; its role as an "organizing force" in economic geography, interaction of transportation, and regional development in different areas of the world. Prereq: GEO 255 or equivalent, or consent of instructor.

643 *Urban Transportation Planning.* (3)
A detailed review of the transportation planning process; inventory methodologies; trip generation, distribution and assignment with associated mathematical models and theories; prediction of future travel; land and use models; modal split; developing and testing proposed systems; simulation. (Same as CE 643.) Prereq: CE 543 or equivalent and STA 381 or 681 or equivalent statistics course.

651 *Urban Climatology.* (3)
Study of the distributions of temperature, precipitation, and air pollutants in and around cities; the effect of cities on local heat and water budgets; and the relation between topographic situation and city climate. Prereq: GEO 151 and 551, or consent of instructor.

652 *Soil Classification and Geography.* (3)
A critical evaluation of the concepts of soil classification, with particular reference to the current U.S. scheme. Study of geographic locations and the nature of their soil associations as related to gross considerations of soil genesis. (Same as AGR 652.) Prereq: AGR 573, 581, or consent of instructor.

655 *Special Study of Systematic Geography.* (3)
The application of the methods of systematic geography to particular special studies in topical areas, such as conservation, urban areas, climatology, cartography, or others. Three class hours per week. Prereq: Appropriate 500-level course work in Systematic or Topical Geography (e.g., Conservation, Urban, Climatology, Cartography). May be repeated to a maximum of six hours.

700 *Quantitative Methods in Geography.* (3)
A survey of the applications of quantitative techniques to geographical problems, with emphasis on the use of models in current geographic literature. Special emphasis will be given to the interpretation of recent findings in physical, urban, economic, and regional geography, and in the preparation of the student for the further use of certain techniques in his own research. Prereq: An elementary course in statistical methods.

702 *Spatial Models in Geography.* (3)
The spatial aspects of models in geographic research are examined with reference to economic, urban geography, settlement pattern, industrial location, and agricultural activity. May be repeated for a total of nine credits.

707 *Seminar in Development of Geographic Thought.* (3)
Series of topics selected in order to acquaint the graduate student of geography or of related subjects with the basic literature and evolution of the broad field of geography. Prereq: Geography major or consent of instructor.

710 *Research Methods and Methodology in Geography.* (3)
A comprehensive review of the problems involved in designing geographical research, planning field work, analysis of data, and in writing geographic reports. Prereq: GEO 560 or equivalent.

715 *Seminar in Systematic Geography.* (3)
Urban geography; population geography; political geography; transportation geography. (Sub-field will be chosen in keeping with the interest of the professor in charge). May be repeated for a total of 12 credits. Prereq: Appropriate 500-level systematic course or consent of the instructor.

720 *Seminar in the Geography of the United States and Canada.* (3)
Research seminar in topics or problems related to geographic aspects of the United States and Canada. Topics will be chosen in keeping with the interest of the professors in charge. May be repeated once. Prereq: At least one year of graduate study in geography.

725 *Applied Geography in Developmental Analysis.* (3)
A systematic review and critical evaluation of the application of geographic concepts and methods of survey, analysis and interpretation in the study of regional developmental problems with particular reference to the developing nations and underdeveloped areas in the United States, Canada, and Europe. Prereq: GEO 560 or equivalent.

730 *Seminar in Regional Geography.* (3)
Australia; Southeast Asia; Himalaya and Central Asia; other world regions in keeping with the regional specialization of the professor in charge. May be repeated twice for a total of nine credits. Prereq: Appropriate 500-level course in regional area, or consent of instructor.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1 to 12 credits equivalence.)

771 *Advanced Seminar in Geography.* (3)
The study of selected topics or current systematic concepts in geography. For Ph.D. candidates. May be repeated to a maximum of nine credits. Prereq: Consent of instructor.

772 *Special Research Problems in Geography.* (3)
Open to doctoral candidates who have the necessary training and ability to conduct research on a selected problem. Prereq: Approval of the director of graduate studies. May be repeated for a total of 12 credits.

GEOLOGY

Director of Graduate Study—William R. Brown

The Department of Geology offers graduate work leading to the M.S. degree under Plan A, and the Ph.D. The credentials of each applicant are considered individually and applicants from disciplines other than geology are encouraged to apply. Prospective students should have a good background in basic science and demonstrated competence at the undergraduate level. Deficiencies in geology and allied sciences must be removed by such course work as the department may specify. Each candidate is expected to have or obtain practice in geological field work and teaching, must submit an acceptable thesis which demonstrates his ability to conduct sound research, and for the Ph.D. must demonstrate acceptable reading ability.

The principal fields of study offered are mineralogy-petrology, geochemistry, sedimentology-stratigraphy and paleontology, but other fields are available and interdisciplinary studies are encouraged.

Resources for the conduct of advanced studies in the way of reference collections, an outstanding library, well-equipped laboratories including the Cabot Spectrographic Laboratory facility, sample preparation and field equipment are available within the department. The laboratory apparatus includes X-ray fluorescence and diffraction, atomic absorption and spectrophotometry, dc arc and laser microprobe emission spectography, petrographic microscopy, and special equipment for sedimentologic and paleontologic studies, clay mineralogy, and rock mechanics. Additionally, such extra-departmental facilities as computing, neutron activation, electron micrscopy, and portable diamond drilling are readily available.

401 *Paleontology.* (3)
A study of fossil invertebrates, their nature, classification, and geological distribution. Lecture, two hours; laboratory two hours. Prereq: GLY 142.

420 *Structural Geology.* (3)
An introduction to earth structures. Advanced geologic map interpretation. Prereq: GLY 142; PHY 213.

424 *Field Work in Regional Geology.* (7)
Eight weeks in the field in Colorado. This course is an effort to bring the student into contact with diverse geological phenomena and problems. Geological field methods. See special announcement. Required of major students at the end of Junior year. Special fee.

426 *Field Work in Regional Geology—Report.* (1)

445 *Advanced Principles of Geology I.* (4)
A general study of geologic processes, designed primarily to meet the needs of advanced students with backgrounds in other fields. Lecture, three hours; laboratory, one hour per week.

446 *Advanced Principles of Geology II.* (4)
A general study of earth history and the history of life on the earth, designed primarily to meet the needs of advanced students with backgrounds other than geologic. Lecture, three hours per week; laboratory, two hours per week. Prereq: GLY 445 or equivalent.

450 *Stratigraphy and Sedimentation.* (3)
Basic principles and concepts of stratigraphy and sedimentation. Lithologic correlation and the interpretation of geologic history and paleogeography. Field and laboratory analysis of sedimentary rocks including megascopic and microscopic methods. Two class hours per week; laboratory, two hours per week. Prereq: GLY 142.

460 *Elementary Mineralogy.* (4)
A study of fundamentals of mineralogy including crystallography, occurrence and identification of common and abundant minerals. Two class hours per week; laboratory, four hours per week. Prereq: CHE 112 or concurrent.

461 *Elementary Petrology.* (3)
The elementary study of igneous, sedimentary and metamorphic rocks. Prereq: GLY 460.

501 *Stratigraphic Paleontology.* (3)
The use of fossils and fossil assemblages for zonation and correlation; and the problems arising from the application of this method as illustrated by specific examples. Practice in the analysis of sample invertebrate faunas for purposes of correlation. Prereq: GLY 401, 450. Lecture, two hours per week; laboratory, two hours.

510 *Ore Deposits.* (3)
Mineral deposits other than petroleum and natural gas. Distribution, mode of occurrence, origin, methods of search for and uses. Lecture, two hours; laboratory, two hours. Prereq: GLY 142, 460.

511 *Petroleum Geology.* (2)
The origin and accumulation of petroleum and natural gas. A study of geological methods used in exploratory work. Geology of principal producing fields.

520 *Advanced Field Geology.* (2)
A field course in geologic mapping involving problems of local structure and stratigraphy. Six hours a week in the field. Prereq: GLY 226.

530 *Low Temperature Geochemistry.* (3)
An introduction to the geochemistry of sediment deposition and diagenesis, weathering, and other topics in aqueous geochemistry. Prereq: GLY 461, MA 114, or consent of instructor.

531 *Geochemistry of Igneous and Metamorphic Processes.* (3)
A discussion of the processes and principles of chemistry as they apply to the mineralogic and petrologic problems associated with the formation of igneous and metamorphic rocks. Prereq: GLY 461, consent of instructor.

533 *Rock Mechanics.* (3)
An engineering science course leading to an understanding of the stresses in the earth, properties of the materials resisting these stresses and methods of determining these stresses. Stability of excavations. Prereq: MET 301, EM 302, GLY 240. (Same as CE 533.)

552 *Sedimentary Petrology.* (3)
Detailed description of sedimentary rock types, their origin and classification. Megascopic and microscopic examination of textures and structures of sediments. Mineralogy of sediments and the significance of sedimentary environments. Lecture, two hours; laboratory, two hours. Prereq: GLY 450.

560 *Optical Mineralogy.* (3)
A study of the optical properties of minerals by means of the petrographic microscope. Prereq: GLY 460, PHY 213.

562 *X-Ray Mineralogy.* (3)
The use of x-ray diffraction and spectroscopy in the qualitative and quantitative analysis of minerals and rocks. Emphasis will be placed upon the rock-forming minerals. One class hour per week. Laboratory, four hours per week. Prereq: GLY 461, PHY 213.

570 *Geology Seminar.* (1)
Reading and discussion of classical and contemporary books and papers having relevance to geology, varying in scope and content to meet the special needs and interest of the participants. May be repeated to a maximum of four credits. Prereq: Geology major with junior standing.

612 *Mineral Deposits.* (3)
Lecture, two hours; laboratory, two hours.

620 *Tectonics.* (3)
A study of the structural features of the earth's crust with an analysis of the mechanics involved. Lecture, three hours; or lecture, two hours, laboratory, two hours. Prereq: PHY 211, 213; GLY 420.

624 *Mesoscopic Structures.* (3)
The analysis of structures of mesoscopic scale in deformed rocks, particularly metamorphic tectonites, and their extrapolation to larger structures; also the study of certain mesoscopic features in igneous rocks and features in sediments useful in basin analysis and the determination of chronologic sequence and environment of deposition. Lecture, two hours; laboratory, two hours. Prereq: GLY 420.

631 *Advanced Prospecting.* (3)
Study of the principles involved in the geophysical investigation of the minerals of the earth's crust. Lecture and recitation, two hours; laboratory, three hours. (Same as CE 631.)

650 *Sedimentology.* (3)
The classification and interpretation of sedimentary rocks, and study of sedimentary processes. Prereq: GLY 450.

652 *Stratigraphy I.* (3)
Regional stratigraphy with emphasis on field relationships in Kentucky and stratigraphic equivalence of Paleozoic rocks in North America. Lecture, two hours; laboratory, two hours. Prereq: GLY 450.

653 *Stratigraphy II.* (3)
Regional stratigraphy with emphasis on world-wide stratigraphic equivalence and Mesozoic and Cenozoic rocks. Lecture, two hours; laboratory, two hours. Prereq: GLY 450.

654 *Carbonate Petrology.* (3)
The composite, classification, and interpretation of environments of deposition and diagenesis of carbonate rocks and modern carbonate sediments. Lecture, two hours; laboratory, two hours. Prereq: GLY 450.

655 *Hydrogeology.* (3)
A study of hydrologic processes and systems in geology, including topics in fluvial geomorphology and groundwater flow. Prereq: GLY 552 or consent of instructor.

660 *Petrography.* (3)
Chiefly the study of igneous and metamorphic rocks with the petrographic microscope, also a consideration of occurrence and classification, and of metamorphic facies. An introduction to the petrography of sedimentary rocks. Lecture, one hour; laboratory, four hours per week. Prereq: GLY 560.

662 *Petrology of the Igneous Rocks.* (3)
A study of crystallization phenomena and phase equilibria in igneous systems. Special emphasis is placed on the application of experimental results to natural systems. Prereq: GLY 461, 531 or consent of instructor.

664 *Petrology of Metamorphic Rocks.* (3)
Nucleation and growth phenomena in metamorphic systems. Differentiation and phase equilibria as applied to natural systems. The geochemistry of metamorphism. Prereq: GLY 461, 531, or consent of instructor.

681 *Mineralogical and Chemical Analysis of Soils.* (4)
Laboratory emphasis on instrumental methods and techniques used in quantitative and qualitative mineralogical and chemical analysis of soils and relation of these analyses to physical, chemical and biological systems. Lecture, one hour; discussion, one hour; laboratory, four hours. Prereq: CHE 226, AGR 581 or equivalent or consent of instructor. (Same as AGR 681.)

710 *Mineral Exploration.* (1)
Techniques and applications of mineral exploration. Oreguides, sampling patterns and techniques, evaluation of data and related topics. Prereq: GLY 612.

711 *Evaluation of Mineral Properties.* (1)
Procedures in property evaluation. Tonnage and grade calculations, political and economic factors, and related topics. Prereq: 612.

730 *Graduate Geology Seminar.* (1)
Discussion of current research or advanced topics in geology and related fields. Subject matter will vary from term to term. May be repeated to a maximum of six credits. Prereq: Geology major with graduate standing.

732 *Advanced Low-Temperature Geochemistry.* (3)
Topics in low-temperature and aqueous geochemistry. Seminar involving review of current literature and laboratory investigation of significant geochemical problems. Two class hours and two laboratory hours per week. Prereq: CHE 442, GLY 530 and 650, or 652, or consent of instructor.

733 *Petrologic Geochemistry.* (3)
Application of thermodynamics to geological problems, melt and aqueous equilibria, phase transitions and the geochemical differentiation of igneous and metamorphic rock systems. Prereq: CHE 442, GLY 530, 531 and either GLY 662 or 664, or consent of instructor.

741 *Clay Mineralogy.* (3)
A comprehensive study of the crystal structures of clay minerals commonly found in soils and sediments. Lecture and discussion, two hours; laboratory, two hours. Prereq: GLY 212 and 213, AGR 581, 681, or equivalent, or consent of instructor. (Same as AGR 741.)

760 *Petrology Seminar.* (2)
Review of classic works and recent developments in important and controversial aspects of igneous and metamorphic petrology. Prereq: GLY 662, 664 or consent of instructor.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely (1-12 credits equivalence.)

782 *Individual Work in Geology.* (1-3)
Problems involving independent laboratory and/or library study conforming to the student's special interest under the direction of an appropriate staff member having proficiency in the area selected. Prereq: Geology major with graduate standing. May be repeated for a total of nine credits.

GERMANIC LANGUAGES AND LITERATURES

Director of Graduate Study—Wayne Wonderley

A fundamental goal of language study is to broaden and deepen acquaintance with the world by revealing aspects of its cultures, old and new. Following the idea that this goal is primarily accessible through study of the pertinent languages and literatures, the department emphasizes German in the graduate program. Supporting work in Scandinavian is offered. The faculty is concerned with the development and encouragement of an understanding of linguistic, human, and critical concepts.

Graduate programs leading to the M.A. (Plan A or Plan B) and Ph.D. in German are offered. Competence in German plus French or another foreign language are required for graduate degrees.

Admission requirements include an acceptable undergraduate major in German and a satisfactory score on the Graduate Record Examination.

Individual programs of study are planned with consideration of the student's competencies and interests. Thus, desiderata for teacher preparation are flexible and accommodate particular emphases appropriate for secondary schools or for two-year or four-year colleges. Likewise, suitable credit for studies successfully completed abroad is recommended.

Areas of specialization of the graduate faculty of the department afford flexible coverage in breadth and depth, with particular strength in medieval linguistics and literature. The library has basic serial holdings in all areas of German language and literatures and supporting fields. Special collections include German drama on microcard and folklore on microfilm, a selection of Danish literature to 1900, and German books printed before 1600 on 35mm microfilm.

The department serves as a publishing center for Germanic studies. Under the aegis of the University Press of Kentucky it sponsors a monograph series in the Germanic languages and literatures. Other publications are Colloquia Germanica, Germanic Notes, and Lyrica Germanica. Lectures and extracurricula activities are provided, including the annual Kentucky Foreign Language Conference. Electronic facilities in support of the instructional program include a departmental tape library focusing on German cultural materials.

Students holding appointments as supervised teaching assistants take about four semesters to complete requirements for M.A. degree and teach two basic or intermediate sections per semester. Those students devoting full time to graduate studies complete the M.A. degree in about three semesters. Those who hold teaching assistantships and fellowships are not required to pay out-of-state fees. Appointments may be renewed. Summer offerings make it possible to obtain the M.A. degree through several semesters of summer study.

The Ph.D. degree in German normally requires a minimum of three years of graduate study (which may include work completed for the M.A. degree).

The department will be glad to answer questions or supply additional information. Address: Department of Germanic Languages and Literatures, Patterson Office Tower 1055, University of Kentucky, Lexington, Kentucky 40506.

GERMAN

412 *Modern German Literature in Translation.* (3)
A study in depth of the author's artistic development and of the structure and content of their major works. Authors treated are novelists Kafka, Hesse, and Mann or dramatists Brecht, Frisch, and Durrenmatt. The course is conducted in English and may be repeated for a total of six hours.

516 *History of German Literature.* (3)
A history of the development of German literature from the "Hildebrandshed" to Hauptmann, with attention to social, political and philosophical background. Prereq: Five semesters of German.

520 *Germanic Proseminar.* (3)
The proseminar is designed primarily to introduce graduate or advanced undergraduate students into the methods of scholarly research based upon the study of a specific area of Germanic language or literature. Topic will vary, and will be announced. Representative components which may be treated in this course are Lessing, Schiller, Goethe, Buchner, Kleist, Grillparzer, Hebbel, Hauptmann, 18th (19th, 20th) century prose narrative, 18th (19th, 20th) century drama, semantics, and expressionism. The course may be repeated for a total of twelve hours. Prereq: Six additional hours of German beyond GER 222, or consent of instructor.

532 *The German Lyric.* (3)
An intensive study of the German lyrical poem from the Age of the Baroque to the present. Prereq: Six semesters of German.

534, 535 *Life and Works of Goethe.* (3 ea.)
This course follows the unfolding of Goethe's genius from his first lyrics through Faust. His principal literary works will be read and attention devoted to autobiographical material, letters and diaries. Prereq: Six semesters of German.

536 *Introduction to the History of the German Language.* (3)
This course in Germanic Philology acquaints the student with the position of German in the European language group and traces the development of the language to the present. Special emphasis is given to the relationship of German and English words. Prereq: Six semesters of German.

537 *Introduction to Middle High German.* (3)
This is a literary course with a necessary minimum of Middle High German grammar. Selections will be read from epic and lyric poetry of the period and reports will be given on assigned topics. Prereq: Six semesters of German.

538 *Advanced German Conversation and Composition.* (3)
This course is primarily for German majors. It involves intensive practice in the writing of German prose, with some review of German grammar. Prereq: Six semesters of German.

539 *Structure of the German Language.* (3)
An introduction to the phonology, morphology and syntax of modern German by means of concepts and methods of linguistic science. Prereq: Six semesters of German or consent of instructor.

553 *The Teaching of German.* (3)
The course is designed for teachers and prospective teachers of the language. Theory and practice, with emphasis upon modern methodology and practical problems encountered by the teacher of beginning German. Required of graduate students in German. This course should precede student teaching.

621 *Introduction to German Bibliographical Studies.* (2)
An introduction to bibliography, original research, and textual criticism. Required of graduate students in German.

622 *Theories of Literature in German.* (2)
An introduction to theories of literature with emphasis upon those of Germany and continental Europe.

624 *German Literature of the 16th and 17th Centuries.* (3)
A survey of the major literary documents of the German Reformation, Renaissance, and Baroque, with special attention given to one period, and involving extensive readings in the texts of the period.

625 *German Literature of the 18th Century.* (3)
A survey of the literary themes and forms of the *Aufklärung* and *Sturm und Drang*, with special emphasis on selected aspects of German letters of the period 1700-1775.

626 *The Age of Goethe (1770-1830).* (3)
A seminar devoted to the investigation of one or more topics in the literature and social development of Germany during the period 1770-1830.

627 *German Drama of the 19th Century.* (3)
This course is a study of the German drama from Schiller's "Die Braut von Messina" to 1870.

628 *The German Novelle.* (3)
This course traces the origin and development of the German Novelle from Goethe to Thomas Mann.

630, 631 *20th Century German Literature.* (3 ea.)
Extensive readings, discussions and comprehensive reports on the leading literary minds and movements of this Century.

635 *Gothic.* (3)
Readings; phonology and morphology of Gothic. Prereq: Reading knowledge of German and GER 536, or consent of instructor.

636 *Old High German.* (3)
Readings; phonology, morphology, and dialects of Old High German. Prereq: Reading knowledge of German and GER 536, or consent of instructor.

640 *Studies in Germanic Language and Literature.* (3)
Exploration in some depth of a theme, genre, author, or period. Topic will vary, and will be announced. Representative components which may be treated are earlier German literature, medieval epic, medieval German lyric, early New High German language and literature, late romanticism, idealism, realism, naturalism, impressionism, expressionism, symbolism, textual criticism, historical linguistics, structure of modern German, dialectology. The course may be repeated for a total of twelve hours with the approval of the departmental director of graduate studies.

642 *Medieval German Literature.* (3)
A survey of the literature of the Middle High German period, with special attention to one major genre or author, and involving extensive readings in the texts of the period. Prereq: GER 537.

643 *Longer Epic Verse of the German Medieval Period.* (3)
A study of German medieval heroic verse, the courtly novel, or the so-called *Spielmannsepik*, with emphasis depending upon composition of the class.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

778 *Seminar: Main Currents of Romance and German Literature.* (3)
Studies of the principal works of the French, German and Spanish literatures. Lectures, student reports.

781 *Special Studies in German.* (3)
Selected studies and investigations in the German language and literature, permitting the student to work in areas of special interest, and providing opportunity for original endeavor. May be repeated to a maximum of 12 credits.

790 *Germanic Seminar.* (4)
Topic to be selected from a Germanic literary or linguistic area. The seminar may be repeated for a total of twelve hours with the approval of the departmental director of graduate studies.

SCANDINAVIAN
(Offered as required)

500 *Swedish.* (3)
Rapid coverage of morphology, phonology and syntax of modern Swedish and reading of selected literary texts. Prereq: Reading knowledge of German; consent of instructor.

501 *Swedish Literature from Bellman to the Present.* (3)
Readings in Swedish literature of the period. Prereq: GER 500.

504 *Danish.* (3)
Rapid coverage of morphology, phonology, and syntax of modern Danish and reading of selected literary texts. Prereq: Reading knowledge of German; consent of instructor.

505 *Danish Literature from Holberg to the Present.* (3)
Readings in Danish literature of the period. Prereq: GER 504 or equivalent.

510 *Medieval Scandinavian Literature in Translation.* (3)
Old Norse-Icelandic literature: Eddas, scaldic verse, sagas. Ballads and folk-literature. The cycles of Sigurth and Volund; heroic poetry. Comparison with related themes in other medieval literatures.

511 *Scandinavian Literature in Translation: Holberg to Lagerkvist.* (3)
Ludvig Holberg: The literature of the Enlightenment in Scandinavia; the Romantic Movement in Denmark, Sweden and Norway. The Modern Breakthrough in Scandinavia; Georg Brandes, J. P. Jacobsen, Henrik Ibsen. National Romanticism: the *Kalevala*, Selma Lagerlof, Knut Hamsun. Modernism: August Strindberg, Par Lagerkvist. Attention will be drawn to literary relationships between Scandinavia and the Continent.

610 *Old Icelandic.* (3)
Rapid coverage of morphology, phonology and syntax of Old Icelandic, with some attention to linguistic affinities within the Indo-European and Germanic groups of languages. Prereq: Reading knowledge of German; consent of instructor. Alternate years.

611 *Old Icelandic.* (3)
Reading of selected saga texts and Elder Edda, with attention to the development of Icelandic literature from the tenth century to the present. Prereq: GER 610. Alternate years.

HISTORY

Director of Graduate Study—George Herring, Jr.

The Master's Program

Students should submit evidence of strong undergraduate preparation in history, preferably an undergraduate major with a minimum grade-point average of 2.8 on a 4.0 scale. Background in at least one modern foreign language is required for admission. No person will receive the M.A. degree in history unless he demonstrates reading knowledge of a modern foreign language approved by the Department of History and by the Graduate School.

The M.A. degree in history may be obtained by Plan A or Plan B.

Under Plan B, the student must complete 36 credit hours. Of the minimum 15 hours in courses above the 500 level, at least six will be in courses of the 700 category. The decision whether a student will follow Plan A or Plan B normally is not made until he has completed the equivalent of at least one semester of full-time graduate study.

The Final Master's Examination under both plans is oral. The Master's Committee has the authority (1) to fail the student, (2) to pass the student and decide that the master's degree will be terminal, or (3) to pass the student and permit him to continue toward the doctoral degree at the University of Kentucky.

The Doctor of Philosophy Program in History

Those who seek the doctorate in history should follow carefully the general directions governing the subjects of residence, courses, and foreign language requisites set forth in the first part of this Bulletin. The applicant does not become a candidate until he has demonstrated reading knowledge of two modern foreign languages approved by his Special Committee, and until he has passed the Qualifying Examinations and has been approved by the Graduate School for candidacy for the degree.

The student's work for the doctorate in history is directed by a Special Committee composed of representatives of his areas and fields under three preparation requirements. The committee's chairman directs the dissertation and the student should consult this person at his earliest convenience.

Requisites for the Ph.D. candidacy in history will be met as follows:

General Preparation: For the purpose of obtaining a sound factual and interpretative understanding to supplement his work in his fields, the student will pursue guided reading, research, and course work in one of the following areas:

I. Ancient History (Greek and Roman)
II. Early Middle Ages (c. 400-c. 1000)
III. Late Middles Ages (c. 1000-c. 1500)
IV. Early Modern Europe (1450-1770)
V. Modern Europe (since 1770)
VI. United States History
VII. Britain and the Empire (1495 to present)
VIII. Russia and East Europe
IX. The Far East
X. Latin America

As an alternative method of satisfying the area requirement, the student may opt an area entitled Western Civilization. This area will require 21 graduate hours of course work at the 500-699 level excluding History 606 but including six hours of Ancient History, six hours of Medieval History, and six hours of European History since 1500 (the last specification possibly including Russian and East European History). None of these hours may be in the student's intensive fields.

Intensive Preparation: The student will pursue guided reading, research and course work to obtain professional preparation in depth in two of the following fields, neither of which will duplicate the area chosen for General Preparation:

I. Renaissance and Reformation (to 1648)
II. Modern Europe (1600-1770)
III. Modern Europe (1770-1870)
IV. Modern Europe (1870 to present)
V. United States to 1865
VI. United States since 1865
VII. Britain and the Empire,1485-1815
VIII. Britain and the Empire, 1815 to present
IX. Russia and East Europe, 1700-1890
X. Russia and East Europe, 1890 to present
XI. Hispanic America since 1810

Specialty Preparation: The student will prepare himself in a third field. Requirements for this field may be satisfied in one of the following ways:

I. Achieving competence in some discipline

other than history, but in one closely related to his major field of history.

II. Achieving mastery in a special field chosen from within the student's program of Intensive Preparation. Examples of such a field might be United States Intellectual History or the History of Germany. The special field will normally require course work or directed reading in one or more outside disciplines. The choice of the special field will be initiated by the student and his major professor. Final acceptance will rest with the student's Special Committee.

The student's success in his General Preparation will be evaluated by a written examination. His success in his Intensive and Specialty Preparations is evaluated by both written and oral examinations.

I. EUROPEAN HISTORY

490 *Modern Europe.* (3)
This course is offered to meet a demand for a broader course which will equip students who are going out to teach European history in the present high school curriculum. Prereq: HIS 104 and 105.

500 *Pre-Classical and Classical Greece.* (3)
A history of Greece from earliest times to the death of Alexander the Great.

501 *Fourth Century Greece and the Hellenistic World.* (3)
A history of Greece and the Greek world from the death of Alexander to the Roman conquest of Egypt. Prereq: HIS 500 or consent of instructor.

502 *A History of the Roman Republic.* (3)
A history of Rome from earliest times to the fall of the Republic. Emphasis will be placed upon the territorial expansion of Rome and the effects of this expansion on republican institutions.

503 *A History of the Roman Empire.* (3)
A study of the foundation of the Roman Empire, the development of Imperial institutions, social and intellectual developments of the Graeco-Roman world, the decline of Rome and the barbarian invasions of the fourth century. Prereq: HIS 502 or consent of instructor.

510 *Medieval Civilization to 1100.* (3)
The formation of a new civilization—our own—in Western Europe between the decline of the Roman Empire and the First Crusade is the central stress in this study of the cultural interests and achievements of the period 300-1100. Prereq: HIS 270 or consent of instructor.

511 *Medieval Civilization Since 1100.* (3)
Medieval culture at its height (1100-1350) is considered as the first notable achievement of European Civilization. Major topics are: Latin and vernacular literatures, the fine arts, philosophy, and science.

512 *Medieval Institutions to 1049.* (3)
A survey of medieval political, social, economic and ecclesiastical institutions from the fourth century to the papal reform movement. Prereq: HIS 270, 271. (Alternating in the Fall Semester with HIS 510.)

513 *Medieval Institutions Since 1049.* (3)
A survey of medieval political, social, economic and ecclesiastical institutions from the beginning of the papal reform to the middle of the Fifteenth Century. Prereq: HIS 270, 271.

519 *The Era of the Renaissance.* (3)
A historical description and analysis of the development of political, economic, social, religious, intellectual and cultural institutions of Europe from Petrarch to Erasmus. Prereq: HIS 104.

520 *The Era of the Reformation.* (3)
An historical description and analysis of the development of the religious, intellectual, cultural, political, economic and social institutions of Europe from Luther to the Treaty of Westphalia. Prereq: HIS 104.

521 *The Age of Absolutism.* (3)
A study of the development of absolute monarchies from Louis XIV; the European rivalries at home and abroad; benevolent despotism and the Age of Enlightment. Prereq: HIS 104 or equivalent.

523 *Europe, 1814-1870.* (3)
This course treats the successive political changes in 1823, 1830, 1848, and 1870, together with the outstanding commercial, cultural, and scientific developments of European life after 1815.

524 *Europe, 1870-1918.* (3)
A balanced treatment of the political, social, cultural, economic, and intellectual life of Europe in the period indicated. Special emphasis placed on diplomatic and military developments leading to the first World War.

525 *Europe since 1919.* (3)
A study of the origins and consequences of the two World Wars together with the revolutionary movements of fascism and communism and their challenge to liberal democracy.

528 *Cultural and Intellectual History of Europe from the Renaissance to the French Revolution.* (3)
An interpretive analysis of the growth of ideas in Europe within their cultural setting. Emphasis upon the 17th and 18th Centuries.

530 *Social History of Europe in the Eighteenth Century.* (3)
A study of the life and manners of the people of Europe in the 1700's. Special attention will be given to Western and Southern Europe.

531 *The French and European Revolutions, 1760-1795.* (3)
The origins, development, institutions, consequences, and interactions of the French and other European revolutions, counter-revolutions and wars and their impact upon France, Europe and the modern world. Prereq: HIS 105 or equivalent.

532 *Napoleonic Europe, 1796-1815.* (3)
A study of France and her European neighbors during the epoch of Napoleon. Political, institutional, social, economic, cultural, religious and international conditions, relationships and changes are analyzed within the historical context of the period. Prereq: HIS 105 or equivalent.

534 *Russia in the Twentieth Century I.* (3)
A survey of the reign of Nicholas II (1894-1917), the Revolutionary and Civil War period (1917-1921), and the consolidation of the Soviet regime to the beginning of Stalin's dictatorship in the late 1920's. Prereq: HIS 105 and consent of instructor.

535 *Russia in the Twentieth Century II.* (3)
A continuation of HIS 534, this course examines the principal features of Soviet society under Stalin's dictatorship and the evolution of Soviet internal and external policy under his successors. Prereq: HIS 105 and consent of instructor.

536 *Intellectual and Cultural History of Russia and East Europe to 1890.* (3)
A study of the main intellectual currents with special emphasis on ideological confrontations between East and West Europe. Prereq: HIS 204 and 286.

537 *Intellectual and Cultural History of Russia and East Europe from 1890 to the Present.* (3)
Continuation of HIS 536. Prereq: HIS 204 and 286.

538 *The East European World from 1770-1920.* (3)
An intensive analysis of the problems which favored or frustrated (a) the modernization and national self-assertion of the East European peoples and (b) their consolidation into the Russian-led "Second World."

539 *The East European World from 1920 to the Present.* (3)
Continuation of HIS 538.

540 *History of Modern France to 1815.* (3)
The course of French history to 1815, including the development of French political, administrative, legal, social, economic and cultural achievements and institutions and their contribution to the modern world. Prereq: Permission of instructor.

541 *History of Modern France Since 1815.* (3)
Continuation of 540.

542 *German History 1815-1914.* (3)
This course is designed as a study of domestic development in Germany. While political history is emphasized due consideration is given to social, economic and intellectual trends. Prereq: HIS 104, 105 or consent of instructor.

543 *German History Since 1914.* (3)
Examines the fall of Imperial Germany, the Weimar Republic, Hitlerian period, and the post 1945 era. The course is primarily concerned with internal affairs, but attention is directed to the international scene when crucial. Prereq: HIS 104, 105 or consent of instructor.

544 *A History of Italy 1789-1890.* (3)
An examination of the developments leading to Italian unification and an analysis of the problems faced during the united state's first twenty years. Prereq: HIS 104-105.

545 *A History of Italy, 1890 to the Present.* (3)
A continuation of 544, this course will deal with political, economic, social and cultural developments in Italy since 1890, including an examination of Fascism and post-World War II Italy. Prereq: HIS 104-105.

547 *The Byzantine Empire.* (3)
A study of Byzantine history from the time of Constantine the Great to the capture of Constantinople by the Turks in 1453. Prereq: HIS 104 and 247, or consent of instructor.

548 *The Ottoman Empire.* (3)
The rise and expansion of the Ottoman Empire, its relations with the European states, its position in the Near East, and the Turkish state in the 20th century. Prereq: HIS 104, 105, or consent of instructor.

549 *Independent Work.* (1-3)
Under special conditions selected students may investigate problems, with weekly reports to the instructor. Prereq: Major and standing of 3.0 in the department. May be repeated to a maximum of 6 credits.

II. ENGLAND AND THE BRITISH EMPIRE

550 *English Constitutional History to 1603.* (3)
A study of the backgrounds of the English constitution. Prereq: HIS 202 or equivalent.

551 *English Constitutional History Since 1603.* (3)
A continuation of HIS 550. The constitutional struggle between the Stuart kings and Parliament; triumph of constitutional monarchy; rise of the Cabinet; effect of democracy in recent times. Prereq: HIS 203 or equivalent.

552 *British Social History During the Tudor Period, 1485-1603.* (3)
A study of British life, manners, and customs in town and country. Particular emphasis will be placed upon the age of Elizabeth, with political events subordinated to social changes. Prereq: HIS 202.

554 *British History 1815-1901.* (3)
A detailed study of Britain's political, social, diplomatic and industrial development in the nineteenth century.

555 *British History Since 1901.* (3)
A detailed study of Britain in the twentieth century with special consideration of Britain in World War I and World War II, and her position in the contemporary world.

556 *The British Empire to 1860.* (3)
Origin of the British Empire, 1783 to 1860; development of British sea power; the early growth and development of Canada, Australia, New Zealand, South Africa, and India.

557 *The British Empire and Commonwealth.* (3)
A continuation of HIS 556. Great Britain and the growth of the Dominions and the Commonwealth since 1860. Prereq: HIS 202 and 203.

558 *History of Canada.* (3)
A brief survey of Canada under the French; the development under British control; evolution of the Dominion; relation with the United States and British Commonwealth of Nations. Prereq: One year of college history.

III. AMERICAN HISTORY

560 *Colonial America to 1748.* (3)
A study of the origins and development of the English colonies; their relations with England and European states. Emphasis on imperial policies and colonial autonomy. Prereq: One year of American or European History.

561 *Colonial America and Independence, 1748-1789.* (3)
This course deals with England's triumph over France in the New World, the drastic change in her colonial policy and the rise of opposition to it, the war for American independence, and the establishment of the United States under the Constitution. Prereq: One year of American or European history.

562 *The New Nation, 1789-1828.* (3)
An intensive study of the most significant men, events, and trends in the first generation of American National growth. Prereq: HIS 108.

563 *Expansion and Conflict, 1828-1865.* (3)
A study of the territorial expansion of the United States and the growth of sectional controversy over expansion and slavery, culminating in the Civil War. Prereq: HIS 108, 109.

564 *Emergence of Modern America, 1865 to 1912.* (3)
A study of the transformation of America from a rural society "isolated" from world affairs into a highly industrialized power. Prereq: HIS 108 and 109 or equivalent.

565 *Recent History of the United States, 1912 to 1939.* (3)
An intensive study of the problems of maturing America from the election of 1912, through World War I, depression, and the New Deal to our involvement in World War II. Prereq: One year of American History.

566 *Recent History of the United States Since 1939.* (3)
An intensive study of the development and maturation of the United States from World War II to the present, synthesizing military, diplomatic, social, economic, political and cultural changes. Prereq: One year of American History.

568 *Cultural and Intellectual History of the United States to 1865.* (3)
An interpretive analysis of the growth of ideas in the United States within their cultural setting before 1865. Prereq: HIS 108 or consent of instructor.

569 *Cultural and Intellectual History of the United States Since 1865.* (3)
An interpretive analysis of the growth of ideas in the United States within their cultural setting since 1865. Prereq: HIS 109 or consent of instructor.

570 *Economic and Social History of the United States to 1865.* (3)
The emergence of the United States from an underdeveloped economy to an industrial state. Interwoven in the theme of economic growth are the social ramifications of change and the role of government in American economic activity. Prereq: HIS 108 and 109, or consent of instructor. Offered in alternate years.

571 *Economic and Social History of the United States Since 1865.* (3)
Emphasis is placed on 20th Century economic and social changes caused by technology, internal and external business modifications, the growing affluence of the United States, and, most importantly, the increasing role of government in American society. Prereq: HIS 108, 109, or consent of instructor. Offered in alternate years.

572 *American Constitutional History to 1865.* (3)
A study of the origins and development of American constitutional institutions from 1603 to 1865, with emphasis on political, economic and social influences.

573 *American Constitutional History Since 1865.* (3)
A continuation of HIS 572 from 1865 to the present, with emphasis on constitutional problems posed by the industrial revolution and the warfare state.

574 *The Diplomacy and Foreign Policy of the United States to 1919.* (3)
A survey designed to acquaint the student with the principles of American foreign policy and its historical evolution. Prereq: HIS 108 or equivalent.

575 *The Diplomacy and Foreign Policy of the United States Since 1919.* (3)
A continuation of 574. Foreign policy after the United States became a world power. Prereq: HIS 109 or equivalent.

576 *The American Frontier.* (3)
A course dealing specifically with American westward expansion. Prereq: HIS 108 and 109 or equivalent.

577 *The American Frontier.* (3)
A continuation of HIS 576. It will consider the trans-Mississippi West.

578 *History of the Old South.* (3)
A study of the colonial beginnings and expansion of southern life, economics, and society. The growth of slavery, staple agriculture, and sectional politics will constitute the major interest. Prereq: HIS 108.

579 *History of the New South.* (3)
The evolution of southern life and society, agrarian politics, relationships with other sections, industrial growth, and new leadership.

580 *U.S. Urban History to 1865.* (3)
A study of urban America from colonial times to 1865, emphasizing origins and growth of cities and their impact upon the development of the United States.

581 *U.S. Urban History Since 1865.* (3)
A continuation of HIS 580, tracing changes and developments which have occurred since 1865.

582 *Immigration and American History, 1815 to the Present.* (3)
A study of the role of the immigrant in American history, emphasizing the impact of large scale immigration upon the receiving society and changes effected by the migration upon the new arrivals themselves, in the century after 1815, and the consequences of restriction in the decades since World War I.

584 *Economic History of Latin America Since Independence.* (3)
Course emphasizes Latin American efforts in the 19th and 20th Centuries to promote economic and social development, the problems encountered, the role of foreign investments and diplomatic pressures, and, more recently, the economic factors in Latin American social revolutions. Prereq: HIS 208 or 209; or approval of instructor.

587 *Twentieth Century Latin American Revolutions.* (3)
An historical and comparative approach to those Latin American social revolutions that have greatly influenced political movements in other Latin American countries. Prereq: HIS 208, 209, or PS 265 or 501, or consent of instructor.

IV. THE FAR EAST

590 *Japanese History to 1800.* (3)
A broad survey of the political, social, economic, and intellectual history of Japan from earliest times to the zenith of shogunate rule under the Tokugawa family.

591 *Japanese History Since 1800.* (3)
A continuation of HIS 590, from 1800 to present.

592 *Diplomatic History of East Asia Since 1787.* (3)
A study of the international relations between China, Japan, and Korea and their relations with the major Western Powers.

593 *East Asian History Since World War II.* (3)
A study of the revolutionary political, economic and social changes occurring in China, Japan, and Korea in the aftermath of World War II. Important political and institutional developments and their relations to pre-war trends will be emphasized.

THE GRADUATE GROUP

Seminars

These are content courses presented by the lecture and discussion method and as such are distinct from those numbered "700," which are concerned with the problems and the practice of research.

600 *European Historiography.* (3)

603 *American Historiography.* (3)

606 *Historical Criticism.* (3)
Required of every entering graduate student in history.

611,612 *Readings in Ancient History.* (3 ea.)
An intensive study of the bibliography of Greek and Roman history, primary (in translation) and secondary, criticism and analysis of selected books, and of recent articles in professional journals. Prereq: Consent of instructor.

613,614 *Readings in Medieval History.* (3 ea.)
A course designed to provide systematic and extensive reading over broad areas of the period indicated, to acquaint the student with the standard source materials and literature of the field, and to provide opportunity for critical discussion of outstanding issues. Prereq: An undergraduate course in Medieval History.

621,622 *Readings in European History, 1500-1815.* (3 ea.)
These courses are designed to provide systematic and extensive reading over broad areas of the period indicated, to acquaint the student with the standard source materials and literature of the field, and to provide opportunity for critical discussion of outstanding issues. Prereq: An undergraduate course in European History.

623,624 *Readings in European History Since 1815.* (3 ea.)
These courses are designed to provide systematic and extensive reading over broad areas of the period indicated, to acquaint the student with the standard source materials and literature of the field, and to provide opportunity for critical discussion of outstanding issues. Prereq: An undergraduate course in European History.

625,626 *Readings in British and British Empire History.* (3 ea.)
An intensive study of the bibliography of British and British Empire History, primary and secondary, with readings, analyses and criticisms of selected titles in the literature of the field and of recent published research in the professional journals. Prereq: An undergraduate course in British History.

631,632 *Readings in United States History to 1865.* (3 ea.)
These courses are designed to provide systematic and extensive reading over broad areas of American History in the period indicated, to acquaint students with source materials and the secondary literature of the field, and to provide opportunity for critical discussion of books and issues. Prereq: An undergraduate course in American History.

633,634 *Readings in United States History Since 1865.* (3 ea.)
These courses are designed to provide systematic and extensive reading over broad areas of American History in the period indicated, to acquaint students with source materials and the secondary literature of the field, and to provide opportunity for critical discussion of books and issues. Prereq: An undergraduate course in American History.

635 *Readings in Modern Russian History I.* (3)
A guided program (with readings ordinarily in the English language) to provide graduate students with a more sophisticated understanding of the Tsarist regime from the reign of Peter the Great to the collapse of the monarchy in 1917. Oral reports and bibliographies will be required, and emphasis will be placed on internal developments, usually with a central theme to be chosen by the instructor. Prereq: Consent of instructor.

636 *Readings in Modern Russian History II.* (3)
A continuation of HIS 635, this course will concentrate on the revolutionary events of 1917 and the subsequent evolution of the Soviet regime. Prereq: Consent of instructor.

637,638 *Readings in Latin American History.* (3 ea.)
Supervised reading at the graduate level of a select topical bibliography covering the main themes of colonial Latin American history or the modern period. Prereq: HIS 208 and 209 or consent of instructor.

639 *Readings in East Asian History.* (3)
Supervised reading at the graduate level of a select topical bibliography covering the main themes of Chinese history during the Ch'ing Dynasty (1644-1912) and Japanese history during the Tokugawa period (1615-1867). Prereq: Consent of instructor.

640 *Readings in East Asian History.* (3)
Supervised reading at the graduate level of a select topical bibliography covering the main themes of Chinese history since 1895 and Japanese history since 1868. Prereq: Consent of instructor.

695 *Independent Work.* (1-3)
Under special conditions selected students may investigate problems, with weekly reports to instructor. Prereq: Consent of instructor. May be repeated for a maximum of nine credits.

COURSES IN THE 700 GROUP

Seminars—basically research in character. These are not content courses. They provide special training in historical research (collection and critical analysis of bibliography, notetaking and organization of materials, and the presentation of a properly documented research paper). Topics will be chosen in keeping with the interests of the professors in charge. Two class hours and one conference hour.

700 *Special Problems in History.* (3)
Professors will conduct research seminars in topics or problems in which they have special research interests. Prereq: At least one year of graduate study in History.

705 *Seminar in Ancient History.* (3)
Select topics in Greek and Roman history, with an intensive study of a particular area or aspect of the ancient world. Prereq: Reading knowledge of at least one ancient language and one modern foreign language, or consent of instructor.

706 *Seminar in Medieval History.* (3)
Directed research on a common problem. Prereq: Latin and one modern European language.

710 *Seminar in American History, 1607-1783.* (3)
May be repeated to a total of six credits.

711 *Seminar in American History, 1783-1865.* (3)
May be repeated to a total of six credits.

712 *Seminar in American History, 1865 to the Present.* (3)
May be repeated to a total of six credits.

715 *Seminar in Latin American History.* (3)
This seminar course will consider special problems encountered in the study of Latin American History. Prereq: HIS 208, 209, 584 or consent of instructor.

720 *Seminar in Modern European History, 1500-1714.* (3)
May be repeated to a total of six credits.

721 *Seminar in Modern European History, 1714-1870.* (3)
May be repeated to a total of six credits.

722 *Seminar in Modern European History, 1870 to the Present.* (3)
May be repeated to a total of nine credits.

730 *Seminar in Modern British History.* (3)

Theses

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

MATHEMATICS

Director of Graduate Study—Raymond H. Cox

The Department of Mathematics grants the M.A., M.S. and Ph.D. degrees. There are no specific course prerequisites for admission; however, two semesters of advanced calculus, and at least one semester each of algebra and topology are suggested.

The master's degree is offered under both Plans A and B. A graduate student who holds a teaching assistantship is expected to complete the M.A. or M.S. program within two years.

A reading knowledge of one foreign language is required for the master's degree.

The doctorate is a research degree granted on the basis of broad mathematical knowledge and exhibited creative ability. Course work leading to the doctorate is available in the fields of algebra, analysis (classical and modern), applied mathematics, differential equations and topology. A comprehensive examination is required of each student. This examination normally is given after two years of graduate study.

In order to be admitted to candidacy for the degree, a student must pass proficiency examinations in two foreign languages chosen from French, German or Russian, complete studies in a minor field (either inside or outside the department) and successfully complete the comprehensive examinations. Subsequent work becomes highly specialized through seminars, independent study, and finally, work on a dissertation which penetrates in depth some field of particular interest. Areas in which members of the faculty have active research projects include functional analysis, algebraic and point-set topology, group

theory, ring theory, complex analysis, Fourier analysis, rational approximation, function algebras, differential equations, topological algebra and differential geometry.

421 *Elementary Numerical Methods.* (3)
Outline of capabilities and limitations of the computer. Number representation. Propagation of errors through basic arithmetical operations. Applications of analysis to error-estimation. Linear and nonlinear equation solving. Matrix eigenvalues. (This course could serve as an introduction both for the specialist and the non-specialist.) Prereq: MA 214 or equivalent. (Same as CS 421.)

423 *Introductory Probability.* (3)
Set theory; fundamental concepts of probability, including conditional and marginal probability; random variables and probability distributions (discrete and continuous); expected values and moments; moment-generating and characteristic functions; random experiments; distributions of random variables and functions of random variables; limit theorems. Prereq: MA 214. (Same as STA 423.)

432 *Methods of Applied Mathematics I.* (3)
Partial differentiation, Jacobians, implicit function theorem, uniform convergence of series, line and surface integrals, Green's and Stoke's theorems. Prereq: MA 214 or equivalent.

433 *Methods of Applied Mathematics II.* (3)
Elementary complex variable theory with applications. Complex field, analytic functions, Cauchy theorum, power series, residue theory. Prereq: MA 432 or 471.

441 *Geometry I.* (3)
Euclidean, affine, projective spaces, and the classical groups. Prereq: MA 361 or consent of instructor.

442 *Geometry II.* (3)
Selected topics chosen from among: hyperbolic geometrics, spherical and elliptical geometries, differential geometry, geometric inequalities, circular transformations, manifolds and differential manifolds. Prereq: MA 441 or consent of instructor.

462 *Matrix Analysis.* (3)
Vectors, matrices, vector-valued and matrix-valued functions, differentiation, integration, Jacobians, Wronskians, inversion of matrices, eigenvalues, matrices of special forms, inner product spaces and tensors. (This course is a prerequisite for 500-level courses in Differential Equations.) Prereq: MA 214 or equivalent.

471 *Advanced Calculus I.* (3)
The first half of a year sequence which will cover the standard topics of uniformity, integrals and derivatives in n-space, Stokes' theorem, and selected other topics. Prereq: MA 214 and 351 or equivalent.

472 *Advanced Calculus II.* (3)
A continuation of MA 471. Prereq: MA 471 or consent of instructor.

481 *Differential Equations I.* (3)
Brief review of linear differential equations and matrix algebra, eigenvalues and eigenvectors of matrices, systems of linear differential equations with constant coefficients, applications, Sturm separation and comparison theorems, Sturm-Liouville theory for second-order equations and applications. Prereq: MA 214 or equivalent.

482 *Discrete Methods and Models in Applied Mathematics.* (3)
Probability on finite sample spaces, combinatorial mathematics, finite Markov chains, linear programming, theory of games. Prereq: MA 214 or equivalent. (Same as STA 482, CS 482.)

483 *Differential Equations.* (3)
A continuation of MA 481. Topics will include perturbation theory; power series techniques and regular singular point theory; asymptotics; eigenfunction expansions; qualitative behavior of linear and nonlinear differential equations. Prereq: MA 481, or equivalent.

485 *Fourier Series and Boundary Value Problems.* (3)
An introductory treatment of Fourier series and its application to the solution of boundary value problems in the partial differential equations of physics and engineering. Orthogonal sets of functions, Fourier series and integrals, solution of boundary value problems, theory and application of Bessel functions and Legendre polynomials. Prereq: MA 432 or equivalent. (Same as EM 585.)

501-502 *Seminar in Selected Topics.* (3 ea.)
Various topics from the basic graduate courses. Designed as a course for teachers of lower division mathematics and usually offered in connection with a summer institute. May be repeated once. Prereq: Teaching experience in the field of mathematics and consent of instructor.

524 *Discrete Probability.* (3)
Sample space, combinatorial methods, combination of events, laws of large numbers, normal approximation to the binomial, generating functions, convolutions, random walks, branching processes, recurrent events. Prereq: MA 432 or 471 or consent of instructor. (Same as STA 524.)

525 *Numerical Solution of Ordinary and Partial Differential Equations.* (3)
Topics may include numerical solution techniques for linear and nonlinear ordinary differential equations; single step methods; predictor-corrector techniques; stability, accuracy and precision of methods; two point boundary value problems; numerical solution of linear and nonlinear problems in partial differential equations by finite difference and variational methods; specific problems, depending on the interests of the audience, such as the nonlinear wave equation with shock waves. Prereq: MA 421, or equivalent, and computer programming ability.

531 *Theory of Statistical Inference I.* (4)
Sample space, concept of probability, conditional probability, random variables, density and distribution functions, mathematical expectation; moment generating functions; functions of random variables; limit laws, usual distributions, certain derived distributions, introduction to estimation and hypothesis testing. Prereq: MA 432 or 471 or consent of instructor. (Same as STA 531.)

532 *Ordinary Differential Equations.* (3)
Successive approximations and elementary existence theorems for scalar and vector equations, qualitative behavior of solutions as functions of initial conditions and parameters, linear systems with constant and periodic coefficients, stability theorems for second order linear and nearly linear equations, second order boundary value problems and regular singular point theory. Prereq: MA 462 and either 432 or 471.

533 *Partial Differential Equations.* (3)
Elementary existence theorems, equations of first order, classification of linear second order equations, the Cauchy and Dirichlet problems, potential theory, the heat and wave equations, Green's and Riemann functions, separation of variables, systems of equations. Prereq: MA 532 and MA 472 or equivalent.

535 *Vector and Tensor Analysis.* (3)
The algebra and calculus of vectors, cartesian tensors, curvilinear coordinates, Christoffel symbols, determinants, exterior forms, integration. Prereq: MA 214.

536 *Operational Calculus and Generalized Functions.* (3)
Testing functions; differentiation and integration of distributions or generalized functions; convolutions; Fourier and Laplace transforms; applications to linear differential equations. Prereq: MA 432 or 481.

538 *Elementary Numerical Analysis.* (3)
Interpolation. Gaussian quadrature, orthogonal polynomials. Richardson process. Numerical treatment of ordinary differential equations and intermediate linear algebra. Linear difference equations. Prereq: MA 421. (Same as CS 538.)

551 *Topology I.* (3)
General topology, separation axioms, normal spaces, connectedness and compactness. Prereq: Consent of instructor.

561 *Modern Algebra I.* (3)
Algebraic structures, quotient structures, substructures, product structures, groups, permutation groups, groups with operators, and the Jordan-Holder theorum. Prereq: Consent of instructor.

565 *Linear Algebra.* (3)
Fields, vector spaces, rings of linear transformations, matrices associated with linear transformations, dual spaces, eigenvectors, canonical forms, adjoint matrices, and tensor products. Prereq: MA 214 or equivalent.

566 *Theory of Numbers.* (3)
Divisibility, prime numbers, congruences and residues, Diophantine equations. Prereq: Consent of instructor.

570 *Multivariate Calculus.* (3)
A self-contained course in n-dimensional analysis, including the general form of Stokes' theorem. Prereq: MA 432 or equivalent.

571 *Analysis I.* (3)
This course is designed for advanced undergraduates and beginning graduate students. Topics include metric spaces, metric space topology, continuous functions on metric spaces, Ascoli's theorum, Stone-Weierstrass theorum and Riemann-Stieltjes integration. Prereq: MA 471 or equivalent.

572 *Analysis II.* (3)
Lebesgue measure in E^n, Lebesgue integration, product measure, Fubini theorum. Applications to L_p spaces and Fourier series. Prereq: MA 571 or consent of instructor.

573 *Applied Complex Analysis.* (3)
Boundary value problems, analytic continuation, contour integration, special functions. Prereq: MA 433.

585 *Boundary Value Problems of Mathematical Physics.* (3)
A continuation of MA 485. Topics may include integral equations, calculus of variations and variational methods; Green's and Riemann functions and their applications; successive approximation techniques and applications. Prereq: MA 485, or equivalent.

611 *Independent Work in Mathematics.* (3-9)
Reading course for graduate students in mathematics. Prereq: Major in mathematics, a standing of at least 3.0 and consent of instructor. May be repeated to a maximum of nine credits.

624 *Advanced Probability I.* (3)
Markov chains, birth and death processes, renewal theory, central limit theorem, stochastic processes. Prereq: MA/STA 524 or 531. (Same as STA 624.)

632 *Advanced Differential Equations.* (3)
General existence and uniqueness theorems, linear systems, regular and singular eigenvalue problems, stability theory, nonlinear oscillation theory, asymptotic theory, equations with retarded argument. Prereq: MA 532 or consent of instructor.

633 *Theory of Partial Differential Equations.* (3)
A continuation of MA 533. Topics may include hypoelliptic operators and interior regularity of solutions; P(D)-convexity and existence theorems; regularity up to the boundary; applications of the maximum principle; semi-group theory for evolution equations; perturbation methods; well-posed and improperly posed problems; equations with analytic coefficients; a symptotic behavior of solutions; nonlinear problems. Prereq: MA 533.

635 *Theory of Tensors.* (3)
Graded tensor algebra of a module over a ring, groups as modules over the integers, vector spaces over fields and the module of vector field germs, vector fields on open sets in vector spaces and on manifolds, graded exterior algebras, and integration of forms. Prereq: MA 561 or consent of instructor.

637 *Approximation Theory.* (3)
Approximation problems in linear normed spaces; Weierstrass theorem and extensions; Muntz theorem; characterization of polynomials of best approximation; approximation of L^p spaces; interpolation processes, entire functions as approximants. Prereq: MA 433 and 571.

638 *Advanced Numerical Analysis.* (3)
Computational methods for algebraic equation systems, both linear and nonlinear. Algebraic and differential eigenproblems. Lambda matrices. Special-purpose methods suitable for linear programming and for the large sparse matrices which arise in the analysis of structures. Prereq: MA/CS 538.

641, 642 *Differential Geometry.* (3 ea.)
Tensor products, exterior algebra, differentiable maps, manifolds, geodesics, metric properties of curves in E^n fundamental forms, surfaces. Prereq: Consent of instructor.

651 *Topology II.* (3)
Embedding and metrization, compact spaces, uniform spaces and function spaces. Prereq: MA 551.

653 *Dimension Theory.* (3)
Primarily concerned with dimensions of separable metric spaces. Will also consider the relationships between various definitions of dimensions. Prereq: MA 651.

654 *Algebraic Topology I.* (3)
Homotopy, fundamental groups, simplicial homology, axioms for homology theory. Prereq: MA 551, 561, and 651 or equivalent.

655 *Algebraic Topology II.* (3)
Singular homology theory and applications, homology of products, singular and Cech cohomology with applications. Prereq: MA 654.

661 *Modern Algebra II.* (3)
Rings, fields of quotients, rings of polynomials, formal power series, modules, exact sequences, groups of homomorphisms, natural isomorphisms, algebras and tensor algebras. Prereq: MA 561 or consent of instructor.

667 *Group Theory.* (3)
A study of homomorphisms for groups, finite groups, solvable groups, nilpotent groups, free groups, and abelian groups. Prereq: MA 661.

671,672 *Functions of a Complex Variable.* (3 ea.)
Differentiation and integration, contour integration, poles and residues, Royster, Taylor and Laurent series, conformal mapping, Riemann mapping theorem, Dirichlet problem, multiple-valued functions, Riemann surfaces, and applications. Prereq: MA 571, 572.

673 *Several Complex Variables.* (3)
Hartogs theorem, domains of holomorphy, pseudoconvexity, Cousin problems, differential forms, DeRham's theorum, cohomology of domains of holomorphy, Levi problem, sheaves, Stein manifolds. Entire functions of several variables. Prereq: MA 672.

678 *Calculus of Variations.* (3)
The ordinary problem for the plane and space; Weierstrass, the necessary conditions of Euler, Weierstrass, Legendre, and Jacobi. The parametric problem; the isoperimetric problem. Sufficiency conditions. Prereq: Consent of instructor.

681 *Functional Analysis I.* (3)
General theory of normed linear spaces including the Hahn-Banach separation theorems, principle of uniform boundedness and closed graph theorem. Dual spaces and representation theorems for linear functionals. Abstract measure theory and Riesz representation theorem for C(X). Prereq: MA 572 or consent of instructor.

682 *Functional Analysis II.* (3)
Weak and weak-star topologies, reflexive spaces, convexity in linear spaces, operators, adjoint operators, spectral theory and Fourier transforms. Prereq: MA 681.

683 *Convergence and Summability.* (3)
Fundamental limit ideas applied to infinite sequences, infinite series, infinite products, etc. Summability of Cesaro, Holder, Abel, Borel, and Leroy. Prereq: MA 571 or consent of instructor.

685 *Fourier Analysis.* (3)
Expression of a general periodic function as a Fourier series, sufficient conditions for convergence, Fejer's theorem, applications. Prereq: MA 572.

687 *Integral Equations.* (3)
Systems of ordinary linear equations, linear operators, orthogonal systems, linear integral equations of the second kind, theorems of Fredholm, Volterra's equation. Prereq: Consent of instructor.

703 *Advanced Probability II.* (3)
Review of probability spaces; general stochastic processes; spectral analysis of stationary random processes; infinitely divisible distributions; theory of queues. Prereq: MA/STA 624; coreq: MA 572. (Same as STA 703.)

732 *Selected Topics in Differential and Integral Equations.* (3)
Advanced topics in theory of differential (ordinary or partial) and integral equations such as topological dynamics, almost periodic solutions, stochastic differential equations, integro-differential and differential-difference equations, generalized functions as solutions, non-linear partial differential equations, singular integral equations.

751,752 *Selected Topics in Topology.* (3 ea.)
Prereq: MA 651.

753,754 *Selected Topics in Functional Analysis.* (3 ea.)
Prereq: MA 682.

755,756 *Selected Topics in Topological Algebra.* (3 ea.)
Topics chosen from: Lie groups, transformation groups, topological groups, semigroups, rings, semirings, and lattices. Also reports on and discussion of recent advances in topological algebra. Prereq for MA 755: MA 651 or consent of instructor.

757 *Seminar in Topology.* (3)
Review of current research in topology. Prereq: Consent of instructor.

761 *Homological Algebra.* (3)
Homological algebra, modules, exact sequences, functors, homological dimension, extension problems. Prereq: Consent of instructor.

762 *Theory of Rings.* (3)
This course will consist primarily of the study of ring theory. Prereq: Consent of instructor.

763 *The Theory of Fields.* (3)
Separable and inseparable extensions, splitting fields, normal extensions, fundamental theorems of Galois theory, and transcendental extensions. Prereq: MA 561 and 661.

764,765 *Selected Topics in Algebra.* (3 ea.)
Reports and discussion on recent advances in group theory, ring theory, and homological algebra. Prereq: MA 661 and consent of instructor.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

771,772 *Selected Topics in the Theory of Complex Variables.* (3 ea.)
Prereq: Consent of instructor.

773,774 *Selected Topics in Analysis.* (3 ea.)
May be repeated once for a maximum of six credits. Prereq: Consent of instructor.

777,778 *Mathematical Seminar.* (3 ea.)
May be repeated once to a total of six credits. Prereq: Consent of instructor.

MUSIC

Director of Graduate Study—Frank Traficante

The Department of Music offers the Master of Arts (M.A.) in music, Master of Music (M.M.) in applied music, music theory, composition, and music education, Doctor of Musical Arts (D.M.A.), and the Doctor of Philosophy (Ph.D.) in musicology. The applicant for the master's degree is expected to have earned an appropriate undergraduate degree at the University of Kentucky or an equivalent degree from a comparable institution.

General Requirements for Master's Degree

Foreign Language Requirements: The Master of Arts degree requires a reading knowledge of one foreign language, preferably French or German. A foreign language is optional for the Master of Music degrees except for candidates in the Applied-Music-Voice major areas. The Voice major must have completed one year of study in each of two modern foreign languages.

Thesis Requirements: The Master of Arts degree requires a thesis. A public recital acceptable to the faculty is required in lieu of a thesis for the Master of Music degree in Applied Music. A composition of major proportions, acceptable to the faculty and publicly performed, must be submitted in lieu of a thesis by candidates for the Master of Music degree in Composition. A thesis is optional in the Master of Music in Music Education or Theory and Master of Arts in Education curricula. Twenty-four hours of work are required with a thesis or 30 hours without.

A final comprehensive examination is required for each program.

MASTER OF ARTS (MUSIC)

Prequisites: A suitable background in music theory or music literature and satisfaction of the Graduate School requirement for a reading knowledge of one foreign language, normally French or German.

	Crs.
Music History and Literature	6
Theory	6
Research Methods (Music 682)	2
Minor (outside Department of Music)	3
Directed electives	9
Thesis	0
	26

MASTER OF MUSIC (THEORY)

Prerequisite: 10 hours of upper division theory, including form and analysis and counterpoint, or the equivalent.

Theory	10
Research Methods (Music 617)	2
Music History and Literature	6
Directed electives	6
	24

The student may either prepare a thesis or take six additional hours of Theory, Composition, or Music History and Literature courses for a total of 30 hours of course work.

MASTER OF MUSIC (COMPOSITION)

Prerequisite: Submission of three original compositions.

Advanced Composition (Music 673)	4
Music History and Literature	6
Theory	8
Directed electives	6
Thesis composition	0
	24

The thesis composition must be publicly performed and the student is responsible for the preparation of legible score and parts.

MASTER OF MUSIC (APPLIED MUSIC)

Prerequisite: Acceptance by the appropriate faculty of applied music.

Applied Music (including recital)	9
Music History and Literature	6
Theory	4
Directed electives	11
Recital	0
	30

Wind, string and percussion majors must participate in at least one University-sponsored performing organization for two semesters unless excused by a vote of the faculty.

MASTER OF MUSIC (MUSIC EDUCATION)

Part I*

History and Philosophy of Music Education (Music 751)	3
Supervision and Administration of School Music (Music 750)	3
Music Education Electives	6
Applied Music (500 level)	3
Research Methods (Music 617)	2
Theory	4
Music History and Literature	6
Electives	3
	30

Plan II*

History and Philosophy of Music Education (Music 751)	3
Supervision and Administration of School Music (Music 750)	3
Music Education Electives	6
Applied Music (500 level)	6
Major	(3)
Electives	(3)
Research Methods (Music 682)	2
Music History and Theory	6
Electives in Music or Education	4
	30

Plan III*

History and Philosophy of Music Education (Music 751)	3
Supervision and Administration of School Music (Music 750)	3
Music Education Electives	3
Applied Music	3
Research Methods (Music 617)	2
Music History and Theory	6
Electives	4
Thesis	0
	24

* Students planning to earn the doctorate in Music Education should elect Plan II or III.

Each full-time resident graduate student in music education must participate in a University-sponsored performing organization for two semesters unless excused by a vote of the faculty.

The Degree of Doctor of Musical Arts

The D.M.A. program offers each candidate opportunities for his fullest development as a specialist in his field of interest. Fields of specialization offered in the D.M.A. program are Music Education, Theory, and Performance Pedagogy. Work in Performance Pedagogy may be done in one of several applied areas such as piano, voice, conducting, etc. In each case, every effort is made to allow for the candidate's growth in terms of his own unique insight and potential.

The requirements for this degree are the same as for the degree of Doctor of Philosophy except that only one foreign language, normally French or German, is required for the D.M.A. degree. The candidate must also demonstrate a working knowledge of music terms in French, German, and Italian prior to the qualifying examination.

The applicant for this degree must have at least two years of successful teaching experience.

He must submit, prior to admission to candidacy, his master's thesis or two papers of approximately 1,000 words each, one of the papers dealing with the teaching of music.

Not later than the first term of study the applicant must take placement examinations in music theory, music history and literature, key-

board proficiency, performance or conducting, and in the field of proposed concentration.

The following minimum core requirements for the D.M.A. beyond the bachelor's degree are as follows:

	Crs.
Music History and Literature	12
Music Theory	8
Research Methods (Music 617, 618)	4
Minor outside department	9
Courses in area of specialization	at least 15

The candidate will minor in either musicology or music theory, with a second minor to be taken outside the Department of Music, subject to the approval of his committee and the chairman of the department concerned.

The Degree of Doctor of Philosophy in Musicology

Musicology is a humanistic discipline drawing upon various research methods necessary to the discovery, correlation, appraisal, and exposition of musical criteria in any given stylistic era or eras. As a humanist, the musicologist must be skilled not only in research methods and techniques, but in the teaching and performance of music as well.

Prerequisites: Every prospective candidate must have the A.B. in music or its equivalent. Those with a master's degree will normally be expected to possess the M.A. in music or the M.M. degree with substantial study in musicology and languages.

All applicants will be asked to provide evidence of ability to write an acceptable doctoral dissertation. Anyone not presenting a master's thesis must submit instead research papers of acceptable scope and quality.

Language Requirement: The foreign languages required are German, and either French or Italian plus any other languages required for preparing the dissertation.

For further information, write to the Director of Graduate Studies, Department of Music.

MUSIC PERFORMANCE COURSES

All music performance courses may be repeated three times for credit.

All music performance courses carry one credit hour if taken in the Summer Session.

Piano	501,601
Voice	502,602
Organ	503,603
Violin	504,604
Viola	505,605
Cello	506,606
String Bass	507,607
Flute	508,608
Oboe	509,609
Clarinet	510,610
Bassoon	511,611
Trumpet	512,612
French Horn	513,613
Trombone	514,614
Baritone	515,615
Tuba	516,616
Saxophone	517,617
Percussion	517,618
Harp	519,619
Harpsichord	520,620
Viol	521,621
Historical Instruments	522,622

500 *Music of the Middle Ages.* (3)
The development of Western music through the 14th century. Prereq: MUS 202, 203, or MUS 200 and permission of instructor.

501 *Music of the Renaissance.* (3)
A survey of vocal and instrumental music of the 15th and 16th centuries. Prereq: MUS 202, 203, or MUS 200 and permission of instructor.

502 *Music of the Baroque Era.* (3)
The history of vocal and instrumental music in the Baroque style from 1600 to 1750. Prereq: MUS 202, 203, or MUS 200 and permission of instructor.

503 *Music of the Classic Period.* (3)
The development of music in the Classic style from the early 18th century to 1800. Prereq: MUS 202, 203 or MUS 200 and permission of instructor.

504 *Music of the Nineteenth Century.* (3)
A study of master works of music composed in the 19th century. Prereq: MUS 202, 203 or MUS 200 and permission of instructor.

505 *Music of the Twentieth Century.* (3)
A stylistic study of representative compositions of the 20th century. Prereq: MUS 202, 203 or MUS 200 and permission of instructor.

506 *History of American Music.* (3)
A study of music in America from colonial times to ca. 1920. Prereq: MUS 202 and 203 or MUS 200 and permission of instructor.

520 *Vocal Solo Literature.* (3)
A stylistic study of solo vocal music from the Baroque to the present. Prereq: MUS 202, 203 or MUS 200 and permission of instructor.

521 *Organ Literature.* (3)
A course of study designed to give the organ student a practical knowledge of the development of the organ, its construction, the standard literature, and teaching materials. Prereq: MUS 202, 203 or MUS 200 and permission of instructor. (Fall Semester only.)

522 *Piano Literature.* (3)
A historical and analytical study of music written for the piano. Matters such as the emergence of the piano idiom and the development of the instrument will also be considered. Prereq: MUS 202, 203 or MUS 200 and permission of instructor.

524 *String Literature.* (3)
A historical and analytical study of music written for strings. Prereq: MUS 202, 203 or MUS 200 and permission of instructor.

530 *Collegium Musicum.* (3)
The study and realization of performance practices in music from antiquity to the present. May be repeated twice for credit.

560 *Supervision of Music.* (1)
A study of supervision of the school music program through curriculum planning, supervisory techniques, administrative and community relationships, the use of mechanical aids in the improvement of teaching, etc. Prereq: MUS 360, 362 or 361, 363.

561 *Current Practices in Elementary and Secondary School Music.* (2)
Contemporary philosophies and objectives of music in the elementary and secondary schools. The in-service training of the classroom teacher; the music specialist as a resource person. Techniques for developing the child's musical interest and capacity for music. The status of music in America's public schools. Open to music teachers only. Prereq: MUS 360 and 362, or 361 and 363 or the equivalent.

565 *Vocal Pedagogy.* (2)
For teachers of voice, supervisors of music and choir directors. The study of physical and psychological problems in the teaching of voice production, the study of breath control, diction, resonance, interpretation, and repertory.

568 *General Music in the Secondary School.* (2)
Techniques and materials for general music activities in junior and senior high schools, emphasizing teaching of music as a humanistic discipline.

570 *Orchestration.* (2)
This course includes a study of the individual instruments of the orchestra and band with practice in scoring for these instruments. Prereq: MUS 371.

571 *Orchestration.* (2)
A continuation of MUS 570. Prereq: MUS 570.

572 *Counterpoint.* (2)
Study of 16th century contrapuntal techniques.

573 *Counterpoint.* (2)
Study of 18th century contrapuntal techniques.

574 *Composition.* (2)
A basic course in original composition and orchestration. Prereq: MUS 371.

575 *Composition.* (2)
A continuation of MUS 574. Prereq: MUS 574.

578 *Analytical Techniques.* (2)
Studies in the analysis of stylistic practices in the music of the 18th and 19th centuries. Prereq: MUS 272 and 273, MUS 372 or equivalent.

601 *History of Performance Practices.* (3)
A survey of practices in the performing of European music from the later Middle Ages to 1800, based on evidence from contemporary sources.

617 *Research Methods.* (2)
A course designed to acquaint the student in music education with the basic research techniques and materials in music.

618 *Research Methods.* (2)
A survey of basic research techniques and materials in musicology and theory. Prereq: A reading knowledge of French or German.

619 *Proseminar in Musicology.* (2)
A continuation of MUS 618. For doctoral students. Two class hours per week. Prereq: MUS 618. (Alternate summers.)

620 *Advanced German Vocal Literature.* (3)
An intensive study of the stylistic and interpretive characteristics of German solo vocal literature.

621 *Advanced Vocal Literature.* (3)
An intensive study of the stylistic and interpretive characteristics of the solo vocal literature other than German.

622 *Symphonic Literature.* (3)
An intensive study of orchestral literature from the classical period to the present. Prereq: MUS 202 and 203, or MUS 200 and permission of instructor.

623 *Opera Literature.* (3)
The development of opera as an art form, and analysis of representative operas from various areas. Prereq: MUS 202 and 203, or MUS 200 and permission of instructor.

624 *Chamber Music Literature.* (3)
An intensive study of the development of instrumental chamber music. Prereq: MUS 202 and 203, or MUS 200 and permission of instructor.

625 *Choral Literature.* (3)
A survey of choral literature from the 16th century to the 18th century. Prereq: MUS 202, and MUS 203 or MUS 200 and permission of instructor.

650 *Music Education Workshop.* (1-4)
Intensive study of advanced methods and materials in one of the following areas of music education: elementary and general music, the school orchestra, the school band, choral music. May be repeated once for a total of two, three or four credits.

671 *Advanced Musical Analysis.* (3)
A course designed to show the changing aspects of musical style through analysis of representative compositions from all periods. Prereq: At least eight hours of upper-division theory or consent of instructor.

672 *Advanced Musical Analysis.* (3)
A continuation of MUS 671. Prereq: MUS 671.

673 *Advanced Composition.* (2)
May be repeated two times for a total of six credits. Prereq: MUS 575.

674 *Pedagogy of Theory.* (2)
The teaching of music theory.

675 *Pedagogy of Theory.* (2)
A continuation of MUS 674. Prereq: MUS 674.

677 *Contemporary Music Idioms.* (3)
An intensive study of compositional procedures in music since 1920. Prereq: MUS 505 (may be taken concurrently with the consent of instructor).

700 *Medieval Notation.* (3)
The study and transcription of the notation of Medieval music from the earliest plainchant sources to mannered notation of the late Ars Nova in Italy and France. Three class hours per week; one laboratory hour per week. Prereq: MUS 500 (may be taken concurrently) and consent of instructor.

701 *Renaissance Notation.* (3)
The study and transcription of the notation of Renaissance polyphony from the time of the Burgundian school through Palestrina and contemporaries, and of the various keyboard and lute tablatures of the 16th and 17th centuries. Three class hours per week; one laboratory hour per week. Prereq: MUS 501 (may be taken concurrently) and consent of instructor.

702 *Seminar in Musicology.* (3)
Study and research in specific musicological problems. May be repeated twice for credit. Prereq: Permission of instructor.

703 *Studies in Music History.* (2)
Intensive studies of a musical genre, a composer, or a school of composers.

718 *Doctoral Seminar.* (3)
A seminar for Ph.D. and qualified D.M.A. students. Prereq: Two semesters of residency, and fluent reading knowledge of French and German.

719 *Independent Work in Musicology.* (1-3)
May be repeated for a total of six hours. Prereq: Four to six hours of graduate credit in the area of specialization *and* consent of instructor.

750 *Administration and Supervision of Public School Music.* (3)
A study of current trends in school music, curricula, testing programs, and other supervisory procedures. (Same as EDC 750.)

751 *History and Philosophy of Music Education.* (3)
A historical survey of thought concerning the place and significance of music in the education of the individual and the group. (Same as EDC 751.)

762 *Music in Higher Education.* (3)
Historical and comparative studies in the teaching and administration of music in colleges and universities. Includes case studies in administration, music in European higher education and the relationship of music to all other elements of the academic program. Prereq: MUS 751.

766 *Seminar in Music Education.* (3)
Advanced professional study in the theory and practice of music education. May be repeated once for total of six credits. Prereq: Permission of instructor.

767 *Independent Work in Music Education.* (1-3)
May be repeated for a total of six hours. Prereq: Four to six hours of graduate credit in area of specialization and consent of instructor.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Psychology of Music.* (3)
A study of the processes of musical thinking and the effects of music on human behavior.

799 *Independent Work in Music Theory.* (1-3)
May be repeated for a total of six hours. Prereq: Four to six hours of credit in area of specialization and consent of instructor.

UNIVERSITY OF LOUISVILLE GRADUATE COURSES

There is available a joint program in Musicology between the University of Kentucky and the University of Louisville. Information relative to this program may be secured from the Department of Music.

Music History

Mus. H. 551-552	Independent Study	
Mus. H. 560	Introduction to Musicology	(3)
Mus. H. 571-574	Musical Notation and Analysis	(2-2-2-2)
Mus. H. 582	Studies in Medieval Music	(3)
Mus. H. 583	Studies in Renaissance Music	(3)
Mus. H. 584	Studies in Baroque Music	(3)
Mus. H. 586	Studies in Romantic Music	(3)
Mus. H. 587	Early 20th Century Music	(3)
Mus. H. 588	Recent 20th Century Music	(3)
Mus. H. 591-592-etc.	Pro-Seminar in Great Composers	(3-3-etc.)
Mus. H. 601-602	Seminar in Great Composers Prerequisite: Consent of Instructor.	(3-3)
Mus. H. 621 A to F	Special Topics in Music History Prerequisite: Consent of Instructor.	(3)
Mus. H. 645-646	Thesis Guidance Prerequisite: Consent of Instructor.	(3-3)
Mus. H. 651-652	Independent Study (Credit according to achievement)	

Theory

T 465-466	Advanced Orchestration	(2-2)
T 475-476	Advanced Counterpoint	(2-2)
T 485-486	Advanced Composition	(2-2)
T 607-608	Advanced Analysis	(2-2)
T 613-614	Analytical Techniques of Contemporary Music	(2-2)
T 631-632	Advanced Private Instruction in Composition and Orchestration II	(2-2)
T 641-642	Advanced Private Instruction in Composition and Orchestra	(2-2)

PHILOSOPHY

Director of Graduate Study—Dallas M. High

The Department of Philosophy offers courses of study leading to a Master of Arts degree under Plan A. The department admits those students who wish to further their philosophical interests with work at the M.A. level and those students who view the program as preparatory to pursuit of the Ph.D. (At present the department does not offer this degree.) The department does not require an undergraduate major in philosophy as a prerequisite to the graduate program; however, remedy for deficient background in history of philosophy and logic must be undertaken upon entrance to the program.

A reading knowledge of one foreign language is required for the master's degree.

418 *Existentialism.* (3)
A systematic study of the fundamental concepts and problems of existentialism. Readings selected from such philosophers as Kierkegaard, Nietzsche, Sartre, Marcel, Heidegger, and Jaspers.

440 *Great Religions.* (3)
A descriptive survey of several religions as they developed within their culture, for example, Hinduism, Buddhism, Confucianism, Judaism, Christianity.

520 *Intermediate Logic.* (3)
An intermediate course in logic which reviews the logic of propositions, develops the logic of quantification and introduces metalogical issues in the construction, consistency and completeness of deductive systems. Prereq: PHI 120 or consent of instructor.

GROUP A

502 *Plato and Aristotle.* (3)
Plato's life and writings. Principal topics in major dialogues (e.g. the Forms or Ideas, body and soul, immortality, the good life, cosmology and theology, and logical explorations). Selected passages in Aristotle's major works. Prereq: one course in Philosophy or consent of instructor.

505 *History of Medieval and Renaissance Philosophy.* (3)
Investigation of the major views in philosophy from Plotinus to Descartes. Neoplatonic and Aristotelian contributions to logic, metaphysics and the theory of knowledge will be examined critically in relation to modern and contemporary issues in philosophy.

511 *Continental Rationalism.* (3)
Critical study of the philosophical systems developed on the basis of rationalistic epistemologies in the seventeenth and early eighteenth centuries. Attention will be given to major works such as Descartes, Leibniz and Spinoza. Prereq: PHI 270 or permission of instructor.

512 *British Empiricism.* (3)
Critical study of the empirical tradition in modern philosophy as founded and elaborated by Locke, Berkeley, and Hume. Prereq: PHI 270 or consent of instructor.

513 *19th Century Philosophy.* (3)
An examination of the major topics and trends in 19th century philosophy. Prereq: PHI 270 or consent of instructor.

514 *American Philosophy.* (3)
A critical survey of American philosophical movements, notably idealism, pragmatism, realism, naturalism, logical positivism, and phenomenology.

515 *Contemporary Philosophy.* (3)
A study of philosophical developments in the Twentieth Century, with concentration on the analytic movements (logical atomism, logical positivism, and linguistic analysis).

516 *Phenomenology.* (3)
An account of the Phenomenological movement from Husserl to the present with emphasis on the development of a phenomenological method including elements such as Intentionality, Reduction, Constitution and their relations to the Structure of Appearance. Prereq: PHI 270.

GROUP B

530 *Ethical Theory.* (3)
A study of ethical theories by detailed examination of a few selected works. Theories considered may include naturalism, intuitionism, noncognitivism, utilitarianism, universalizability, and natural law.

535 *Social and Political Philosophy.* (3)
A critical examination of some philosophical problems concerning the nature and evaluation of social and political organizations. For example, questions concerning the nature, justification, and limits of political power may be explored in connection with a study of important classical positions.

537 *Philosophy of Law.* (3)
Concept of law; relations between law and morals; nature of legal reasoning; analysis of legal concepts; justification of punishment.

545 *Philosophy of Religion.* (3)
An analysis of the philosophical issues raised by religion, such as the problem of religious knowledge, the nature of religious language, science and religion, concepts of God, death, and evil.

592 *Aesthetics.* (3)
Problems of method in aesthetics; major types of aesthetic theory. Aesthetic materials of the arts in literature, music, and the space arts. Form and types of form. Meaning in the arts. Interrelations of the arts. Lectures, discussions, reports. (Same as A-H 592.)

GROUP C

550 *Metaphysics.* (3)
Examination of efforts by philosophers to construct general conceptions of the world. Recent approaches to philosophy and metaphysical investigation. Prereq: two courses in Philosophy or consent of instructor.

555 *Epistemology.* (3)
A study of the origins, nature, kinds and validity of knowledge, with accent both on traditional epistemological problems and on analyses of epistemological concepts.

560 *Philosophy of Science.* (3)
An examination of the logical and epistemological foundations of empirical science, including fundamentals of concept formation, criteria of cognitive significance, logic of explanation and prediction, and testing and confirmation of theories and laws. Prereq: PHI 120 or equivalent or consent of instructor.

562 *Philosophy of the Social Sciences.* (3)
An examination of the foundations of the social sciences, focusing upon the character of the theories and concepts used to explain human behavior, including the role of laws and the nature of confirmation.

565 *Philosophy of Language.* (3)
An investigation of problems current in the philosophy of language such as meaning and reference, the nature of analysis, linguistic relativity and the relation of linguistics to philosophy.

570 *Philosophy of History.* (3)
An examination of the theories and methods utilized by historians with special attention to the problems of laws and explanations in history, the nature of historical knowledge and narrative, and the roles of causal judgments and historical understanding. Attention will also be given to theoretical interpretations of history as offered by Marx, Hegel, Toynbee and others.

575 *Philosophy of Mind.* (3)
An examination of problems current in the philosophy of mind, such as the concept of person, the relation of mind and body, the relation of minds and machines, knowledge of other minds, and the roles of dispositions and volitions in human action. Attention will be given to the philosophical analysis of such psychological categories as consciousness, feeling, emotion, perception, imagination, thinking and will.

GRADUATE STUDIES

625 *Advanced Logic.* (3)
Intensive study of selected topics arising from propositional as well as lower and higher order predicate logic, e.g., Modal Logic, Many-valued Logic, Quantification Theory, Class Logic and Paradoxes. The course will stress the diversity of approaches to these issues within formal logic. Prereq: PHI 520 or consent of instructor.

680 *Special Topics in Philosophy.* (3)
Studies in philosophical problems which either cut across or lie outside the standard areas of philosophical inquiry. May be repeated to a maximum of six credits.

700 *Seminar in Ancient Philosophy.* (3)
Intensive study of original works of such major classical philosophers as Plato and Aristotle. May be repeated twice for a total of nine credits. Prereq: PHI 260 or equivalent.

705 *Seminar in Medieval Philosophy.* (3)
An intensive study of the issues treated by one or more Medieval philosophers, e.g., Augustine, Aquinas, Scotus or Ockham. Prereq: PHI 505.

710 *Seminar in Modern Philosophy.* (3)
Intensive study in the major works of such prominent philosophers of modern times as Descartes, Locke, Hume, Kant, and Hegel. May be repeated twice for a total of nine credits. Prereq: PHI 270 or equivalent.

715 *Seminar in Recent Philosophy.* (3)
Intensive study of major philosophers of the 20th Century such as Russell, Wittgenstein, J. L. Austin, and Merleau-Ponty. May be repeated twice for a maximum of nine credits. Prereq: PHI 515 or its equivalent.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

790 *Research in Philosophy.* (3)
This course is primarily intended for advanced students who desire and are prepared to do research in philosophy. May be repeated three times for a total of 12 credits.

PHYSICS AND ASTRONOMY

Director of Graduate Study—Ben Gossick

The Department of Physics and Astronomy offers courses and research options leading to the Ph.D. degree in the special areas of theoretical astro-physics, experimental and theoretical atomic and molecular physics, experimental and theoretical nuclear physics, experimental and theoretical solid-state physics, and many body theory, and leading to the M.S. degree in these areas and also in the special area of optics. Excellent laboratory facilities and library materials are available. A major experimental facility is the six-million volt Van de Graaff accelerator. More detailed descriptions of each of these options will be sent on request.

Plan A or Plan B may be used to satisfy the requirements for the M.S. degree.

A reading knowledge of one foreign language is required for the master's degree.

Physics

404 *Mechanics.* (3)
A lecture and problem course covering the fundamental laws of mechanics. Newton's Laws, statics and dynamics of a particle and rigid bodies, and oscillatory motion. Prereq: PHY 232 or 251, 242, MA 213; MA 214 concur.

416 *Electricity and Magnetism.* (3)
A lecture and problem course covering the theory of electrostatic fields, conductors, dielectrics, and steady currents. Prereq: PHY 232 or 251, 242; MA 213.

417 *Electricity and Magnetism.* (3)
A continuation of PHY 416. A lecture and problem course covering electromagnetic induction, magnetic fields, magnetic materials, alternating currents and electromagnetic radiation. Prereq: PHY 416.

472 *Interaction of Radiation with Matter.* (3)
Sources of radiation; penetration of charged particles, electromagnetic radiation, and neutrons through matter; excitation and ionization processes; radiation detection and spectroscopy; dosimetry of ionizing radiations. Prereq: PHY 260.

504 *Advanced Mechanics.* (3)
A continuation and extension of PHY 404. Includes dynamics of a particle, rigid bodies, Lagrange's equations, constrained motions, and oscillations. Prereq: PHY 404; MA 214.

508 *Optics.* (3)
A lecture and problems course covering the basic phenomena of geometrical and physical optics. Topics include thick lenses, apertures, wave motion, interference, diffraction, polarization, double refraction, and the theory of selected optical instruments. Prereq: PHY 232 or 251, 242; MA 213.

510 *Spectroscopy.* (3)
A lecture and problems course dealing with the production, recording, measuring, and interpretation of atomic and molecular spectra. Topics include basic principles of atomic structure, spectrographs, photometry, interpretation of spectra in fields of atomic structure and spectrographic analysis. Prereq: PHY 232 or 251, 242; MA 213.

512 *Experimental Physics: Electricity and Magnetism.* (2)
An advanced laboratory course in electrical measurements. Special projects are elected by the student to explore certain physical relations through standard electrical measurements. Prereq: PHY 416.

514 *Electronics.* (3)
A lecture and laboratory course on the theory and application of solid-state and vacuum tube electronic devices. Lecture, two hours; laboratory, two hours. Prereq: PHY 416.

515 *Theory of Measurements.* (3)
A lecture and problem course in the analysis of experimental data. Topics include finding an empirical equation to fit a set of data, approximations, probability distributions, errors and deviations, quantitative graphs, least square solutions. Prereq: PHY 504; MA 213.

522 *Heat and Thermodynamics.* (3)
A lecture and problem course stressing some of the fundamental principles of heat phenomena, the laws of thermodynamics, equations of state for ideal and real gases, continuity, derivation of thermodynamic relations. Prereq: PHY 232 or 251, 242; MA 213.

524,525 *Solid State Physics.* (3 ea.)
Structure of solids and the physical basis of the properties of materials. Bonding, solid types, lattice energy; thermal, dielectric and magnetic properties; electrons in metals and semi-conductors; theory of rectifiers, transistors and solid state devices. Prereq for PHY 524: PHY 232 or 251, 242; MA 213; Prereq for PHY 525: PHY 524.

530 *Experimental Physics: Spectroscopy.* (2)
An advanced laboratory course in the use and properties of various light sources, spectrographs, photographic materials, and photometric methods; analysis of unknown materials by spectrographic methods. Prereq: PHY 508 or 510.

535 *Experimental Physics: Atomic and Nuclear.* (2)
Measurement of e, e/m, h/e, resonance potentials, x-ray absorption, half-lives, beta-ray and gamma-ray absorption, gamma spectra, specific activity, alpha-particle ranges, and radiation dosage. Prereq: PHY 260.

538 *Experimental Physics: Light.* (2)
An advanced laboratory course dealing with the properties of lenses, mirrors, prisms, gratings, and combinations of these elements in optical systems. The important phenomena of optics are studied experimentally by means of microscope, telescope, spectrometer, interferometer, polarimeter. Prereq: PHY 508.

546 *General Medical Radiological Physics.* (2)
Following a mathematics and physics review, the nature, origin, uses and dosimetric aspects of radiation will be discussed. Application in the fields of diagnostic radiology, therapeutic radiology and nuclear medicine will be emphasized. Prereq: PHY 260 or consent of instructor. (Same as RM 546.)

547 *Medical Radiation Imaging—I, Physical Aspects of Diagnostic Radiology.* (2)
Medical radiation and the generation of information; X-ray circuits and operation of the X-ray apparatus; the radiological image and the retrieval of information; X-ray image intensification; image intensifiers; fluoroscopy; cinefluorography; special procedures and patient dosimetry. Prereq: PHY 260, or RM 546 or consent of instructor. (Same as RM 547.)

548 *The Physics of Radiation Therapy.* (2)
The terminology and advanced methods of treating various diseases using beam devices such as X-rays, Co-60, and linear accelerators as well as brachytherapy (interstitial and intracavitary implantation of radioactive sources). Emphasis will be placed upon "treatment planning" including dose calculation and methods of optimizing tumor to healthy tissue dosage by both hand and computer methods. Prereq: PHY 260 or RM 546 or consent of instructor. (Same as RM 548.)

554 *Fundamental Atomic and Nuclear Physics.* (3)
Atomic models, electromagnetic radiation, special theory of relativity, x-rays and crystal structure, Compton effect, wave nature of matter, atomic spectra, vector model, Zeeman effect. Prereq: PHY 232 or 251, 242; MA 213.

555 *Fundamental Atomic and Nuclear Physics.* (3)
A continuation of PHY 554. Prereq: PHY 554.

598 *Introduction to Quantum Mechanics.* (3)
A lecture and problem course providing an introduction to quantum mechanics at the undergraduate level. Primary emphasis is on one-dimensional problems so that fundamental ideas can be assimilated without complications of purely mathematical nature. Basic postulates; Schrödinger's wave equation and its applications. Prereq: PHY 232 or 251, 242; MA 214.

600 *Selected Topics in Advanced Physics.* (2-3)
Topics of an advanced and specialized nature such as the theory of angular momentum, topics in advanced theoretical nuclear physics, topics in advanced statistical mechanics. May be repeated twice. Prereq: Consent of instructor.

604 *Classical Mechanics.* (3)
A lecture and problems course covering the methods of Lagrange and Hamilton and their application to particles, systems of particles, and continuous media; variational principles; and transformation theory. Prereq: PHY 504 or equivalent; MA 214.

611 *Electromagnetic Theory I.* (3)
A lecture and problem course treating electrostatics, boundary conditions, potential problems, energy in electric and magnetic fields, magnetic materials and Maxwell's equations. Prereq: PHY 416; MA 214.

613 *Electromagnetic Theory II.* (3)
Continuation and extension of PHY 611. Includes theory of electromagnetic waves and applications to optical phenomena of reflection, refraction, polarization and absorption. Prereq: PHY 611.

624,625 *Theory of the Solid State.* (3 ea.)
A lecture and problem course covering the fundamental theories of the

structure and properties of solids, including lattice dynamics, electron propagation, electrical thermal and optical properties. Prereq: PHY 524, 525 and 714.

629 *Nuclear Physics I.* (3)
A lecture and problem course dealing with advanced experimental nuclear physics. Topics include properties of nuclei, nuclear transformations, observational methods, radioactivity and interaction of radiation with matter. Prereq: PHY 604.

630 *Nuclear Physics II.* (3)
A lecture and problem course concerned with the theories of the structure of atomic nuclei. Topics include nuclear shell structure, internuclear forces, nuclear binding energies, and theory of nuclear reactions. Prereq: PHY 714 or equivalent.

631 *Atomic Structure.* (3)
A lecture and problem course treating the theory of atomic structure. Topics include atomic and molecular spectra, multiplet structure, interatomic and intermolecular forces, and quantum mechanical treatment of the vector model. Prereq: PHY 714 or equivalent.

632 *Statistical Mechanics.* (3)
A lecture and problem course dealing with the thermal properties of matter from the standpoint of statistical mechanics. Topics include thermodynamic properties, perfect gases, and Fermi-Dirac statistics. Prereq: PHY 522, 604.

639,640 *Theoretical Astrophysics.* (3 ea.)
A study of those branches of physics which have thus far proved most useful in astronomical applications and a thorough treatment of several major astronomical problems which have been elucidated by these methods. Prereq: PHY 504, 611.

650 *Theory of Relativity.* (3)
A lecture and problem course dealing with the special and general theories of relativity. Topics include relativistic kinematics, the Lorentz transformation, the principle of equivalence, Riemannian spaces, field equations and experimental tests of the special and general theories. Prereq: PHY 604.

652 *Theory of Elementary Particles.* (3)
A lecture and problem course dealing with the application of modern theoretical concepts to elementary particle systems. Prereq: PHY 714.

682 *Electric Phenomena in Gases.* (3)
Considers basic phenomena of the motion and interaction of electrons in gases including ion formation, mobility, diffusion, recombination, ion lifetimes, atomic and molecular excitations and energetics. Prereq: PHY 417, 554, or 510; MA 214.

706 *Methods of Mathematical Physics.* (3)
Solution of physical problems systematized according to the equations they satisfy. Variational methods, boundary conditions, eigenfunctions. Green's function, integral representations, approximation procedures, with applications from electromagnetic theory, quantum mechanics, acoustics. Prereq: Consent of instructor.

714 *Quantum Mechanics I.* (3)
A lecture course covering a brief review of the origin of quantum theories, mathematical techniques of quantum mechanics, the general aspects of wave mechanics and matrix mechanics, the uncertainty principle.

715 *Quantum Mechanics II.* (3)
A continuation of PHY 714 with extensions into special methods of solving problems in the theory, problems in more than one dimension, and the Pauli and Dirac theories of the electron. Prereq: PHY 714 or equivalent.

716 *Advanced Quantum Mechanics.* (3)
A continuation of PHY 715. Topics covered will include the relativistic wave equations, second quantization, quantum electrodynamics. Prereq: PHY 715.

755 *Topics in Chemical Physics* (subtitle required). (3)
An introduction to current research areas in chemical physics. Topics may include theory of atomic spectra, atomic and molecular processes, molecular theory, electrons and phonons in crystals, and optical properties of metals. Lectures, two or three hours. May be repeated to a total of 12 credits. Prereq: Consent of instructor. (Same as CHE 755.)

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Colloquium.* (1)
A weekly meeting of the staff and advanced students for the discussion of recent developments in physics and of work in progress in the department. Credit is given to those who satisfactorily present papers. May be repeated to a maximum of eight credits.

781 *Independent Work in Physics.* (3)
May be repeated three times for a total of 12 credits.

790 *Research in Physics.* (3)
May be repeated once for a total of six credits.

791 *Research in Physics.* (5)
May be repeated once for a total of 10 credits.

Astronomy

492 *Galactic Astronomy II.* (3)
Study of the content, organization, and evolution of our own and other galaxies. Prereq: AST 292 or consent of instructor.

495 *Elementary Astrophysics I.* (3)
Applications of the principles of elementary physics to the problems of stellar and planetary interiors. Prereq: PHY 232 or 251.

496 *Elementary Astrophysics II.* (3)
Applications of the principles of elementary physics to the problems of stellar atmospheres and interstellar matter. Prereq: AST 495.

591 *Cosmology I.* (3)
Consideration of observational basis of cosmology, cosmological theories of general relativity, the steady state theory, and kinematic relativity. Prereq: MA 213.

592 *Cosmology II.* (3)
A study of the universe as a complete physical unit. Consideration of the various relativistic models and theory evaluation in the light of current observations. Prereq: AST 591.

POLITICAL SCIENCE

Director of Graduate Study—Malcolm Jewell

Candidates for admission to the graduate program in political science must provide the information required by the Graduate School and must also submit their scores on the Graduate Record Examination Aptitude Test and at least two letters of recommendation from members of the political science faculty of the applicant's undergraduate college. Students who are deficient in political science background must take such additional courses as are required by the department, and Ph.D. candidates will need to take an introductory statistics course if they have not had one.

The Political Science Department offers both the M.A. and Ph.D. degrees. The M.A. degree may be earned under either of two plans: Plan A requires at least 24 hours of course work and a thesis; Plan B requires at least 30 semester hours of course work and an examination in three fields of political science, or in two fields of political science and one outside field. Under either plan, the student must take at least two-thirds of the

required semester hours in political science, and at least half of the political science work must be in courses open only to graduate students. A candidate for a master's degree has the option of passing a foreign language requirement or demonstrating his analytical skills in a formal paper.

The Ph.D. program is divided into a general phase and a specialized phase. Entering students spend their first year in the general phase, which includes proseminars in methodology and in at least four major fields of political science. (Students who have previously taken graduate work may be exempt from some of these proseminars.) At the end of his first year of graduate work, the student is evaluated by a departmental committee and may be required to do further work and take examinations in one or more of these fields.

During the specialized phase of his graduate program, the student's work is based on a program that he prepares for approval by his special committee. He takes more advanced work in political science. He may take a minor in another discipline; if he does not, he must still take at least nine semester hours of course work outside political science. The qualifying examination in political science consists of two parts: (1) the student must prepare a paper on his major field of specialization and be examined orally on this paper by his special committee, (2) the student must write a prospectus for his dissertation and be examined orally on this by his special committee. The student must then write a dissertation and defend it in a final oral examination.

Candidates for the Ph.D. in political science are required either to demonstrate a reading knowledge of two modern foreign languages or to meet that requirement in one modern foreign language and to demonstrate proficiency in an allied field contributing to research competence in political science. Research competence may be demonstrated by successfully completing at least six hours of course work in one or more allied fields, including statistics, computer sciences, and research methods in another discipline.

Additional details concerning departmental requirements may be secured from the chairman of the department.

501 *Latin American Relations.* (3)
The relations between the United States and the Latin American countries, with emphasis on the Monroe Doctrine and Pan-Americanism.

520 *Governments and Politics of South Asia.* (3)
A study of the political processes of India, Pakistan, and Ceylon.

521 *Government and Politics of Southeast Asia.* (3)
Study of the political processes, problems and behavior of the several states of Southeast Asia with emphasis on their chief determinants. The different patterns of political development will be examined.

530 *The Conduct of American Foreign Relations.* (3)
The formulation, conduct, and control of American foreign policy, basic principles, comparison with other countries. Prereq: PS 151.

531 *National Security Policy.* (3)
The organization and formulation of military policy; the theory and practice of deterrence; and the problems of disarmament and arms control. Prereq: PS 265.

540 *Rural Local Government.* (3)
A study of the organization and functioning of units of local government, with primary emphasis on government in Kentucky counties.

541 *The Foreign Policy of the Soviet Union.* (3)
A factual survey of the Soviet record in foreign affairs and an introduction to the guiding concepts and principal techniques of Soviet foreign policy; the role of Communist ideology. Prereq: PS 556 or consent of instructor.

550 *Comparative Political Parties.* (3)
A comparative cross-national study of the organization and function of political parties within their historical, socio-economic, cultural and political contexts.

551 *Comparative Foreign Policies.* (3)
This course will emphasize comparative analysis and the development of propositions to explain why states behave as they do. Lecture, three hours. Prereq: PS 265 or consent of instructor.

552 *Municipal Government.* (3)
An introductory course in the study of the structure and functions of modern city governments with some attention to other forms of local government.

553 *Urban Government and Politics.* (3)
An analysis of the formulation of public policy in small towns, middle-sized cities, and metropolitan areas. A theoretical model appropriate to all three settings will be formulated. The principal methods of studying community decision-making will be evaluated.

554 *Survey of Sub-Saharan Politics.* (3)
A survey of Sub-Saharan government and politics intended to give the student broad knowledge about the setting of African politics, precolonial African political systems, the political legacies of major European colonial powers, and problems of political development.

555 *Comparative Government—Parliamentary Democracies I.* (3)
A study of the governments of Britain and selected Commonwealth countries.

556 *Government and Politics of the Soviet Union.* (3)
Analysis of political development in the Soviet Union with emphasis on party-government relations, Communist ideology, and major approaches to the study of Soviet politics.

557 *Government and Politics in Sub-Saharan Africa.* (3)
The course will focus on the relationship between ideologies, institutions, and individuals in African political systems. Implications of these factors for African political behavior (domestic and international) will be examined. Prereq: PS 554.

559 *Constitutional Politics.* (3)
A survey of the interpretation of the Constitution is embodied in leading Supreme Court decisions. Concentrates upon (1) the substantive nature of constitutional doctrine, and (2) its relationship to political, economic and social trends.

561 *Civil Liberties.* (3)
A study of the philosophy and development of civil liberties in the U.S. Major concentration on the interpretation of constitutional guarantees by the Supreme Court.

563 *The American Judicial Process.* (3)
A study from the standpoint of the social sciences, of the judicial

process at the state and national levels, dealing with the organization of courts, the making of judicial decisions, and the exercising of judicial power.

565 *Comparative Government—Parliamentary Democracies II.* (3)
A study of the political systems of selected continental European countries with special attention to France and Germany.

566 *The United Nations.* (3)
Background of the United Nations. Problems and issues at the San Francisco Conference; analysis of charter and comparison with League of Nations Covenant; nature, structure, and functions.

568 *The Governments and Politics of Eastern Asia.* (3)
A comparative analysis of the modern political experiences of China and Japan, exploring their responses to the West, the development of differing political elites in each country, and contemporary problems of the Chinese Communist and Japanees politics.

569 *Latin American Government and Politics.* (3)
A study of contemporary Latin American political institutions and of the dynamics of the Latin American political process.

570 *American Political Parties.* (3)
An analysis of pressure groups; organization, methods, and functions of political parties in the United States.

571 *Early Political Theory.* (3)
The history of political theory from classical Greece to the Seventeenth Century with emphasis on the relationships between political and cultural change and the development of Western political thought.

572 *Modern Political Theory.* (3)
Political theory from the seventeenth century to the present with emphasis on the development of contemporary ideologies, the impact of industrialism and modern science, and the relationships between modern democracy and dictatorship.

573 *Public Opinion.* (3)
A study of the nature of public opinion and its influence on government, the role of the press, and other media, propaganda techniques, and voting behavior.

574 *Kentucky Government and Constitution.* (3)
An intensive study of government and administration in Kentucky. The course is intended primarily for teachers of civics in the secondary schools, and for teachers of government in colleges.

575 *American Political Thought.* (3)
Analysis of the development of American political thought especially as it relates to the role of government in the society.

576 *Legislative Process.* (3)
A study of Congress and the state legislatures, covering the legislative power structure, the selection of legislators and the roles they play, decision-making, and the relations of the legislative and executive branches.

577 *Introduction to Public Administration.* (3)
A study of theories of administration and organization, problems of line management and control, the principal staff and auxiliary functions and agencies, and the problem of administrative responsibilities under democratic government.

578 *Public Personnel Administration.* (3)
A study of the history of the merit system in public administration, recruitment, position classification, pay policies, employee relations and morale, tenure, promotion, transfer, and training in the public service; the role of the personnel officer.

579 *Administrative Agencies and Public Policy.* (3)
A study of the development, implementation and impact of government policies focusing particularly on the role of administrative agencies.

610 *Comparative Politics: Theory and Method.* (3)
A study of the evolution and development of comparative government and politics within the discipline with particular emphasis upon the formulation, application, and limitations of the theories, taxonomies and conceptual frameworks employed in comparative research.

630 *Proseminar in Non-Institutional Political Behavior.* (3)
Focuses on literature which has implications for most areas of political science research. Some major works in such fields as "macro-politics", "micro-politics", political socialization, biopolitics, political communications, and political games and coalitions will receive attention. It should be noted that these fields are neither mutually exclusive nor exhaustive of relevant concerns. Accordingly, there may be appropriate additions and deletions from time to time. Readings in a substantive field, such as voting behavior, are also examined as examples of the application of the above listed areas. Prereq: Consent of instructor.

654 *Proseminar in Judicial Process.* (3)
A thorough survey of the recent literature in the judicial process, focusing particularly on judicial recruitment, the relationship of the judiciary to other power centers, and the decision-making process of judges.

671 *Introduction to Methods and Methodology in Political Science I.* (3)
Analysis of the application of scientific method to the study of political phenomena; problems of concept formation; law, cause and explanation; theory construction; and the place of values in political inquiry.

672 *Introduction to Methods and Methodology in Political Science II.* (3)
Consideration of various modes of conducting research in political science. Focus on research techniques, applications, and theory building. Prereq: PS 671.

674 *Proseminar in Theories of International Politics.* (3)
A survey of the major theoretical approaches to the study of international systems and processes.

680 *Proseminar in Political Institutions and Process.* (3)
A thorough survey of recent literature on political institutions and the political process, including political parties and the legislative and executive process, at the national and sub-national levels.

690 *Contemporary Political Thought: Theoretical Foundations of Political Concepts and Issues in the Twentieth Century.* (3)
An examination of the history and nature of political theory, its relationship to and role in contemporary Political Science. Attention will be given to fundamental concepts and problems such as ideology, development, and pluralism. Relationships of thought and action, knowledge and power, especially in advanced industrial societies, will be studied.

751 *Seminar in Metropolitics.* (3)
Overview of research on Metropolitan Government and Politics; power structures, voting behavior and elections in Metropolitan areas; emphasis on student research in Metropolitan problems. Prereq: PS 553 or permission of instructor.

752 *Problems in State and Local Government.* (3)
An intensive study of the basic problems of state and local government. Special emphasis will be given to such current problems as are of fundamental importance. May be repeated once.

757 *Seminar in Comparative Democratic Political Systems.* (3)
An analysis of democratic political systems with emphasis upon the comparative approach as a method of political analysis. Prereq: PS 555 or consent of instructor.

758 *Seminar in Soviet Politics, Government and Foreign Policy.* (3)
Emphasis on methodology of various approaches to the study of the USSR, as well as substantive research. Subjects will alternate yearly between Soviet Politics and Soviet Foreign Policy. Prereq: PS 556 and PS 541 or permission of instructor.

759 *Seminar in African Political Systems.* (3)
The seminar will focus on dimensions of change in African political systems. Dimensions to be analyzed include ideology, economic development, socialization, authority, political recruitment and political party and interest group behavior.

761 *The Constitution and Civil Rights.* (3)
The American conception of civil rights as expounded by the Constitutional Fathers and as interpreted by the courts. The social, economic, and political aspects and implications of these rights.

762 *Seminar in Judicial Policy Making.* (3)
Formulation, development and implementation of Constitutional policy by the United States Supreme Court and other agencies. Primary focus on areas of contemporary importance (excluding Civil Rights). Cases and supporting materials. May be repeated once. Prereq: Permission of instructor.

763 *Seminar in Administrative Politics.* (3)
The processes by which administrative agencies establish and enforce policy are analyzed in terms of both legal and political considerations and behavioral theory. Prereq: Consent of instructor.

764 *Research in Judicial Behavior.* (3)
Participant research on selected substantive inquiries about judicial behavior; in depth examination of related theory, methods, and research strategies. Prereq: Permission of instructor.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Seminar in Contemporary Political Theory.* (3)
An intensive study of contemporary political ideologies. May be repeated once to a maximum of six credits.

772 *Advanced Problems in Research Methods.* (3)
A seminar in selected topics; the application of mathematical models and advanced statistical techniques to political science data.

773 *Asian Political Theory.* (3)
An examination of the major political thought patterns of ancient and contemporary Asia, with emphasis on India and China. Prereq: Consent of instructor.

776 *Seminar in Political Development.* (3)
Study of the processes of political change; concepts; approaches; and methodology; problems of political development; research problems in studying political development. The geographical focus of this course will vary from time to time. May be repeated once for a maximum of six credits. Prereq: Permission of instructor.

777 *Research Problems in International Relations.* (3)
This seminar focuses on research strategies that can be utilized in dealing with problems in International Relations. May be repeated once with consent of instructor. Prereq: PS 674 or consent of instructor.

778 *Seminar in Comparative Foreign Policies.* (3)
Emphasis upon internal and external factors impinging upon decision-making in the area of foreign policy. May be repeated once with consent of instructor.

779 *Voting Behavior.* (3)
A study of recent research in the field of voting behavior, including analysis of survey research techniques. Prereq: An undergraduate course in parties or public opinion or consent of instructor.

780 *Legislative Behavior.* (3)
A study of recent research in the legislative process emphasizing both the substantive and methodological aspects. Prereq: An upper division course in the legislative process or consent of instructor.

784 *Seminar in Political Socialization.* (3)
A course in contemporary research in the acquisition of political orientations. The focus is on children. The objects, agents, and consequences of political socialization are analyzed, as well as the processes by which it may proceed. Some attention is given to research design appropriate to the area. Prereq: Graduate student status.

785 *Psychological Bases of Political Behavior.* (3)
The role of psychological constructs and theory in political explanation; measurement and inference problems; critical analysis of research concerned with such topics as the effect of psychological mechanisms on loyalty, quiescence, participation, political change and revolution. Prereq: PS 671 and PS 672 or consent of instructor.

790 *Special Problems in Public Administration.* (3)
A research course in selected problems of public administration. The problems will be chosen in accordance with the needs and desires of students registered for the course.

791 *The Organization as a Political System.* (3)
This course involves an examination of theoretical concepts pertaining to the design of organizational structure and the prediction and control of administrative behavior, including detailed analysis of the models evolving from traditional, behavioral and decision-making approaches to the study of administrative organization. Major emphasis will be placed on such concepts as those relative to power and its allocations, leadership, representation and policy formation. Student work will include participation in field research projects as well as extensive reading in the field of organization theory. Prereq: PS 577 or equivalent.

795 *Special Problems in Political Science.* (3)
May be repeated once to a maximum of six credits.

PSYCHOLOGY

Director of Graduate Study—Robert A. Baker

The major goal of the doctoral program in psychology is to prepare the student for a career in teaching and research in the fields of clinical, experimental, or social psychology. A master's degree in general psychology is also available.

The program in clinical psychology provides academic courses, practica, and an internship which permit the student to combine his teaching and research activities with a clinical career in the mental health field. Current areas of research interest include psychotherapy, behavior therapy, psychopathology, projective techniques, and experimental personality. Clinical experience is available at such facilities as the University of Kentucky Medical Center, the U.S. Veterans Administration Hospital, the National Institute of Mental Health Clinical Research Center, and various nearby state institutions.

The program in clinical psychology provides academic courses, practica, and an internship which permit the student to combine his teaching and research activities with a clinical career in the mental health field. Current areas of research interest include psychotherapy, behavior therapy, psychopathology, projective techniques, and experimental personality. Clinical experience is available at such facilities as the University of Kentucky Medical Center, the U.S. Veterans Administration Hospital, the National Institute of Mental Health Clinical Research Center, and various nearby state institutions.

The program in experimental psychology provides academic courses and research experience in any of the following areas of concentration: learning, motivation, perception, developmental psychology, cognitive processes, and social psychology. Current areas of research interest include verbal learning, psycholinguistics, instrumental learning, classical conditioning, visual perception, discrimination learning in children, mathematical spychology, and social leraning. Laboratories for the study of human and animal

behavior with supporting shop and computer facilities are available.

The program in social psychology is designed to provide intensive experience in research with members of the social psychology faculty, with the aim of developing in the student a strong theoretical and research competence with complex social phenomena. Traditions of both experimental laboratory research and naturalistic study are utilized; emphases include theoretical and applied significance of research. Within broad limits set by the program, any given student's course of study is designed to fit his particular needs and interests. Course work in related behavioral sciences (for example, sociology, anthropology) is encouraged.

During the first year of the doctoral program, all students gain experience in the major content areas of psychology and in psychological statistics. Thereafter, the student and his adviser construct a program of study consistent with the academic interests and professional goals of the student. This program of study includes a minor in some field outside the Department of Psychology. A reading knowledge of one modern foreign language is required for Ph.D. candidates.

The M.A. or M.S. degree is awarded under Plan A only.

The minimum departmental standards for admission to graduate work in psychology include an undergraduate department over-all average of B or better, a satisfactory score on the verbal and quantitative aptitude tests of the Graduate Record Examination and three letters of recommendation. For additional information concerning the program in psychology and such matters as financial support, contact the Chairman, Department of Psychology.

501 *Personality.* (3)
An examination of several prominent personality theories in terms of the contexts in which they were originated, their influence upon contemporary psychological thought, and their present applications. Prereq: PSY 104 and 106, or PSY 210; permission of instructor required for graduate students.

505 *Human Senses and Perception.* (4)
A study of the stimulus, receptor and organism variables that underlie perceptual experience and perceptually based behavior with emphasis upon theory and experimental method. Prereq: PSY 104 and 106, or 210.

507 *Psychology of Learning.* (4)
Fundamental principles and findings from laboratory investigations of classical, instrumental, and verbal learning. Prereq: PSY 104 and 106, or 210 and 336, or equivalent.

509 *Animal Behavior.* (4)
Experimental techniques used in investigations of animal behavior. Topics include: heredity and environment, activity, instinct, motivation, learning, sensory discrimination, and personality in subhuman species. Prereq: PSY 104 and 106, or 210.

511 *Experimental Child Study.* (3)
An advanced course in the psychology of the normal child. The scientific background of experimental and observational method. Opportunities are provided to work with children. Prereq: PSY 200.

512 *Physiological Psychology.* (3)
An intensive study of physiological bases of behavior. Principal concerns are the chemical and neural substrates of processes such as sensation, perception, learning, memory, and behavior disorders. Prereq: PSY 336 or equivalent, and PSY 330.

518 *Mental Hygiene.* (3)
A general orientation to the subject of mental hygiene, its historical development, its scope and relation to various sciences. The individual and cultural determinants of behavior will be discussed. Prereq: PSY 104 and 106, or 210, or EDP 202. Not open to students who have had CH 520. (Same as EDP 518.)

521 *Abnormal Psychology.* (3)
A study of the major mental disorders, especially the psychoneuroses and the psychoses, and the biological, psychological, and sociological factors which contribute to their causation. Prereq: PSY 104 and 106, or 210.

522 *Counseling Psychology.* (3)
The methods of dealing with problems in counseling psychology in college and high school, including the problems of selection, classification, grading, personal adjustment, motivation, academic, vocational and personal counseling. Prereq: PSY 520 or 521.

530 *Biology of Motivation.* (2)
Fundamental activating and goal-seeking processes of living organisms, biologically considered, including experimental and theoretical studies on such topics as instincts, drives, motives, and taste preferences. Prereq: PSY 104 and 106, or 210.

531 *Genetic Psychology.* (3)
Influence of hereditary factors in the development of human behavior, a critical survey of the evidence regarding psychological traits such as musical and other special abilities, intelligence, and interests. Prereq: PSY 104 and 106, or 210.

535 *Psychological Testing.* (3)
A general orientation to the field of psychological testing. Introduction to the principles and methods of psychological testing, and a survey of the various kinds of psychological tests. Prereq: PSY 104 and 106, or 210, and 201.

540 *Introduction to Industrial Psychology.* (3)
Review of tl.e functions and findings of psychology applicable to business and industry. Topics covered are: employment procedures, personnel testing, attitude analysis, motivation, and morale. Prereq: PSY 104 and 106, or 210.

541 *Psychology of Industrial Personnel Procedure.* (3)
A practical course for those preparing for personnel administration and for psychology in industry and business. A study is made of the theory and methods of position classification, job analysis, job evaluation, merit rating, supervisor selection and training, and collective bargaining. Prereq: PSY 104 and 106, or 210.

544 *Social Psychology.* (3)
Theoretical and empirical analysis of individual behavior in the social setting with particular emphasis on social learning, motivation, and the measurement, formation, and changing of social attitudes. Prereq: PSY 104 and 106, or 210; SOC 101. (Same as SOC 544.)

545 *Small Group Behavior.* (3)
Detailed theoretical and empirical analysis of small groups. The course systematically covers properties of groups and how these properties have been manipulated experimentally. Prereq: PSY 104 and 106, or 210, and one introductory course in Sociology.

570 *Verbal Behavior.* (3)
A broad coverage of several basic areas of human verbal behavior with particular emphasis on rote learning, memory and retention, associative processes, and psycholinguistics. Prereq: PSY 330 or 507.

579 *Stuttering.* (3)
The nature, causes and treatment of stuttering, with emphasis on therapeutic procedures. Prereq: EDS 577. (Same as EDS 579.)

601 *Theories of Learning.* (3)
A systematic presentation and critical analysis of the major theories of learning. Prereq: PSY 505, 507 or equivalent and 600.

602 *Theories of Personality.* (3)
An examination of current theories of personality. The relation of these theories to psychological research will be examined. Prereq: PSY 505, 507 or equivalent, and 600.

603 *Psychopathology.* (3)
An examination of the descriptive, theoretical, and research material relevant to the major classes of disturbed behavior. Special attention is devoted to the stylistic features of neurotic and psychotic communication and behavior. Prereq: Enrollment in the graduate program in psychology.

610 *Psychometrics.* (3)
Analysis and interpretation of human measurements. The course deals with the computation and interpretation of simple, partial, and multiple correlations, regression equations, and reliability of measures. Prereq: A course in statistics.

611 *Psychological Research.* (3)
A study of the application of experimental methods in the major areas of psychology, including sensation and perception, learning, motivation, emotion, and personality. The design of research studies will be emphasized. Prereq: PSY 610.

616 *Research Design in Clinical Psychology.* (3)
Concentrates on current methodologies utilized in clinical research and on the application of sophisticated techniques to traditional research problems. Students are expected to master critical skills for the evaluation of research designs and are encouraged to explore creative approaches to research in important clinical areas. Prereq: Admission to graduate program.

617 *Experimental Approaches to Personality.* (3)
A critical evaluation of experimental studies in selected areas in personality. Each student is required to design and conduct an empirical investigation of a specific problem. Two hours lecture, three hours laboratory per week. Prereq: Completion of one year of graduate program in psychology or permission of instructor.

618 *Experimental Approaches to Psychopathology.* (3)
A critical evaluation of experimental studies in selected areas of psychopathology. Each student is required to design and conduct an empirical investigation of a specific problem. Two class hours, three laboratory hours. Prereq: Completion of one year of graduate program in psychology, or permission of instructor.

620 *Proseminar in Systematic Psychology.* (2)
An examination of some works of important theorists in psychology of the last 40 years. Prereq: PSY 507 or equivalent.

621 *Proseminar in Learning.* (2)
An intensive treatment of concepts, methodology, and current developments in the field of learning. Prereq: PSY 507 or equivalent.

622 *Proseminar in Personality.* (2)
An intensive treatment of theories, methods of investigation and current developments in the area of personality. Prereq: PSY 501 or its equivalent.

623 *Proseminar in Sensation and Perception.* (2)
An intensive examination of the facts, methods and concepts involved in the study of sensory and perceptual processes. Prereq: Consent of instructor.

624 *Proseminar in Social Psychology.* (2)
An intensive examination of the methods and data of social psychology with emphasis on social attitudes. Prereq: PSY 544 or its equivalent.

625 *Proseminar in Developmental Psychology.* (2)
An intensive treatment of theoretical and experimental literature, both classical and contemporary, in developmental psychology. Prereq: PSY 200 or equivalent.

627 *Proseminar in Physiological Psychology.* (2)
An intensive examination of theories, methods of investigation, and current developments in the field of physiological psychology. Prereq: Graduate student or permission of instructor. (Same as PGY 627.)

629 *Introduction to Clinical Psychology.* (1)
Offered conjointly by the clinical faculty; covers the broad perspectives of clinical psychology, methods, history, ethics, and professional issues. Prereq: Enrollment in the graduate program in psychology.

630 *Clinical Methodology I.* (2)
An intensive survey and evaluation of tests of intelligence and objective methods of assessment of normal and abnormal personality. Special emphasis is given to major theoretical issues and relevant quantitative methods. Prereq: PSY 336, 501, 521, 535, or equivalent, and enrollment in graduate program in psychology.

631 *Practicum in Clinical Methodology I.* (2)
Clinical interviewing and practice in writing reports on behavioral observations, content of verbalization, and case history data. Practice in administration, scoring and interpretation of intelligence tests and objective personality tests. Four hours laboratory per week. Prereq: PSY 501, 521, and 535, or the equivalent, and enrollment in the graduate program in psychology. PSY 630 to be taken as co- or prerequisite.

632 *Clinical Methodology II.* (2)
Theoretical issues, quantitative methods and research findings on the projective methods of assessment of normal and abnormal personality. Prereq: PSY 630, and enrollment in graduate program in psychology.

633 *Practicum in Clinical Methodology II.* (2)
Practice in the administration and scoring of projective techniques and batteries of clinical tests. Four hours of laboratory per week. Prereq: PSY 630 and 631, and enrollment in graduate program in psychology. PSY 632 to be taken as co- or prerequisite.

634 *Practicum in Clinical Psychology III.* (3)
Administration, scoring, and interpretation of projective techniques and personality inventories, individually administered. Nine hours laboratory per week. Prereq: PSY 632 and 633, and enrollment in graduate program in clinical psychology.

635 *Practicum in Clinical Psychology IV.* (3)
Administration, scoring, and interpretation of batteries of clinical tests, with emphasis on organization of all relevant behavioral and test data, and professional report writing. Students will be assigned to local clinical installations. Nine hours lab per week. Prereq: PSY 634, and enrollment in graduate program in clinical psychology.

636 *Systems of Psychotherapy.* (3)
An intensive examination of the major theoretical and research approaches to therapeutic behavior change. Prereq: PSY 632 and 633, and enrollment in graduate program in clinical psychology.

637 *Practicum in Psychotherapy and Behavior Change.* (1-3)
Supervised experience in the techniques of psychotherapy with adults, children and groups, and in community mental health approaches. Laboratory, two to six hours. Each clinical student must have a cumulative minimum of three different supervisors. May be repeated to a maximum of six credits. Prereq: PSY 636 and enrollment in graduate program in clinical psychology.

638 *Clinical Child Psychology.* (3)
Theory and research relevant to behavior problems of children; supervised experience in the diagnosis and therapy of children. Two hours lecture, two hours laboratory per week. Prereq: PSY 636 and 637 and enrollment in graduate program in clinical psychology.

640 *Practice in Testing: Intelligence Tests.* (4)
This course provides theoretical material and advanced laboratory practice in the measurement of intelligence by individual techniques. Lecture, three hours; laboratory, two hours. Prereq: PSY 535 or EDP 653 or equivalent and consent of instructor. (Same as EDP 640.)

641 *Psychological Measuring Instruments.* (3)
A study is made of a wide variety of psychological tests including group intelligence tests, personality and interest inventories, area aptitude tests, and special aptitude tests. Prereq: PSY 201 or EDP 522 and 657. (Same as EDP 641.)

647 *Disorders of Language.* (3)
Emphasis on adult aphasia and developmental language disabilities, theories, research findings, assessment procedures, and therapy approaches. (Same as EDS 647.)

650 *Diagnosis and Counseling in Counseling Psychology.* (3)
An advanced course in diagnosis and application of theories, techniques

and tools in counseling psychology. Prereq: A graduate major in psychology or Educational Psychology and Counseling and consent of instructor. (Same as EDP 650.)

663 *Practicum in Industrial Psychology.* (3)
Nine hours of supervised work each week. May be repeated to a maximum of 12 credits.

700 *Seminar in Behavior Modification.* (3)
Considers the general behavioristic orientation, history, theoretical foundations, research investigations and case study material related to clinical approaches to behavior modification. Prereq: Enrollment in the graduate program in clinical psychology and consent of instructor.

701 *Seminar in Clinical Child Psychology.* (3)
Theory and research relevant to behavior problems of children. Prereq: Enrollment in graduate program and consent of instructor.

702 *Seminar in Community Mental Health.* (3)
Considers psychological intervention and the application of psychological principles to community problems in terms of problem definition, program development, program funding, assessment and evaluation. Emphasis is on the application of research findings to community problems in ways which permit adequate evaluation of program's effectiveness. Prereq: Enrollment in the graduate program and consent of instructor.

703 *Seminar in Group Therapy.* (3)
An examination of the major theoretical and research approaches to individual behavior change within a group. Prereq: Enrollment in the graduate program in clinical psychology and consent of the instructor.

704 *Seminar in Hypnosis.* (3)
A survey of the facts, theories, and therapeutic applications of hypnosis. Prereq: Enrollment in the graduate program in clinical psychology and consent of the instructor.

705 *Research in Psychotherapy and Behavior Change.* (3)
A critical examination of experimental studies in selected areas of psychotherapy and behavior change. Prereq: Enrollment in the graduate program in clinical psychology and consent of the instructor.

710 *Seminar in Clinical Psychology.* (3)
A selected topics course designed to cover content areas which are not being met by the current faculty; may be taught by persons with special qualifications from the community or by existing faculty exploring new areas. The topics, which may be offered as the need arises, may include on a semester basis, mental retardation, intensive psychoanalytic theory, psychopharmacology, etc. Prereq: Enrollment in graduate program and consent of instructor.

767 *Seminar in Physiological Psychology.* (3)
A study of selected topics in physiological psychology with emphasis on recent research and theory. May be repeated to a maximum of nine credit hours. (Same as PGY 767.) Prereq: Consent of instructor. This course may be elected to fulfill requirements in the Psychology and Physiology graduate programs.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1 to 6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1 to 12 credits equivalence.)

770 *Seminar in Psychology I.* (0)
One two-hour discussion each week of some current systematic concepts and of research underway by graduate students and members of the staff. May be repeated indefinitely.

771 *Seminar in Psychology II.* (0)
One two-hour discussion each week of some current systematic concepts and of research underway by a graduate student or staff member. For Ph.D. candidates. May be repeated indefinitely.

772 *Seminar in Learning.* (3)
The study of selected topics in the learning area with emphasis on the recent experimental and theoretical literature. May be repeated to a maximum of six credits. Prereq: PSY 507 and consent of instructor.

774 *Seminar in Verbal Behavior.* (3)
The study of selected topics in the area of verbal behavior with emphasis on recent research and theory. May be repeated to a maximum of six credits. Prereq: Consent of instructor.

775 *Advanced Seminar in Perception.* (3)
A study of the major theoretical approaches to perception and an examination of critical experiments and well established phenomena in the field of perception from the vantagepoint of these theories. Prereq: PSY 623 or equivalent.

776 *Seminar in Animal Motivation.* (3)
A variety of topics in motivation and unlearned behavioral determinants in sub-human species will be treated intensively in comprehensive reports based on the research literature and related to such problems as instinct, drive theory, activation, stress, work decrement, and neural components. Human implications may also be considered. Prereq: Consent of instructor.

777 *Seminar in Mathematical Psychology.* (3)
Topics in psychology which are receiving detailed mathematical analysis. Examples are mathematical learning theory, decision and judgment processes, advanced application of probability and statistics in psychological theory. Prereq: PSY 610.

778 *Seminar in Child Psychology.* (3)
Topics in psychological development of the individual, e.g., learning, sex typing, identification, emotional problems, mental retardation, theories of infant care, achievement motivation, etc. Prereq: PSY 200 or equivalent.

779 *Seminar in Social Psychology.* (3)
Each semester some topic in the field of social psychology, such as attitudes and beliefs, structure and function of social groups, social determinants of behavior, leadership, and morale will be studied intensively. May be repeated to a maximum of six credits. Prereq: PSY 544; SOC 101. (Same as SOC 779.)

780 *Problems in Psychology.* (2)
Shorter research problems are registered under this number. A minimum of six hours a week is required in consultation with the instructor. May be repeated to a maximum of 12 credits.

781 *Research Participation.* (1)
Emphasis on the team approach to research. Designed primarily for first year graduate students, but may be repeated to a maximum of four credits. Laboratory, two to four hours per week. Prereq: Enrollment in the graduate program in psychology.

790 *Research in Psychology.* (3)
Research or thesis work may be registered under this number. A minimum of nine hours a week is required on research conducted in consultation with the instructor. May be repeated to a maximum of 12 credits.

SLAVIC AND ORIENTAL LANGUAGES AND LITERATURES

At present no graduate majors are offered in Slavic and Oriental Languages and Literatures.

RUSSIAN

461 *Advanced Readings in Russian Literature* (3)
Based on the reading of the 19th Century and 20th Century short stories and plays by Russian masters. Intended for students desiring to combine extensive reading with oral and written expression. Particular emphasis will be placed on advanced grammar and syntax. Prereq: SO 367, 368. (Recommended.)

462 *Advanced Readings in Russian Literature.* (3)
A continuation of SO 461. Prereq: SO 461 or equivalent. (Recommended.)

463 *Russian Drama* (in Russian). (3)
A survey of the growth and development of the Russian drama, with special emphasis on the outstanding dramatists of the 18th, 19th, and the beginning of the 20th centuries. Prereq: SO 367 or permission of instructor. (Recommended.)

464 *Survey of Russian Literature to* 1800 (in Russian). (3)
An introduction to the literature of Russia from earliest times to Pushkin. The emphasis will be on 18th century authors. Prereq: SO 367, 368, or consent of instructor. (Required.)

563 *Tolstoy and Dostoevsky* (in English). (3)
A study of the period, significant works, influence at home and abroad. Lectures, oral and written reports, class discussions. Required of majors in addition to 24 hours of courses in Russian. (Open to non-majors.)

HEBREW

401 *Hebrew Grammar and Syntax I.* (3)
Intensive coverage of Hebrew grammar and syntax designed to prepare upper level and graduate students to *read* Hebrew for their particular needs and programs. Prereq: A minimum of two years' exposure to another foreign language, either modern, classical, or non-Western.

402 *Hebrew Grammar and Syntax II.* (3)
Continuation of SO 401. Prereq: SO 401.

576,577 *Studies in Semitic Philology.* (3 ea.)
Courses to meet the needs of students in various areas of Semitic Philology, e.g., in literature, in civilization, in linguistics, etc. Prereq: Consent of instructor.

ARABIC

440 *Arabic Grammar and Syntax I.* (3)
Intensive coverage of Arabic grammar and syntax designed to prepare upper-level and graduate students to read Arabic for their particular needs and programs. Prereq: A minimum of two years of exposure to another foreign language, either modern, classical or non-Western.

441 *Arabic Grammar and Syntax II.* (3)
A continuation of SO 440. Prereq: SO 440.

442 *Arabic Reading I.* (3)
Readings in selected Arabic authors. Prereq: SO 441.

443 *Arabic Reading II.* (3)
Readings in selected Arabic authors. Prereq: SO 442.

OTHER DEPARTMENTAL OFFERINGS

544 *The Writings of the Muslim Mystics.* (3)
The origin and development of Muslim mysticism. From asceticism to institutionalism. Prereq: Reading knowledge of French or German or Spanish.

555 *Arabic Literature of the Iberian Peninsula.* (3)
A survey of the major Arabic authors of Islamic Spain, in translation. Prereq: Reading knowledge of French or German or Spanish.

556 *Arabic and Persian Masterpieces.* (3)
A study of the main authors and genres of Medieval Arabic and Persian literature, in translation. Prereq: Reading knowledge of a modern Western language or of Arabic or Persian.

SOCIOLOGY

Director of Graduate Study—John O'Donnell

Graduates from accredited colleges who meet the requirements of the Graduate Program in Sociology and the Graduate School may work toward the following advanced degrees with major work in sociology; Master of Arts, Master of Science in Agriculture, and Doctor of Philosophy. Only one modern foreign language is required for the Ph.D. degree in sociology.

Graduate students pursuing the Ph.D. degree are expected to choose a specialty area within sociology and to select a minor area outside the department. Areas of specialization in sociology currently stressed are: community and social organization; deviant behavior; family; medical sociology; population; social change and development; and social institutions, which includes study of two or more sub-areas such as sociology of religion, political sociology, and economic and industrial sociology. While core seminars in these specialties are offered, individual program flexibility is maintained so that a student may develop his own interests.

To aid in financing graduate education, a considerable number of assistantships, fellowships and other stipends are available to qualified students.

Sociologists at the University of Kentucky carry on a substantial variety of research projects, consultative activities, extension education programs and community services. Through affiliations with nearby institutions, specialized experience and training is available to graduate students.

Research opportunities within the prisons and other correctional institutions of the state may be arranged. Experience is available in rural sociological research at the Agricultural Experiment Station. Opportunity for applied sociology experience in the Cooperative Extension Service is also available.

The department participates in the University's Center for Developmental Change, which is devoted to interdisciplinary research and training in planned change. The Department of Behavioral Science, College of Medicine, includes sociologists on its staff and conducts research and other activities of a sociological nature. Sociology graduate students with appropriate interests and training are eligible for assistanships and other appointments in these fields.

Department standards for admission to graduate work in sociology are similar to those of the Graduate School, including satisfactory scores on the verbal and quantitative tests of the Graduate Record Examination. Three letters of recommendation, a statement of educational and career goals, and a special departmental application are required. For additional information on departmental requirements and opportunities for financial assistance, write to the Director of Graduate Study in Sociology.

409 *The Family.* (3)
A study of the institutions of marriage and the family and an analysis of the various factors and forces at work in our time which are

affecting the individual marital relationships. Prereq: SOC 101 or consent of instructor.

413 *Community Analysis.* (3)
A study of communal structure and processes with special emphasis on strategies of field investigation of particular communities. Prereq: SOC 101 or equivalent or consent of instructor. (Same as HE 575; same as SOC 413 in Agriculture.)

418 *Social Change.* (3)
A sociological analysis of the sources, processes and consequences of social change. Prereq: SOC 101.

436 *Sociology of Deviant Behavior.* (3)
A systematic examination of the various types of social disorganization with particular emphasis upon the sociological explanation of underlying factors. Prereq: SOC 101 or consent of instructor.

437 *Criminology.* (3)
A study of general conditions as to crime and delinquency, of measures of punishment and reform of offenders, of criminal procedure and its possible reform, and of measures for the prevention of crime. Prereq: SOC 101 or consent of instructor.

441 *Group Organization and Leadership.* (3)
A study of the structure and dynamics of organized groups; leadership, membership participation, and the processes of problem-solving and group development. Prereq: SOC 101 or consent of instructor. (Same as SOC 441 in Agriculture.)

501 *Population Analysis.* (3)
Distribution and composition, fertility and mortality, migration, ecological relationships and growth of population. Prereq: SOC 101 or consent of instructor.

502 *Methods of Demographic Analysis.* (3)
Application of statistical techniques employed in the analysis of census and vital statistics data, including methods of population standardization, life table construction, and preparation of population estimates. Prereq or concur: SOC 501 and one of the following introductory statistical courses: ECO 291, or AEC 530; SOC 101.

503 *Social Classes.* (3)
A systematic treatment of the factors underlying social differentiation and stratification, with particular attention to class and caste; social mobility in American society. Prereq: SOC 101 or consent of instructor.

510 *The Family.* (3)
A study of the various social situations in which children grow to early adolescence with emphasis on the primary group relationships in home, neighborhood, play group, and school. Prereq: SOC 409 or permission of instructor; SOC 101.

515 *Diffusion of Technology in Modern Society.* (3)
A study of the personality, social structure and change agent factors in the spread of new techniques among groups and individuals in modern society. Prereq: Either GEN 102 or SOC 101, 153. (Same as SOC 515 in Agriculture.)

517 *Rural Sociology.* (3)
Systematic study of the structure and function of family, informal and locality groups, social strata, religious, educational, political and occupational groups in rural society. Prereq: Either GEN 102 or SOC 101. (Same as SOC 517 in Agriculture.)

519 *Sociology of Urban Life.* (3)
This course is a study of the sociology of city life. The major emphasis is upon the ecological and social characteristics of urban life in contrast to rural community life. Prereq: SOC 101 or consent of instructor.

521 *Industrial Sociology.* (3)
A sociological analysis of the division of labor, the characteristics of occupational groupings; principal socio-economic movements, and group relationships in modern industry. Prereq: SOC 101 or consent of instructor.

522 *Sociology of Complex Organizations.* (3)
An intensive study of intra- and inter-organizational structures and processes. Special emphasis is given to emergence, maintenance, and change of bureaucratic and non-bureaucratic organizations and the impact of organizations on individuals. Prereq: six hours of Sociology, or consent of instructor; SOC 101.

523 *Social Determinants of Economic Behavior.* (3)
A study of the sociology of consumption, the effect of social values upon business and employee behavior, and the socio-economic implications of welfare legislation. Prereq: SOC 101 or consent of instructor. (Same as ECO 523.)

525 *Religion and Culture.* (3)
An analysis of the structure, function, and process of religion, using the development of the Hebrew and Christian religions to show social origins of the two faiths and the effect of cultural change on their growth. Prereq: SOC 101 or consent of instructor.

526 *Culture and Personality.* (3)
The cultural basis of personality. Personal character considered as the result of culturally fostered patterns. The ideal personality in several selected societies. Prereq: SOC 101. (Same as ANT 526.)

527 *Society and Health.* (3)
The study of human behavior in illness and of medicine as a complex form of social organization in perspective of historical, cross-cultural and contemporary analysis. This course is designed primarily for students preparing for careers in an allied health science or profession. Prereq: SOC 101. (Same as BSC 527.)

529 *Political Sociology.* (3)
A study of the sociological aspects of political systems, movements, and ideologies. Special attention is given to comparative analysis of parties, pressure groups, voting patterns, elites, bureaucracy, political socialization, mass politics, and the role of intellectuals. Prereq: six hours of Sociology or consent of instructor; SOC 101.

531 *Sociological Analysis of American Society.* (3)
A study of the contemporary U.S.A. with emphasis upon the changing relations among various aspects of American society and culture. Prereq: SOC 101 or consent of instructor.

532 *Intergroup Relations.* (3)
Analysis of relationships between groups which differ in religious, ethnic, or sociocultural backgrounds; the development of educational and social techniques for reduction of tensions. May be repeated once to a maximum of six credits. Prereq: SOC 101. (Same as EDF 532.)

533 *Social Anthropology.* (3)
History and theory of social anthropology with special emphasis on the comparative approach to analysis of structure, function, and change in social and cultural systems. Prereq: SOC 101; consent of instructor. (Same as ANT 533.)

534 *The Southern Appalachians: A Sociological Interpretation.* (3)
A sociological interpretation of the Southern Appalachians, emphasizing the great diversity—social, cultural, economic—in the various parts of this area by study of the major institutions, value orientations, and social and cultural changes affecting both the whole area and its sections. Prereq: SOC 101. (Same as ANT 534, and SOC 534 in College of Agriculture.)

538 *Juvenile Delinquency.* (3)
Study of the extent, ecological distribution, and cause of delinquency in contemporary American society, including a critical examination of trends and methods of treatment. Prereq: SOC 101 or consent of instructor.

540 *Collective Behavior and Social Movements.* (3)
An analysis of mass movements and collective behavior, including fads, fashions, crowd phenomena, panic situations, riots. Generalizations concerning the structure, tactics, ideology, and leadership of social movements will be considered. Prereq: SOC 101 and 201.

542 *Human Relations in Administration.* (3)
Analysis of the role of social structure, leadership, authority, power, and psychological stress in the administration of large-scale organizations in the United States. Prereq: SOC 101 or consent of instructor.

544 *Social Psychology.* (3)
Theoretical and empirical analysis of individual behavior in the social setting with particular emphasis on social learning, motivation, and the measurement, formation, and changing of social attitudes. Prereq: PSY 104 and 106 or 210; SOC 101. (Same as PSY 544.)

546 *Social Factors in Mental Health.* (3)
The significance of social and cultural factors in the recognition, course, and management of mental health problems; social organization of the mental hospital and cultural alternatives to hospitalization. Prereq: Permission of instructor; SOC 101. Offered every other year. (Same as BSC 546.)

547 *The Sociology of Aging.* (3)
Analysis of demographic and institutional patterns, social roles, psychological and physiological changes, and rehabilitative and educational programs associated with aging. Prereq: SOC 101 or consent of instructor.

549 *Sociological Aspects of Mass Communication.* (3)
The relationship between the organization of modern society and its communication media. Special emphasis is given the way in which cultural processes and social change have an impact upon the mass media, and upon the way in which the mass media influence cultural processes and social change. The social-psychological bases of communication are studied within a context of theory and research. Prereq: SOC 101. (Same as EDC 549.)

551 *Principles of Sociology.* (3)
A survey of the basic elements of culture, collective behavior, communities, social institutions, and social change. Basic concepts required for the analysis of sociological data are systematically considered. Prereq: SOC 101 or consent of instructor.

561 *Comparative Sociology.* (3)
Two or more societies are analyzed and compared sociologically. The specific societies considered may vary from time to time; for example, Soviet and American society; the middle Eastern countries; Latin American societies, etc. Prereq: SOC 101 or consent of instructor.

565 *Special Problems in Sociology.* (1-3)
Supervised individual study in selected sub-fields of sociology, population, community, organizations, social attitudes, deviant behavior, and social change are among the fields available for investigation. Prereq: SOC 101. (Same as SOC 565 in Agriculture.)

571 *Contemporary Sociology.* (3)
A survey of the current state and organization of sociology as indicated by consideration of the main fields of sociology and developments in each. Most of the staff participate as special lecturers in their specialty. Prereq: Major or minor in SOC and nine hours in SOC; SOC 101.

581 *Techniques of Social Investigation.* (3)
A study of the practical applications of sociology in organizing, conducting, and interpreting social surveys and other forms of sociological research. Prereq: SOC 101 and an introductory course in statistics.

615 *Rural Urban Relations.* (3)
Interdependence of city and country; solidarity and antagonistic relationships of city and country; the process of urbanization; problems of rural adjustment to urban influences. Prereq: SOC 101. (Same as SOC 615 in College of Agriculture.)

618 *Theories of Social Change.* (3)
The study of theories of change in social units with emphasis on models of social structure and social change and on methodological problems of studying change with historical, evolutionary, conflict, functional, and other approaches. Prereq: Consent of instructor.

625 *Sociology of Religion.* (3)
Critical study of reciprocal relation of religion and culture, the function of religion in society, social sources of religious concepts, religious differentiation and institutionalization, the problem of church and state. Prereq: SOC 525 or consent of instructor.

632 *Minority Groups.* (3)
A sociological scheme of analysis is applied to the special problems of adjustment arising from ethnic group relations and culture contacts. Prereq: SOC 101.

636 *Theory and Research in Deviant Behavior.* (3)
Use of conceptual tools in the analysis of significant sociological problems, such as relationships between individual and society, conformity, stratification, and conflict through readings and projects. Required for graduate study of deviant behavior. Prereq: Graduate standing; SOC 536 or equivalent.

651 *Systematic Sociology.* (3)
An intensive study of certain selected sociological theorists such as Weber, Durkheim, Simmel, Pareto, and others. Prereq: SOC 101.

661 *Educational Sociology.* (3)
A course in the sociological foundations of education. Prereq: SOC 101. (Same as EDF 661.)

670 *Seminar on Role Theory.* (3)
An exploration of differences and similarities in the utilization of the concept of role in Sociology, Anthropology and Psychology. Emphasis is placed on the potentiality of role as a unifying concept in the behavioral sciences. Prereq: Consent of instructor; SOC 101. (Same as BSC 670 and ANT 670.)

671 *Seminar in Contemporary Sociology.* (0)
Each member of the Department of Sociology presents a summary of his past and present research and his current interests. The purpose is to acquaint the student with the wide range of interests, projects and personnel in his graduate department. One hour per week. Prereq: SOC 101.

681 *Research Design and Analysis.* (3)
Problem definition and delimitation, design appropriate to problem and data, and selection of appropriate analysis techniques; critical examination of representative research studies and students' designs. Prereq: Elementary Statistics and SOC 581 or equivalent; SOC 101.

685 *Integration of Theory and Research.* (3)
Systematic analysis of problems related to the verification of sociological theory through empirical research. Prereq: SOC 681; SOC 101.

690 *Community Action Analysis.* (3)
The structure and dynamics of complex, collective actions are analyzed in terms of their social and cultural characteristics and their temporal patterns. Prereq: SOC 101.

702 *Seminar in Social Demography.* (3)
A seminar designed to explore the relations between sociology and demography. Emphasis is given to the influence of social factors on demographic behavior and to the utilization of population data and demographic techniques in the investigation of sociological problems. Prereq: SOC 501 or equivalent; SOC 101.

720 *Seminar in Community Theories.* (3)
An intensive examination of selected theories and writings relevant to an understanding of territorial communities. Includes a study of the writings of Durkheim, Park, Redfield, Warner, and others. Prereq: SOC 101.

727 *Seminar on Socio-Cultural Change.* (3)
A seminar for advanced students. Emphasizes economic, religious, political, technological, psychological, etc., factors in change, and social and cultural patterns and processes of change. Prereq: ANT 527 or SOC 518, or permission of instructor; SOC 101. (Same as ANT 727.)

731 *Seminar in Comparative Social Organization.* (2)
A seminar for advanced students. Emphasizes principles in the comparative study of social systems; the role of kinship, age, sex, locality, and voluntary associations in determining relationships between individuals and between groups in nonliterate and literate societies. May be repeated once. Prereq: SOC 101. (Same as ANT 731.)

738 *Seminar: Drug Use as Deviant Behavior.* (3)
A seminar for advanced students. Data on drug abuse and its control used to exemplify and test sociological theories of deviant behavior. Covers characteristics of users, treatment approaches, relations to control measures, changes over time and drug policies. Prereq: SOC 636. (Same as BSC 738.)

766 *Concepts in Medical Sociology.* (3)
A systematic review of sociological concepts and methods which have been applied to the study of health and medicine; the contributions of medical sociology to general sociological theory; the roles of sociology in education for the health professions and in research on health related problems of society. Two class hours and four laboratory hours per week. Prereq: Predoctoral status in one of the Social or Behavioral Sciences with a concentration or minor in Medical Behavioral Science; SOC 101. (Same as BSC 766.)

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

770 *Seminar in Sociological Theory.* (3)
An intensive survey of contemporary general theorists from Comte to the present. The principal sociological concepts of each are considered and their role in the development of contemporary sociology is assessed. Prereq: SOC 101.

772 *Topical Seminar in Sociology.* (3)
Advanced study of topics of current importance in sociology, such as structural strain and social change, game theory, decision processes, communication and power structures. May be repeated once to a maximum of six credits. Prereq: At least nine hours in the social sciences, preferably in Sociology; SOC 101.

773 *Topical Seminar.* (3)
Analysis of topics of scientific interest in rural sociology, selected from such fields as the following: criticism of research; sociological factors in land use; migration; rural social ecology of the South; highland societies. May be repeated once for a maximum of six credits. Prereq: SOC 101. (Same as SOC 773 in Agriculture.)

775 *Seminar in the Family.* (3)
A seminar for students with a professional interest in the family. Selected topics are intensively examined. Prereq: SOC 101.

779 *Seminar in Social Psychology.* (3)
Each semester some topic in the field of social psychology, such as attitudes and beliefs, structure and function of social groups, social determinants of behavior, leadership, and morale will be studied intensively. May be repeated to a maximum of six credits. Prereq: SOC 101, PSY 544. (Same as PSY 779.)

780 *Special Problems in Sociology.* (1-6)
May be repeated to a maximum of 10 credits. Prereq: SOC 101.

790 *Research in Rural Sociology.* (1-3)
Individual graduate research with correlated study of rural social research types and methods. May be repeated for a maximum of six credits. Prereq: SOC 101. (Same as SOC 790 in Agriculture.)

792 *Research in Sociology.* (1-6)
Individual research and reading in particular fields of sociology, under staff supervision. Open to advanced graduate students who are prepared for intensive study beyond that offered in regular classes in each field. May be repeated to a maximum of 10 hours. Prereq: SOC 101.

SPANISH AND ITALIAN LANGUAGES AND LITERATURES

Director of Graduate Study—Daniel R. Reedy

The Department of Spanish and Italian offers the Master of Arts in Spanish, and the Doctor of Philosophy in Spanish degrees.

General Prerequisites: Graduate Record Examination scores are required for admission. All entering degree candidates must be able to read, write, speak and understand English with a level of fluency sufficient to take courses in other departments.

Master of Arts Degree, Prerequisites: Attainment in Spanish equivalent to that required for the undergraduate major in Spanish at the University of Kentucky.

M.A. Requirements: Standard Graduate School requirements except course work must include SPI 501 or equivalent, and reading knowledge of another language.

Doctor of Philosophy Degree, Requirements: 1) SPI 601-602, 621, and a minimum of two seminars in the department; 2) a reading knowledge of two foreign languages other than Spanish and English; 3) a minimum of three courses cognate to the field of special emphasis outside the area of Spanish; 4) successful completion of a series of four written examinations (plus a two hour oral); and 5) presentation of an acceptable dissertation.

Remarks: All candidates for the Ph.D. degree are required to spend at least two consecutive semesters of full-time residence beyond the M.A. degree (excluding summer sessions) in the department. Full-time residence is defined as follows: 1) nine course hours (excluding SPI 782) for departmental assistants teaching six hours, and 2) 12 course hours for fellowship holders. Experience has shown that doctoral candidates should plan to complete two years of full-time course work (nine hours per semester) beyond the M.A. degree.

The department recognizes four areas of study: Spanish Medieval, Renaissance, Modern (18th, 19th, 20th Centuries), and Spanish American literature. All candidates for the doctorate are asked to declare one of the four as an area of special competence. The minimum three courses outside of Spanish should be cognate to this field of special emphasis; they need not be taken entirely in one department. The final written examinations are designed to test competence in four areas and are required of all candidates. The examination corresponding to the field of special emphasis is longer and more detailed than the other three.

SPANISH

400 *Senior Seminar.* (3)
Detailed investigation of a given topic, author, or theme with emphasis on both content and methods of research. Topics, which are selected jointly by students and faculty in advance, are announced the preceding semester. Prereq: 12 hours of course work in Spanish on the 300 level or above.

405 *The Works of Cervantes.* (3)
Study and analysis of Miguel de Cervantes' *Don Quijote*, the *Novelas Ejemplares*, and selected dramatic works. Prereq: One course of SPI 315, 316, 318, 319 or equivalent.

406 *Spanish Literature of the 20th Century.* (3)
A study of the works of the Generation of 1898 and representative works of recent writers.

407 *Literature of Social Protest in Spanish America.* (3)
Analysis and study of the thematic use of socio-political elements in works by Spanish American poets and prose writers. Attention is focused on the novel of the Mexican Revolution, the Indigenista novel, Criollista writers and other major groups. Prereq: SPI 318 or 319.

420 *Twentieth Century Spanish American Literature in Translation.* (3)
A study of major literary currents in 20th Century Spanish America. Readings of selected prose and poetic works of Mistral, Vallejo, Neruda, Paz, Borges Fuentes, Vargas Llosa and others. No knowledge of Spanish required. *Not open to Spanish Majors.*

501 *Survey of the Spanish Language.* (3)
The development of the Spanish language from its Vulgar Latin stages to the modern period. Special emphasis is placed on the Spanish of the 12th through the 14th Centuries. Representative texts are analyzed.

502 *Spanish Phonetics, Pronunciation and Phonemics.* (3)
Introduction to Spanish descriptive linguistics with intensive study of variant speech sounds and established norms in the major cultural areas of the Hispanic world with discussions of the theory and isolation of phonemes. Prereq: SPI 202.

503 *Masterpieces of Medieval Spanish Literature.* (3)
A close reading and analysis of representative masterpieces from the Old Spanish Period, including the *Poema of the Cid,* the works of Gonzalo de Berceo, the *Libro de Buen Amor* and the *Conde Lucanor.*

509 *Spanish Literature of the 17th Century: Drama.* (3)
A careful study of the important works of the great Spanish dramatists of the 17th Century: Lope de Vega, Calderon, Tirso de Molina and their contemporaries. Prereq: SPI 315, 316.

510 *Spanish Literature of the 17th Century: Non-Dramatic Literature.* (3)
Representative masterpieces of the novel, poetry and theoretical writings of the 16th and 17th centuries. Prereq: SPI 315, 316.

515 *Masterpieces of Modern Spanish Poetry.* (3)
Study of the most significant movements from the 18th Century to the present. Prereq: SPI 315, 316.

516 *Masterpieces of Modern Spanish Drama.* (3)
A study of the most important plays of the Neoclassic, Romantic and Modern theatre. Prereq: SPI 315, 316.

517 *Masterpieces of the Modern Novel.* (3)
Representative novelists from the 18th Century to the contemporary period are analyzed, with special emphasis on the period of the realistic novel through the post Civil War generation. Prereq: SPI 315, 316.

523 *Spanish American Prose Fiction.* (3)
A study of the novel in Spanish America, with emphasis on the principal authors and works from Lizardi to the present. Prereq: SPI 315, 316, or 318, 319.

524 *Spanish American Essay.* (3)
A comprehensive study of the principal currents of thoughts in the Spanish American essay, with special attention to the *americanistas.* Prereq: SPI 315, 316, or 318, 319.

525 *Spanish American Drama.* (3)
A study of dramatic production in Spanish America from the missionary theatre to the present, accentuating the work of later authors beginning with Florence Sanchez. Prereq: SPI 315, 316, or 318, 319.

526 *Spanish American Poetry.* (3)
A study of Spanish American poetry, stressing the outstanding poets since Sor Juana. Prereq: SPI 315, 316, or 318, 319.

527 *Spanish American Short Story.* (3)
A study of the Spanish American short story from Echeverria to the present with particular emphasis on Dario, Quiroga, Lillo and Borges. Prereq: SPI 319 or equivalent.

534 *Structure of the Spanish Language.* (3)
A linguistic approach to Spanish grammar with attention to its transformational aspects and comparative structure.

535, 536 *Advanced Spanish Grammar and Composition.* (3 ea.)
A study of the finer points of Spanish grammar. Prereq: SPI 210.

551 *Tutorial Seminar for Majors in Spanish.* (1)
Research in special topics of Spanish and Spanish American literature for majors during the senior year. May be repeated once for a total of two credits.

553 *The Teaching of Modern Foreign Languages.* (3)
A course for teachers and prospective teachers.

601 *Old Spanish: Phonology and Paleography.* (3)
An intensive study of the phonology of Spanish with emphasis on the various linguistic backgrounds that developed it. Examination and study of medieval texts with exercises in paleographical transcription of medieval manuscripts.

602 *Old Spanish: Morphology and Syntax.* (3)
An intensive study of the morphology and syntax of Spanish, with emphasis on the Latin and Vulgar Latin grammatical systems which were the background of Spanish. Further examination of medieval texts with exercises in paleographical transcription of medieval manuscripts. Prereq: SPI 601.

603 *Medieval Spanish Literature I.* (3)
A survey of Medieval Spanish literature from the beginning to the end of the 13th Century. (SPI 604 is intended to cover the 14th and 15th centuries.)

604 *Medieval Spanish Literature II.* (3)
A survey of medieval Spanish literature of the 14th and 15th centuries.

605 *The Spanish and Spanish American Ballad.* (3)
A study of the rise and development of the Spanish and Spanish American ballad from its origins to the present. Special emphasis on both the folkloristic and literary phases of the ballad, with comparison with the English ballad, since Spain and Great Britain produced the greatest score of ballads.

606 *Romance Philology.* (3)
Study of the historical development of the various Romance languages with reading of texts chiefly from the medieval period. Special attention will be given to historical phonology and morphology. Prereq: FR 603 or SPI 501 or equivalent. May be repeated once.

607 *Early Brief Narrative—13th, 14th, 15th Centuries.* (3)
The rise and development of the brief narrative in prose and rise of the oriental apologue, hagiographical tales and Greco-Roman fables.

608 *Spanish Epic.* (3)
Study of the Poem of the Cid and the important cycles of Spanish epicry with their sources, parallels in history and influences upon other genres.

609 *Spanish Poetry of the 13th, 14th, and 15th Centuries.* (3)
Development of lyric poetry from the earliest beginnings to the 15th century. The *harchas,* Galician-Portuguese, lyric, sacred lyric and the poets of the *concioneros,* exclusive of the ballad.

615 *The Spanish Novel to Cervantes.* (3)
The development of the novel from *El caballero Cifar* to *Guzmán de Alfarache,* including masterpieces of chivalresque, sentimental, pastoral and picaresque prose.

616 *Cervantes.* (3)
The works of Cervantes, with emphasis on *Don Quixote,* but including other works and major works of Cervantine criticism.

617 *The Spanish Novel from Cervantes to Romanticism.* (3)
The post-Cervantine novel, including works by Lope, Tirso, Quevedo, Gracián, Isla and lesser novelists and *novella*-writers of 17th and 18th centuries.

618 *Mystic and Ascetic Writers of the 16th and 17th Centuries.* (3)
A survey of ascetic and mystic writers including among others: Juan de Avila, Luis de Leon, Luis de Granada, Santa Teresa, San Juan de la Cruz.

619 *Lope de Vega.* (3)
The major dramatic and non-dramatic works of Lope de Vega.

620 *The Theatre of Tirso de Molina.* (3)
The dramatic works of Tirso de Molina.

621 *The Theatre of Calderon de la Barca.* (3)
The dramatic works and techniques of Calderon de la Barca.

622 *Minor Dramatists of the Golden Age.* (3)
The dramatic works of such playwrights as Guillen de Castro, Alarcon, Mira de Amescua and other contemporaries of Lope de Vega and Calderon.

623 *Spanish Poetry of the 16th and 17th Centuries.* (3)
An examination of several schools and forms of poetry, both lyric and narrative, in this period.

624 *Spanish Medieval and Renaissance Drama.* (3)
Readings, lectures and discussions on the origin of the Spanish vernacular drama and its growth through the 16th Century.

628 *Spanish Drama from the Neoclassic Period to the Generation of 1898.* (3)
Representative works and dramatic trends of the 18th and 19th centuries.

629 *Spanish Drama from the Generation of 1898 to the Present.* (3)
Representative works of the major dramatists and dramatic trends from Benavente and his contemporaries through Garcia Lorca, Casona and Buero Vallejo.

630 *Prose Fiction from the Romantic Period to the Generation of 1898.* (3)
The major schools of fiction from the Romantic Period through the Generation of 1898.

631 *Prose Fiction from the Generation of 1898 to the Present.* (3)
Studies in most important novels and short stories of the later part of the modern period, produced from 1930 to the present.

632 *The Spanish Essay from the 18th Century to the Present.* (3)
An examination of the intellectual preoccupation of Modern Spain as expressed in the essay from the 18th century to the present.

633 *Spanish Poetry from the 18th Century to the Present.* (3)
A study of the major poetic schools from the 18th Century throughout the Civil War.

641 *Spanish American Novel: Mexico, Central America, the Caribbean.* (3)
The works of the principal novelists in Mexico, Central America and the Caribbean with special emphasis on the novelists of the Mexican Revolution.

642 *Spanish American Novel: South America.* (3)
Representative works of the principal authors of South America with special emphasis on Peru, Argentina, Chile, Colombia, Venezuela.

643 *Spanish American Poetry: Colonial Period to 1888.* (3)
Representative works of the principal poets from the Colonial Period through the Romantic Movement with emphasis on Sor Juana Ines de la Cruz and the Romantics.

644 *Spanish American Poetry: Modernism to the Present.* (3)
Representative works of the principal poets of the Modernist Period to the present.

645 *Literary Currents in Contemporary Spanish American Fiction.* (3)
An examination of the outstanding works of Spanish American authors during the past ten years, with emphasis on literary innovations and new currents in the novel, short story, poetry and drama.

660 *Bibliography and Methods of Research.* (3)
Investigation of Spanish bibliography and modern methods of research designed to provide guidance to the graduate student leading to an understanding of research methods and publication. Taught by various members of the staff, with each member dealing with his own specialty.

701 *Seminar in Historical Linguistics.* (3)
Intensive study of specific problems in the medieval Spanish language. Prereq: SPI 601-602 or equivalent.

702 *Seminar in Medieval Spanish Literature.* (3)
Special and intensive study of a single problem in medieval Spanish literature. Prereq: SPI 601-602 or equivalent. May be repeated for a total of six credits.

703 *Seminar in Golden Age Non-Dramatic Literature.* (3)
Special and intensive study of the work or works of a single Golden Age writer or of a movement in the non-dramatic literature of the Golden Age. Prereq: Two Spanish courses in 606-610 bracket. May be repeated for a total of six credits.

704 *Seminar in Golden Age Theatre.* (3)
Special and intensive study of a specific area of the Golden Age theatre. Prereq: SPI 611-614 (any two courses). May be repeated for a total of six credits.

705 *Seminar in Modern Spanish Literature.* (3)
Seminar in the recent Premio Nadal novels and other post-Civil War novelists. May be repeated for a total of six credits.

706 *Seminar in Spanish American Literature.* (3)
Special and intensive study of particular areas of Spanish American literature. Prereq: SPI 624-627, 512 (any two courses). May be repeated for a total of six credits.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

772 *Seminar in Spanish Literature.* (3)
A seminar designed to provide intensive study of a literary, scholarly, or intellectual problem of Spanish letters not covered as such in any of the above listed offerings. Prereq: 21 semester hours of college Spanish. May be repeated for a total of six credits.

782 *Special Studies in Spanish.* (3)
Selected studies and investigations in the Spanish language and literature, permitting the student to work in areas of special interest and providing opportunity for original endeavor. May be repeated once.

ITALIAN

543 *Survey of Italian Literature I.* (3)
A survey of Italian literature from its beginnings to the 17th century. Prereq: SPI 292 or 009.

544 *Survey of Italian Literature II.* (3)
A survey of Italian literature from the 17th century to the present. Prereq: SPI 292 or 009.

561 *Old Italian.* (3)
An intensive study of the Old Italian language and its derivation, with mention of the development of the more important dialects along with the modern language. Examinations and study of medieval texts. Prereq: Adequate reading knowledge of modern Italian.

563 *Dante I.* (3)
Dante, the *Vita Nuova* and the *Divina Commedia, Inferno.* Prereq: SPI 543 or 544 or consent of instructor.

564 *Dante II.* (3)
Dante. The Divina Commedia: Purgatorio and Paradiso. Prereq: SPI 563.

565 *Petrarch and Boccaccio.* (3)
Study of the Italian works of Petrarch and Boccaccio. Prereq: SPI 543 or 544, or consent of instructor.

566 *Literature of the Italian Renaissance.* (3)
A study of the major literary trends and figures of the Italian Renaissance, from the literary and humanistic successors of Petrarch and Boccaccio to the writers of the Cinquecento. Prereq: SPI 543 or 544 or consent of instructor.

571 *Modern Italian Novel.* (3)
A study of the origins and development of the modern Italian Novel, with emphasis on major nineteenth century trends as represented by the works of Foscolo, Manzoni, Verga, Fogazzaro, and D'Annunzio, and on Pirandello and selected contemporary novelists. Prereq: SPI 292 or consent of instructor.

572 *Modern Italian Drama.* (3)
A study of the origins and development of modern Italian drama, from Goldoni and Alfieri in the Eighteenth Century, through Verga and D'Annunzio to Pirandello, Betti, Sem Benelli and other contemporary dramatists. Prereq: SPI 292 or consent of instructor.

573 *Modern Italian Poetry.* (3)
A study of the development of Modern Italian Poetry, with emphasis on major figures and trends, and close reading of texts. Prereq: SPI 292 or consent of instructor.

591 *Dante in Translation.* (3)
A study of the works of Dante from the literary viewpoint. Emphasis given to his sources, his enormous impact upon subsequent Italian and European literatures. The Divine Comedy would be the focal point of the course, but the poet's lesser works would also be studied. Not open fo graduate students in Italian.

592 *Italian Renaissance Masterpieces in Translation.* (3)
A study of the great authors of the Italian Renaissance and their works in English translation: Petrarch, Boccaccio, Poggio, Piccolomini, Bruni, Pontano, and others. Not open to graduate students in Italian.

593 *Modern Italian Literature in Translation.* (3)
A study of the major trends and figures of nineteenth and twentieth century Italian literature.

RUMANIAN

461 *Rumanian I.* (3)
An intensive and practical study of the Rumanian language, with emphasis on ability to read modern literary and expository texts. Prereq: Knowledge of a Romance or Slavic language, or consent of instructor.

462 *Rumanian II.* (3)
An intensive and practical study of the Rumanian language, with emphasis on ability to read modern literary and expository texts. Prereq: Knowledge of a Romance or Slavic language, or consent of instructor.

STATISTICS

Director of Graduate Study—
Richard L. Anderson

The Department of Statistics offers programs of study leading to the degrees of Master of Science and Doctor of Philosophy. There is a close connection with the Departments of Computer Science and Mathematics, with regard to courses, graduate programs and faculty. An interdepartment program in Operations Research is under consideration, and the University is expanding its research capability in other areas associated with Statistics, such as Econometrics, Quantitative Genetics and Biological and Engineering Systems.

A student intending to pursue graduate work in Statistics should obtain previously as much mathematics as possible. One course each in advanced calculus and matrix algebra are basic prerequisites for the first year's graduate course in statistics. If possible, mathematics deficiencies, especially in calculus, should be corrected during the summer prior to entering the Graduate School.

Statistics applicants must meet the general requirements for admission to the Graduate School; in addition they are expected to have at least a B average in previous mathematics and statistics courses. Students with an undergraduate major in an applied field, as well as majors in mathematics or statistics, are urged to apply.

The University of Kentucky is represented on the Committee on Statistics of the Southern Regional Education Board. This committee sponsors annually a Summer Research Conference and a Regional Graduate Summer Session. The 1971 summer session to be held at Clemson University will consist of two Advanced Sciences Seminars in Probability and Statistics in addition to standard introductory and advanced courses. When a student of an institution which is represented on the Committee on Statistics participates in a Regional Graduate Summer Session in Statistics, that student, upon recommendation of his Graduate Committee, will receive credit as though earned on his home campus. The courses are arranged to provide some consecutive work in successive summers. Information regarding these courses may be obtained from the Department of Statistics or the Dean of the Graduate School.

Master's Program

The department offers the degree of Master of Science with a major in statistics with or without a thesis. All master's candidates are expected to complete the equivalent of STA 524, 531, 601, 602, 614 and 624. Additional course requirements depend on the student's interests. A student primarly interested in probability and mathematical statistics should select from such courses as STA 612, 661 and 721, as well as graduate courses in mathematics. One primarily interested in applied statistics and data analysis would take STA 616 and could select from such courses as STA 641, 642 and 643, as well as courses in computer science and applied areas. Any combination of these courses would be accepted. There are no formal minor requirements Departmental written examinations in basic statistical theory and analysis are required of all master's candidates.

A full-time graduate student usually will require three semesters to complete a master's degree; however, it would be possible to complete the work in one calendar year if related courses are available in the summer.

Doctoral Program

A Ph.D. student can major in either experimental or mathematical statistics and should complete the equivalent of the six required master's degree courses plus at least eight others, as follows:

Majors in Experimental Statistics:

I STA 616, 701

II At least two from STA 641, 642, 643 and 678

III At least two from STA 612, 661 and 721

IV Selected advanced statistics courses or courses from the computer science or other departments.

Majors in Mathematical Statistics:

I MA 571, 572

II STA 701, 702

III At least two from STA 612, 661 and 721

IV Advanced courses in the dissertation area, possibly including more mathematics.

Written qualifying examinations for the doctorate consist of the two basic examinations in statistical theory and analysis (if not completed satisfacorily for the master's degree) plus a special examination in the major area. An oral qualifying examination also is required. A reading knowledge of one modern language is required of all Ph.D. candidates. Areas of dissertation research include Bayesian inference, categorical data analysis, distribution problems, experimental design construction, large sample theories, misclassification problems, multivariate analysis, non-linear models, non-parametric inference, prior information in regression models, probability theory, response surface design and analysis, selection of predictors, stochastic models, and variance component design and analysis.

421 *Basic Statistical Theory I.* (3)
Discrete and continuous probability distributions; simple random sampling; point and interval estimation; hypothesis testing. Coreq: MA 214.

422 *Basic Statistical Theory II.* (3)
Theory of least squares; regression; analysis of variance and covariance; experimental design models; factorial experiments; variance component models. Prereq: STA 421.

423 *Introductory Probability.* (3)
Set theory; fundamental concepts of probability, including conditional and marginal probability; random variables and probability distributions (discrete and continuous); expected values and moments; moment-generating and characteristic functions; random experiments; distributions of random variables and functions of random variables; limit theorems. Prereq: MA 214. (Same as MA 423.)

482 *Discrete Methods and Models in Applied Mathematics.* (3)
Probability on finite sample spaces, combinatorial mathematics, finite Markov chains, linear programming, theory of games. Prereq: MA 214 or equivalent. (Same as CS 482, MA 482.)

511 *Statistical Analysis.* (3)
Procedures for collecting and summarizing population data; index members; measures of central tendency and dispersion; random sampling; empirical frequency distributions; point and interval estimators; control charts; hypothesis testing; goodness-of-fit; contingency tables; equality of means and variances; simple analysis of variance; multiple comparisons; simple regression and correlation. Coreq: STA 421 or STA 531.

524 *Discrete Probability.* (3)
Sample space, combinatorial methods, combination of events, laws of large numbers, normal approximation to the binomial; generating functions, convolutions, random walks, branching processes, recurrent events. Prereq: MA 432 or MA 471 or consent of instructor. (Same as MA 524.)

531 *Theory of Statistical Inference I.* (4)
Sample space, concept of probability, conditional probability, random variables, density and distribution functions, mathematical expectation; moment generating functions; functions of random variables; limit laws, usual distributions, certain derived distributions, introduction to estimation and hypothesis testing. Prereq: MA 432 or MA 471 or consent of instructor. (Same as MA 531.)

601 *Theory of Statistical Inference II.* (3)
Elements of decision theory; properties of estimators; point and interval estimation; hypothesis-testing; sequential testing; inference from categorical data; linear regression as conditional expectation; multivariate normal distribution. Prereq: STA 531.

602 *Theory of the General Linear Model.* (3)
Distribution of quadratic forms, linear estimable functions and their best estimates; principle of conditional error; testing linear hypotheses; multiple and polynomial regression; regression estimation using prior information; estimation of error variance; complete and incomplete block designs; factorial experiments; covariance; variance components; mixed models. Prereq: STA 531 and MA 462.

603 *Design and Analysis of Experiments.* (3)
One-way layout; multiple comparisons. Two-way layout with fixed, random and mixed models and interaction. General complete factorial design, including nested factors. Prereq: STA 602.

612 *Selected Areas in Statistics.* (3)
Two or more of the following areas will be briefly surveyed: nonparametric and distribution-free methods; sequential analysis; Bayesian inference; multivariate analysis. Prereq: STA 531.

616 *Design and Analysis of Sample Surveys.* (3)
Sampling from finite populations; estimation of sample size; stratification; ratio and regression estimators; systematic sampling; cluster sampling; multistage sampling (selection of sampling units with probability proportional to size); double sampling; response errors. Prereq: STA 421 or Coreq: STA 531.

624 *Advanced Probability I.* (3)
Markov chains, birth and death processes, renewal theory, central limit theorem, stochastic processes. Prereq: MA/STA 524 or 531. (Same as MA 624.)

641 *Design and Analysis for Variance Component Models.* (3)
Expected values, variances and covariances; balanced and nonbalanced designs; comparison of estimators; reduction of product variability; compositing; sequential designs; Bayesian estimation; confidence limits; negative estimates; finite populations. Prereq: STA 602.

642 *Response Surface Techniques.* (3)
Analysis in vicinity of stationary point; canonical analysis; steepest ascent for locating optima; first order designs for fitting response surfaces; orthogonal designs; second order designs; rotatability; central composite designs; conditions for orthogonal blocking; designs to minimize bias and mean squared error; designs for sets of constrained variables. Prereq: STA 603.

643 *Advanced Experimental Design.* (3)
Advanced topics in analyses of incomplete block designs; confounding and change-over designs; data collected at several places and times; principles of design construction. Prereq: STA 603.

652 *Advanced Mathematical Programming.* (3)
A course for those desiring to study linear and non-linear programming from an advanced mathematical point of view. Theory of graphs; discrete linear programming; stochastic, non-linear and dynamic programming. Prereq: A course in Linear Programming.

661 *Multivariate Analysis I.* (3)
Characterization and properties of the multivariate normal distribution, random samples from this distribution; multivariate analysis of variance, related distribution theory; factor analysis. Prereq: STA 601, STA 602.

665 *Analysis of Categorical Data.* (3)
Multinomial and product-multinomial models; large-sample theory of estimation and testing, Pearson chi-square and modified chi-square statistics, Pearson-Fisher Theorem, Wald Statistics and generalized least squares technique; applications to problems of symmetry, association and hypotheses of no interaction in multi-dimensional contingency tables. Prereq: STA 601, or 602.

670 *Basic Statistical Analysis.* (4)
Primarily in biological, behavioral and social sciences. Introduction to methods of analyzing data from experiments and surveys; the role of Statistics in research; statistical concepts and models; probability and distribution functions; estimation; hypothesis testing; regression and correlation; analysis of single and multiple classification models; analysis of categorical data. Three class hours, two laboratory hours per week. Prereq: Previous statistical experience or consent of instructor.

674 *Statistical Analysis and Experimental Design.* (3)
Multiple comparisons; individual degrees of freedom; multiple regression; covariance; methods of constructing designs for experimental investigations; concepts of blocking, randomization and replication; experimental unit technique; complete and incomplete block designs; response surface methodology. Prereq: STA 670.

676 *Statistical Analysis and Survey Design.* (3)
Multiple regression; covariance; non-parametric methods; model construction; methods of constructing designs for survey investigation; simple random, stratified and multistage sampling designs; methods of estimation; questionnaire construction. Prereq: STA 670.

677 *Applied Multivariate Methods.* (3)
Survey of multivariate statistical techniques. The multivariate normal distribution; the general linear model; general procedures for parameter estimation and hypothesis testing in the multivariate case; Hotelling's T^2, multivariate analysis of variance and covariance; structural models for the covariance matrix; utilization of existing computer programs. Prereq: STA 674 or 676, and a knowledge of linear algebra equivalent to MA 262.

678 *Statistical Genetics.* (3)
Statistical approaches to the analysis of quantitative inheritance; definition and estimation of genetic parameters relating to selection; inbreeding theory; random-mating and inbred populations; testing and planning in genetic experiments. Prereq: STA 674 and BIO 620 or consent of instructor. (Same as AGR 678 and BIO 678.)

681 *Statistical Techniques for Engineers and Physical Scientists.* (3)
Primarily in the engineering and physical sciences. Random variables; distribution functions; hypothesis testing; simple and multiple regression; transformations; estimation of functional relationships from experimental data; full, fractional and central composite designs. Two lecture hours per week; two lab hours per week. Prereq: MA 214.

690 *Seminar in Statistics.* (1)
Seminar—May be taken a maximum of two times.

691 *Special Topics in the Planning and Analysis of Experiments.* (3)
Place of statistics in experimentation; topics in experimental design; response surfaces; departures from usual assumptions in analysis of variance; other selected topics. Prereq: STA 603 or consent of instructor. May be repeated to maximum of nine credits.

695 *Special Topics in Statistical Theory.* (3)
To be selected by staff. May be repeated to maximum of nine credits. Prereq: STA 601.

701 *Advanced Theory of Statistical Estimation.* (3)
General decision theory approach to estimation; method of maximum likelihood, BAN estimates; Cramer-Rao inequality and its extensions; sequential estimation; sufficiency and completeness in unbiased estimation; unbiased and minimax prediction; estimation by confidence sets; Stein's two-stage procedure. Prereq: STA 601. Coreq: MA 572 or equivalent.

702 *Advanced Theory of Hypothesis Testing.* (3)
Review of basic concepts of measure and integration; sufficiency and exponential family of distributions; most powerful and uniformly most powerful tests; likelihood ratio test procedures; sequential testing; unbiased and similar tests; permutation and invariant tests. Prereq: STA 701.

703 *Advanced Probability II.* (3)
Review of probability spaces; general stochastic processes; spectral analysis of stationary random processes; infinitely divisible distributions; theory of queues. Prereq: MA/STA 624; Coreq: MA 572. (Same as MA 703.)

721 *Nonparametric Inference.* (3)
Estimation and testing when the functional form of the population distribution is unknown; rank and sign tests; tests based on permutations of observations; power of nonparametric tests; optimum nonparametric tests and estimators. Prereq: STA 601; Coreq: MA 572.

722 *Topics in Nonparametric Inference.* (3)
Order statistics, estimation of density function, rank orders; rank order tests; sequential nonparametric procedure, asymptotic normality and efficiency. Prereq: STA 721.

762 *Multivariate Analysis II.* (3)
A more rigorous study of distribution theory than in STA 661; random and mixed effects models; multivariate non-normal analysis. Assorted other topics. Prereq: STA 661.

768 *Residence Credit for Master's Degree.* (0)
May be repeated. (One to six credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (One to 12 credits equivalence.)

THEATRE ARTS

Director of Graduate Study—Raymond Smith

The Department of Theatre Arts requires for the master's degree a minimum of 30 semester hours of Theatre Arts and English dramatic literature courses including English 600, Bibliographical Studies. A maximum of six of these 30 semester hours may be taken in other allied subjects provided these courses have a approval of the Chairman of the Department of Theatre Arts. All candidates for the Master's Degree in theatre arts will be required to attain a reading knowledge of one modern foreign language (ordinarily French or German) before receiving the degree.

It is assumed that a student who seeks a master's degree in the Department of Theatre Arts will have had courses approximating those required for an A.B. degree with a major in Theatre Arts. If not, he must remove the deficiency by taking (without graduate credit) courses in addition to those normally specified for the master's degree.

The Department offers the master's degree according to Plan B only at the present time.

590 *History of the Theatre I.* (3)
A study of the theatre from primitive times through the Elizabethan period. Theatre and stage architecture, scene design, costuming and acting styles are discussed and their relation to dramatic literature analyzed.

591 *History of the Theatre II.* (3)
A continuation of TA 590, a study of the theatre from the Jacobean period to the present.

592 *Scene Design I.* (3)
Study of theory, principles and techniques of scene and lighting design for the contemporary theatre. Comprehensive analysis of a play and the development of a design through the media of floor plans, lighting plot, and perspective line drawings. Three class hours per week plus laboratory assignments. Prereq: TA 292 or 293 or consent of instructor.

593 *Scene Design II.* (3)
Intensified and expanded application of TA 592. Advanced theory and practice in scene and lighting design for the theatre. Three class hours per week plus laboratory assignments. Prereq: Consent of instructor.

594 *Acting I.* (3)
Study of acting styles from antiquity to the present, with emphasis on important acting periods. Lecture and weekly demonstrations for the development of skill in the use of body and for projection of voice and total characterization. Two hours of lecture and two hours of laboratory weekly. Prereq: Major or consent of instructor.

595 *Acting II.* (3)
Study and acting of scenes from classical and modern dramatic literature. Intensive application of Techniques studied in TA 594. Two hours of lecture and two hours of laboratory weekly. Prereq: TA 594 or consent of instructor.

596 *Playwriting.* (3)
A course designed for students interested in creative drama. The completion of at least one play is required. May be repeated to a total of six credits. Prereq: Consent of instructor.

597 *Teaching of Theatre Arts.* (3)
A course designed to introduce teachers and community theatre workers to the problems of staging under circumscribed conditions; minimum essentials of play production and the means of supplying these needs. Required of all certification students.

598 *Theatre Directing I.* (3)
Study of movement, interpretation of lines, creation of atmosphere, use of stage areas, use of levels, methods of achieving a climax, handling of groups, planning of mob scenes. Prereq: Major or consent of instructor.

599 *Theatre Directing II.* (3)
Analyses and direction of the characteristics of tragedy, comedy, melodrama, farce and their variants. Intensive application of techniques studied in TA 598. Prereq: TA 598 or consent of instructor.

690 *Studies in Technical Theatre: Production.* (3)
Problems in advanced sceno-graphic techniques including drafting for the theatre, period composition and design, translation of the design into actuality, planning and laying out the technical schedule. Prereq: Consent of instructor.

691 *Studies in Technical Theatre: Lighting.* (3)
Investigation and critical evaluation of lighting practice and artistry in the contemporary theatre. Prereq: Consent of instructor.

694 *Advanced Styles of Acting.* (3)
The rehearsal and performance of scenes and class exercises in improvisation to develop creative imagination as a basis for acting. Three class hours; two laboratory hours per week. May be repeated once for a total of six credits. Prereq: Consent of instructor.

794 *Special Topics in Theatre Arts.* (3)
Study and research on specific topics and problems according to the interests and needs of individual students. Normally offered as an independent work course. (May be repeated once for a total of six credits.)

798 *Directing.* (3)
Seminar and research in the aesthetics and techniques required for the production of period classics of dramatic literature. Three class hours per week; laboratory, two hours per week. May be repeated once for a total of six credits.

Business and Economics

Coordinator of Graduate Study

Charles F. Haywood

The Degree of Master of Science in Accounting

Director of Graduate Study—James A. Knoblett

Objectives:

The principal objectives of the Master of Science Program in Accounting are to develop the ability to perform, and report upon, significant research and to further the understanding of the relationship between accounting and other disciplines. Since the specific needs of individuals for advanced study differ, the program has been structured to provide maximum flexibility.

Requirements:

1. Admission to the advanced degree program is open to students who hold a bachelor's degree from any accredited college or university, an undergraduate grade-point average of 2.7 or above, and at least 450 on the Admission Test for Graduate Study in Business. If the grade-point average is between 2.4 and 2.7, the Admission Test for Graduate Study in Business must be 490 or above.
2. Graduate study in accounting presumes a minimal preparation in economics and business, including the following areas (undergraduate credit can be applied). In certain cases, these areas may be satisfied within the M.S. program upon approval of the Director of Graduate Studies:

	Crs.
Principles of Economics	6
Principles of Accounting	6
Statistical Method	6
Business Finance	3
Marketing	3
Management	3

Additional minimal preparation is one course each in intermediate accounting, cost accounting, and income taxation.

3. A minimum of 30 semester hours must be presented in courses carrying graduate credit. At least 18 semester hours must be in courses reserved exclusively for graduate students and at least 12 of these must be in accounting.
4. The course requirements are:
   a. One course in each of the following fields:
      Advanced Managerial Accounting
      Income Taxation
      Attest Function
      Accounting Theory
   b. At least six semester hours of graduate credit outside the Department of Accounting, three of which must be in Economics.
   c. A course in Computer Science or Data Processing.
5. The candidate must submit evidence of competence in statistics, as follows: six hours of minimal preparation in statistics, and three hours in an approved statistics course numbered 400 or higher.
6. Minimal average of grade B in all courses attempted while enrolled in Graduate School.
7. Successful completion of a comprehensive examination.

The Degree of Master of Business Administration

Director of Graduate Study—Philip K. Berger

1. Admission to this program is open to students who hold a bachelor's degree from any accredited college or university, with an undergraduate grade-point average of 2.7 or above and 450 or above on the Admission Test for Graduate Study in Business. If grade-point average is between 2.4 and 2.7, the Admission Test for Graduate Study in Business must be 490 or above.
2. Graduate study in business presumes a minimal preparation in economics and business, including the following areas (undergraduate credit can be applied). In certain cases, these areas may be satisfied within the M.B.A. program upon approval of the Director of Graduate Studies:

	Crs.
Principles of Economics	6
Principles of Accounting	6
Statistical Method	6
Business Finance	3
Marketing	3
Management	3
3. Graduate Courses:	
BA 635 Managerial Economics	3
BA 636 Research and Report Writing	3
ACC 628 Accounting for Control and Planning	3
BA 637 Administrative Behavior	3
BA 645 Corporate Financial Policy	3
BA 630 Advanced Marketing Management	3
BA 639 Advanced Business Management	3
One of the following:	
BA 652 Production Management	3
BA 650 Management Science I	3
Electives: Six hours of courses giving graduate credit	6
	30

Master of Business Administration with Area Specialization: Six-hour sequences of courses may be approved for specialization beyond the core in the following fields: Marketing, Finance, Management Science, Managerial Accounting, Managerial Economics, and International Business.

Additional requirements are:

1. Residence for at least two semesters at the University of Kentucky as a full-time student, or its equivalent as a part-time student.
2. Minimal average of grade B in all courses attempted while enrolled in Graduate School.
3. Successful completion of a comprehensive final examination.

The Degree of Doctor of Business Administration

Director of Graduate Study—Philip K. Berger

The basic purpose of the program leading to the Doctor of Business Administration degree is to enable persons who are seeking careers in collegiate business teaching, business research, or business consultation in acquiring a comprehensive, professional education appropriate to their goals.

Objectives:

The Doctor of Business Administration degree is designed for persons who are seeking careers in collegiate teaching, business research, or business consultation. A basic purpose of the program is to develop a broad understanding of business administration, economic analysis, and related behavioral and quantitative disciplines. An appreciation of the administrator's point of view in decision making within an organizational setting, and the development of scientific methods and techniques in research investigations will be emphasized.

Requirements:

1. Background Training in Business and Business Related Areas.

   The D.B.A. is designed to provide specialization beyond the master's level. The educational background of each candidate will be reviewed by an admissions committee which will identify any deficiencies. In most cases, an M.B.A. from an accredited institution (A.A.C.S.B. accreditation) provides the background.

   Applicants with previous graduate credits are evaluated generally according to the following rules, but each case is individually examined. A minimal grade-point average of 3.2 is required on all previous graduate credits. Also, students without ATGSB scores must take these exams before admission, with minimal score of 500.

2. Core Requirements (24 credit hours):
   a. Six hours of course work in administrative science and management science
      BA 735, Administrative Science I
      BA 736, Administrative Science II
   b. Six hours of course work in research
      BA 762, Research Methodology
      A graduate course in research techniques appropriate to major interest
   c. Six hours of course work selected from
      ECO 660, Advanced Microeconomic Theory
      ECO 661, Advanced Macroeconomic Theory
      A graduate course directly supporting major research interest
   d. Six hours of course work in quantitative analysis
      BA 650, Management Science I
      BA 750, Management Science II

3. Major and Minor Field Requirements:
   The major field will consist of at least nine hours of graduate credit course work from the following fields:
   Accounting
   Finance
   Management and Organizational Behavior
   Management Science
   Marketing
   The minor field will consist of at least six hours of graduate credit course work from the above fields or from an outside department closely related to the major field. This course work must be approved by the Graduate Coordinator of the Department of Business Administration.
4. No foreign language is required.
5. Written and oral comprehensive examinations are required in the major and minor fields.
6. The dissertation will be based on original research on a significant topic. The dissertation will be defended in an oral examination

The Degree of Master of Science In Economics

Director of Graduate Study—Richard E. Gift

The M.S. in economics is primarily for students who wish to have a large amount of flexibility in a program of advanced study in economics. This degree program provides minimal preparation for employment as an undergraduate teacher of economics and as a researcher for government, business, and other organizations. The program can be structured to prepare a student for further graduate work in economics, but it is also highly suitable for students with strong interdisciplinary interests.

The M.S. in economics is primarily for students who wish to have flexibility in a program of advanced study in economics. The M.S. in economics provides adequate preparation for initial employment as a teacher in colleges and as a researcher for government, business, and other organizations. The program can be structured to prepare a student for further graduate work in economics and related fields.

Recommended minimal undergraduate preparation—six hours of intermediate theory, six hours of statistics, and college algebra-trigonometry. These can be taken in the program as additional work.

Requirements for the M.S. in economics are:

1. A minimum of 30 hours of graduate credit courses.
   a. Fifteen hours must be in courses in the Department of Economics, and 12 of these hours must be in courses reserved exclusively for graduate students.
   b. At least 15 hours of the total of 30 must be in courses reserved exclusively for graduate students.
   c. The 30 hours must include ECO 660 and 661, Economic Theory, and ECO 662, Research.
2. Successful examination in one modern foreeign language or competence in mathematical sciences evidenced by nine hours of approved course work.
3. Success in a final examination.
4. Minimal average of grade B in all courses attempted for graduate credit.

The Degree of Master of Arts In Economics

Director of Graduate Study—Richard E. Gift

Objectives:

The program for the M.A. in economics is the first stage of the Ph.D. program. However, this program also provides preparation for employment in undergraduate college teaching and as a researcher for government, business, and other organizations. The program is designed to develop basic foundations in (1) economic theory, (2) quantitative techniques, (3) some area of specialization within economics, and (4) research and writing skills.

Requirements:

1. Recommended minimal undergraduate preparation—six hours of intermediate theory, six hours of statistics, and six hours of college mathematics.
2. A minimum of 30 hours of graduate credit courses.
   a. At least 24 of the 30 hours must be in courses reserved exclusively for graduate students.
   b. ECO 590, Mathematical Economics (or its equivalent), ECO 660 and 661, Economic Theory.
   c. One of the basic courses (600 or 700

level) in each of three of the elective fields from the Ph.D. program.

d. ECO 662, Research.

3. Successful examination in one modern foreign language or competence in mathematical sciences, evidenced by nine hours of approved course work, six hours of which must be in statistics courses numbered 400 or higher.
4. Success in a final examination.
5. Minimal average of grade B in all courses attempted for graduate credit.

The Degree of Ph.D. In Economics

Director of Graduate Study—Richard E. Gift

Objectives:

The Ph.D. program is designed to enable the graduate to contribute to the advancement of economics. The program is also aimed at producing graduates who are qualified to teach, as well as engage in industrial and governmental research and consulting.

To attain these objectives, the program is designed to provide the student with the appropriate knowledge, understanding, skills and abilities, including:

1. An understanding of economic theory.
2. Skill in the use of quantitative techniques, specifically mathematics and statistics.
3. Specialization in a limited number of areas.
4. A knowledge of the broad social and political background of the economic environment.
5. Experience in the development of research projects throughout his entire program.
6. Research and writing skills that would lead to the publication of original research.
7. Competence in communicating economic knowledge to broad and diverse audiences.

Requirements:

Work for the degree of Doctor of Philosophy in Economics must conform to the general requirements of the Graduate School. Although there is no specific course work required in the Ph.D., the student must develop a depth of understanding in the following areas and the equivalent of the material in the following courses:

1. Economic Theory
   ECO 590, Introduction to Mathematical Economics
   ECO 660, Advanced Microeconomic Theory
   ECO 661, Advanced Macroeconomic Theory
   ECO 760, Seminar in Microeconomic Theory
   ECO 761, Seminar in Macroeconomic Theory
2. The Elective Requirement: All Ph.D. students must complete three fields in economics in addition to the above. A sequence of two courses covers the minimum material necessary for each field.
   ECO 671 and 771, International Economics
   ECO 673 and 773, Economic Development
   ECO 676 and 776, Labor Economics
   ECO 679 and 779, Public Finance
   ECO 682 and 683, Regional Economics
   ECO 686 and 786, Monetary Economics
   ECO 688 and 788, Mathematical Economics
   ECO 692 and 792, Econometrics
3. Supporting Work: At least six hours of supporting course work must be selected. These courses of study must be approved by the student's Special Committee.
4. Competence in mathematical sciences, evidenced by nine hours of approved course work, six hours of which must be in statistics courses numbered 400 or higher.
5. Successful examination in one modern foreign language.
6. Qualifying Examinations
   a. Written Examinations: Written examinations must be taken in each of the four fields (Economic Theory, and three electives from above eight), as part of the requirement for candidacy for the Ph.D. These examinations usually are given in the spring and fall.
   b. Oral Examination for Candidacy: After passing the above written examinations, the student will prepare a proposal for his dissertation. An oral examination will be held in which the prospective candidate must defend his proposal and demonstrate competence in his fields.
7. The Dissertation: The dissertation will be based on original research on a significant topic. The dissertation will be defended in an oral examination.

ACCOUNTING

Director of Graduate Study—James Knoblett

401 *Accounting Theory.* (3)
An investigation into earlier attempts to develop a coordinated statement of accounting theory; a critical examination of selected current accounting practices; and discussion of recent developments in accounting research. Prereq: ACC 301.

403 *Auditing.* (3)
The attest function of accounting with both internal and independent application. Emphasis is placed on the ethics, standards, and objectives of auditing and management's responsibilities in implementing internal control. Prereq: ACC 401 and senior standing.

408 *Cost Accounting.* (3)
Concepts of costs in developing information for management use in the determination of income, the selections of activities (or projects) and the measurement of performance. Prereq: ACC 202.

410 *Accounting for Institutions and Regulated Industries.* (3)
The requirements of adequate accounting systems for various governmental units, including the recording of usual transactions and the form and content of reports. Prereq: ACC 202.

416 *Accounting for Business Combinations.* (3)
Accounting records for consolidations and mergers, preparation of consolidated statements. Insolvency and receivership records and statements. Accounting for estates and trusts. Prereq: ACC 301.

417 *Income Taxation.* (3)
A comprehensive study of the federal income tax structure with emphasis on its application to individuals. Prereq: ACC 301.

418 *Controllership.* (3)
The organizational position of the comptroller, his functions and objectives; his methods and procedures. Prereq: ACC 408 or consent of instructor.

419 *Internship in Accounting.* (3)
Students are placed with cooperating firms for on-the-job training in accounting. Written reports to be submitted by the firm and the student to the instructor. Prereq: ACC 301 and consent of instructor.

422 *Functions of Accounting.* (3)
Introduction to the basic concepts and uses of accounting data. Prereq: Consent of instructor. (Not open to students who have ACC 202 or its equivalent.)

515 *C.P.A. Problems.* (3)
The application of generally accepted principles to representative problems from C.P.A. examinations. Prereq: Senior standing and consent of instructor.

517 *Tax Accounting Problems.* (3)
A comprehensive study of corporation, partnership and fiduciary income tax problems. Consideration given to gift and estate taxes. Prereq: ACC 417 or consent of instructor.

601 *Research in Accounting Theory.* (3)
Critical examination of accounting concepts and standards. Study of current problems and contemporary developments reflected in accounting literature and reports. Prereq: ACC 302 or consent of instructor.

603 *Attest Function.* (3)
A critical examination of contemporary professional attestation theory and practice including a comprehensive review of AICPA audit case studies, statements on audit procedure, and their application in simulated business situations. Prereq: ACC 403 or consent of instructor.

608 *Advanced Managerial Accounting.* (3)
Accounting procedures for the evaluation of performance in business, including the analysis of revenues and costs by projects and responsibilities and the use of budget cost studies and rates of return. Prereq: ACC 408.

615 *Advanced Professional Problems.* (3)
The application of generally accepted principles to advanced problems of a professional level, including an analysis and study in depth of problems from professional examinations. Prereq: Consent of instructor.

617 *Income Tax Development.* (3)
A theoretical and historical approach to the study of federal income taxation with emphasis upon the public finance, legal and accounting aspects of its development. Consideration will be given to tax research and planning as well as to the critical appraisal of the current law and proposals for its revision. Prereq: ACC 417 or consent of instructor.

619 *Independent Study in Accounting.* (1-3)
Designed for students undertaking special studies to be conducted in regular consultation with the instructor. Prereq: Consent of instructor.

624 *Accountametrics.* (3)
A study of the techniques and methods available to measure and evaluate the response of sub-systems to stimuli within the total systems concept. Both the analytical and computer simulation approaches are used to displace uncertainty associated with typical business problems in which the data are generated by the accounting system. A knowledge of FORTRAN is advisable. Prereq: ACC 202, ECO 391 and permission of instructor.

628 *Accounting for Control and Planning.* (3)
A study of the application of accounting information and services in the recognition or solution of management problems in business. Prereq: ACC 202 or equivalent.

701 *Seminar in Accounting.* (3)
A study of accounting history and contemporary problems. Prereq: Consent of instructor.

795 *Independent Study in Accounting.* (1-6)
Designed for students undertaking special studies to be conducted in regular consultation with instructor. Class hours by appointment. Prereq: Consent of instructor.

BUSINESS ADMINISTRATION

Director of Graduate Study—Philip K. Berger

431 *Contemporary Marketing Problems.* (3)
An examination of selected areas in the field of marketing with a focus on contemporary problems. Emphasis will be placed on individual work by students. Prereq: BA 330.

432 *Marketing Strategy and Planning.* (3)
An examination of and participation in analytical processes for managerial marketing decisions. Topics will include such problem areas as: product planning, distribution systems, advertising strategies, information systems, pricing decisions and buying behavior. Prereq: BA 330 and two other marketing courses.

434 *Market Research.* (3)
Training in the application of scientific method to research in fields of marketing. A major marketing investigation will be undertaken by the class. Prereq: BA 330, ECO 391 or equivalent.

435 *Analysis of Organizational Behavior.* (3)
The behavior of business organizations and their participants is analyzed in the contemporary language of social psychology, systems, and models. Various theories of the firm are reviewed and evaluated. The interdependence of economic, social and behavioral factors is stressed. Prereq: BA 335 or consent of instructor.

439 *Business Policy.* (3)
Analysis of management problems, formulation of alternative courses of action, determination of policy decisions. Prereq: Senior standing, BA 435 or 450, or consent of instructor.

441 *Business Law II.* (3)
A continuation of BA 341. Prereq: BA 341 or consent of instructor.

446 *Investments.* (3)
Analysis of corporation statements for investment purposes; the security market, market influences on security prices; effect of interest changes on security prices; and the development of investment programs. Prereq: ACC 202.

447 *Life Insurance.* (3)
Economics of life insurance; organization and control; special forms of life insurance; and fundamental principles of rate-making. Prereq: ECO 261.

448 *Property and Casualty Insurance.* (3)
Public control; nature of contracts; analysis of reserve functions, and rate-making processes. Prereq: ECO 261.

450 *Quantitative Analysis in Management.* (3)
An introduction to quantitative techniques in management decisions. Includes basic linear programming, Monte Carlo, and waiting line theory. Prereq: BA 335 and ECO 391, or consent of instructor.

456 *World Business.* (3)
Examines the impact of international business upon society from a political, cultural and economic point of view. Particular stress will be given to U.S. business in international operations; its past involvement, present position, and future direction. Prereq: ECO 260-261.

536 *Applied Personnel Management.* (3)
Analysis of the problems, theories and techniques used in recruitment, job analysis, selection decisions, interviewing, performance evaluation, and training in organizations. Prereq: BA 335, ECO 391, or consent of instructor.

537 *Contemporary Problems in Industrial Relations.* (3)
An examination of selected areas in the field of Industrial Relations with a focus on contemporary problems. Emphasis will be placed on individual work by the students. Prereq: BA 536 and ECO 578, or consent of instructor.

556 *International Commercial Policy.* (3)
America's position in the world economy and its international accounts; United States tariff policies, war debts, financial cooperation and investment policy. Prereq: ECO 471. (Same as ECO 571.)

573 *Automatic Data Processing.* (3)
Examination of the role of high speed data processing equipment in the solution of business and economic problems. The study of computer fundamentals; input, arithmetic and logical units, control, storage, and output. Includes digital computer programming. Prereq: Junior standing.

584 *Financial Markets and Institutions.* (3)
Analysis of securities markets, savings and loan associations, insurance companies, pension funds, credit unions, broker-dealer operations and government agencies with particular attention to their role in the flow of funds in the American economy. Prereq: ECO 485.

585 *Bank Management.* (3)
A study of the principles and cases in commercial banking practice. Bank management practices are studied within the economic, monetary, fiscal and legal framework of the American economy. Prereq: ECO 485 or consent of instructor.

630 *Advanced Marketing Management.* (3)
A critical study of significant trends, controversial issues and advanced techniques in the fields of marketing. Prereq: A course in marketing or consent of instructor.

631 *Consumer Behavior.* (3)
An explanation and evaluation of theory and research from the behavioral sciences in order to assess the marketing implications of the various processes and facets of consumer motivation and behavior. Prereq: BA 330 or equivalent.

635 *Managerial Economics.* (3)
Analysis of applications of economic theory to management decision-making. Such problems as demand and cost determination, pricing, and capital budgeting are treated.

636 *Research and Report Writing.* (3)
An introduction to business research and formal report writing. Emphasis is placed on methodology, research design, techniques of analysis, and data sources. The actual writing of research reports is stressed.

637 *Administrative Behavior.* (3)
A critical examination of the principles, methods, policies and procedures related to the effective utilization of human resources in business concerns, consideration being given to mutual relationships.

638 *Comparative International Management.* (3)
A comparison of management concepts and practices in different countries and the role of management in economic development; an interdisciplinary approach emphasizing the impact of sociological-cultural factors, legal-political factors and education on management development. Prereq: BA 335 or consent of instructor.

639 *Advanced Business Management.* (3)
A functional study of business management. Control devices and procedures for carrying out and testing policies.

645 *Corporate Financial Policy.* (3)
A study of financial management from the viewpoint of the corporate financial officer. Problems of planning the capital structure, issuing securities, the management of working capital, and policies with reference to reserves, surplus and dividends. Prereq: A course in business finance or consent of instructor.

646 *Investment Management.* (3)
Evaluation of sources of information and advice concerning securities, methods of analysis and policies of individuals and institutions in the management of investment funds. Prereq: Appropriate undergraduate courses in accounting and finance.

650 *Management Science I.* (3)
Application of mathematical analysis in business decision-making. Includes linear programming, total value analysis, incremental analysis, and other phases of operations research. Prereq: MA 113.

651 *Topics in Optimization.* (3)
A study of topics such as linear programming, duality theory, sensitivity analysis, integer programming, and non-linear programming. Prereq: BA 650, STA 422.

652 *Production Management.* (3)
A study of procedures and techniques employed in manufacturing plants. An analysis of actual cases in production planning and control, time and motion study, quality control, plant layout, and budgetary control. Visits to industrial plants.

656 *International Marketing.* (3)
A comparative approach to marketing systems with emphasis on the adaptability of U.S. marketing policies in overseas areas. The nature of the foreign markets, their growth, distribution systems and government policies. The U.S. firm and its overseas activities, organization structure, management, finance, product policies, physical distribution, promotion and research. Prereq: Consent of instructor.

730 *Seminar in Marketing Theory.* (3)
A survey, analysis and evaluation of the current research in marketing theory. Detailed attention is given to problems of determining the meaning and boundaries of marketing theory. Emphasis is placed on introducing the student to the substantive content of marketing theories and their methodologies. Prereq: BA 630 or consent of instructor.

735 *Administrative Science I.* (3)
Primary emphasis upon the identification and investigation of the schools of thought concerning the field of administration. Analysis of various theory bases for purposes of integration and generalization will also make up a major portion of the course. Prereq: BA 335 or consent of instructor.

736 *Administrative Science II.* (3)
Examination of empirical research on organizational behavior, structure and dynamics. Integration of research and theory and development of modified theoretical approaches. Design of research to test some of the theory. Prereq: BA 735.

750 *Management Science II.* (3)
Continuation of BA 650 to include dynamic programming, game theory, Bayesian Decision Theory, and Monte Carlo techniques. Prereq: BA 650 or equivalent.

751 *Seminar in Management Science.* (3-6)
Each semester some topic in management science such as simulation, queuing theory, stochastic processes, numerical methods, and Bayesian decision theory will be studied intensively. Prereq: BA 651, 750.

761 *Seminar in Managerial Economics.* (3)
Each semester some topic in managerial economics such as cost analysis, capital budgeting, production management, demand analysis, forecasting will be studied intensively. Prereq: BA 635.

762 *Research Methodology.* (3)
This course will deal with the philosophy of science, problems of scientific logic, induction and deduction and the role of theory construction in the behavioral and social sciences. It will emphasize the nature of scientific method and problems in research design.

763 *Research, Design and Analysis.* (3)
This course deals with the design and analysis of business research. Emphasizes the practical application of analysis of variance and correlational techniques to problems in business research. Focus will be on design, implementation, and interpretation of research. Prereq: BA 762.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

771 *Seminar in Business Administration.* (3)
Each semester some topic currently discussed in scholarly journals in business administration will be studied intensively. May be repeated to maximum of 9 credits. Prereq: Consent of instructor.

781 *Independent Work in Business Administration.* (1-6)
Designed for advanced students who undertake research problems to be conducted in regular consultation with the instructor. May be repeated to maximum of 6 credits. Prereq: Consent of instructor.

ECONOMICS

Director of Graduate Study—Richard E. Gift

461 *Market Structure and Anti-Trust Policy.* (3)
A study of the relationship between industry performance and market structure, and the role and effect of the government's anti-trust policies. Prereq: ECO 361 or consent of instructor.

462 *Seminar in Economic Theory.* (3)
An advanced undergraduate seminar in economic theory, including micro and macro. Each semester one or two topics will be selected for intensive study. May be repeated twice for a maximum of six credits. Prereq: ECO 360 and 361, and senior level standing.

463 *Analysis of Business Conditions.* (3)
A study of economic factors causing fluctuations in aggregate economic activity and the methods of forecasting business activity. Prereq: ECO 360 and 391, or equivalent.

465 *Comparative Economic Systems.* (3)
A study of capitalism, socialism, fascism, communism, and cooperation, with attention to current experiments in economic planning. Prereq: ECO 261.

466 *Seminar in Comparative Systems.* (3)
A seminar designed to provide intensive study of the economic theories, institutions, and policies which provide direction and coordination for economic systems—from classical capitalism to authoritarian socialism. The fodcus of the course will be directed toward the latter, in particular the Soviet Union and its East European neighbors. Prereq: ECO 465.

467 *The Economic Evolution of the North Atlantic Community.* (3)
The related development of the European and American economies will be examined within the general framework of economic theory. Major emphasis will be given to the long-run process of economic growth with the period of analysis being from the 16th to the beginning of the 19th century. Prereq: ECO 260 and 261.

468 *Seminar in Economic History.* (3)
An extension of ECO 467 with emphasis being placed on independent study of various aspects of growth and development of the U.S. economy since 1790. Prereq: ECO 467.

469 *History of Economic Thought.* (3)
A study of several of the great ideas in the history of economic thought with special emphasis on the works of Adam Smith, T. R. Malthus, David Ricardo, Karl Marx, and Thorstein Veblen. Prereq: ECO 260-261.

471 *International Economics.* (3)
An analysis of the determinants of the pattern of international trade and the behavior of the international financial system, with careful attention to the problems of government policy in both the highly developed and the less developed countries.

472 *Seminar in International Economics.* (3)
An intensive study of selected problems in contemporary international commerce, with an emphasis upon student research and informal discussion. Prereq: ECO 471.

473 *Economic Development.* (3)
A comparative study of economic progress in selected countries; growth patterns, theories of development and capital formation, interaction of social and economic change. Prereq: ECO 261.

474 *Seminar in Economic Development.* (3)
Application to the principles of economic development to particular cases and issues. Selection of topics based on contemporaneity and student interest, as well as susceptibility to analytical treatment. Prereq: ECO 473.

477 *Labor Economics.* (3)
Insecurity, wages and income, substandard workers, industrial conflict; wage theories; the economics of collective bargaining; unionism in its structural and functional aspects; recent developments. Prereq: ECO 261.

478 *Seminar in Labor Economics.* (3)
The seminar will focus on contemporary issues and problems of economics and social interest in the field of labor economics. An exploration and evaluation of selected topics may include labor law, weapons of conflict, collective bargaining in the public and private sectors of the economy, technology and labor market imperfections, manpower policy, wage determination, and trade union philosophy and development. Prereq: ECO 477 or consent of instructor.

479 *Public Finance.* (3)
A study of public receipts; public expenditures, the principles of taxation with special reference to their application to the tax systems, federal and state. Prereq: ECO 261.

480 *Seminar in Public Finance.* (3)
Selected readings on public finance problems will be discussed in seminar. Prereq: ECO 479.

481 *Collective Bargaining.* (3)
The principles and procedures of bargaining and dispute settlement studied in detail. Includes a review of the content of labor contracts and provisions for administration. Union and management techniques are considered. Prereq: ECO 476 or consent of instructor.

483 *Regional Economics.* (3)
A survey of the major tools, measurements, and theories utilized in studying the regional economy. The topics covered include the basic elements of location theory, regional growth theory, and such economic models as economic base, input-output, and shift-share. Prereq: ECO 360 and 361.

484 *Seminar in Regional Economics.* (3)
A further extension of the basic theoretical framework of regional economics particularly with reference to the spatial and interdisciplinary aspects of the theoretical structure, supervised independent study will concentrate on the application of the theoretic analysis to various policy questions. Prereq: ECO 483.

485 *Monetary Economics.* (3)
A detailed discussion of the financial sector of basic static macroeconomic models, including the views of both the Monetarist and Neo-Keynesian schools. Institutional aspects of the financial system are discussed. The course stresses problems of economic stabilization. Prereq: ECO 360.

486 *Seminar in Monetary Economics.* (3)
Recent developments and contemporary issues in monetary economics. Prereq: ECO 485.

491 *Survey Sampling Design.* (3)
Sampling theory applied to research design and data collection in economics. Covers simple random, stratified random, systematic, and cluster sampling. Prereq: ECO 391 or consent of instructor.

493 *Social and Cultural Determinants of Economic Growth and Development.* (3)
The first part of the course deals with economic variables determining growth and development. The second part deals with the social and cultural forces having a predominant impact upon the variables discussed in part one. The purpose is to emphasize that economic development is a long run concept and depends heavily upon the impact of the social and cultural forces on the economic variables. Prereq: SOC 101; ECO 261. (Same as SOC 493.)

590 *Introduction to Mathematical Economics.* (3)
An introduction to mathematical approaches to economic theory.

Emphasis on linear models, constrained optimization, and techniques used in comparative statics. Prereq: ECO 361; MA 113; or consent of instructor.

592 *Introduction to Econometrics.* (3)
Advanced time series analysis, multiple and partial correlation, elementary analysis of variance and experimental design. Prereq: ECO 291 or consent of instructor.

594 *Transportation.* (3)
Railways, waterways, highways and airways. Rates, services, management and regulation. Prereq: ECO 261.

595 *Social Accounting.* (3)
An analysis of social accounts and use of accounts in creating development plans for underdeveloped and developed economies. Topics include the measurement of national income and its use in development planning; the qualitative and quantitative aspects of a development plan; the planning of economic policy and implementation of economic programs. Prereq: ECO 360 or equivalent.

660 *Advanced Microeconomic Theory.* (3)
An intensive course covering microeconomic theory and its various methodological and analytical techniques. Prereq: ECO 361 or consent of instructor.

661 *Advanced Macroeconomic Theory.* (3)
National income and employment theory, theories of inflation, and problems of economic growth. Prereq: ECO 360 or consent of instructor.

662 *Research Methods and Procedures in Economics.* (3)
The basic procedures and methods of research in economics are considered from the standpoint of their applicability to problem solving and discovery of new scientific facts and generalizations in economics. Definition of the problem, statement of hypothesis, research design, data collection methods, and data analysis constitute the major topics. Attention is given to proper style and preparation of research reports in economics. Prereq: Second semester standing as a graduate student in Economics.

665 *History of Economic Thought I.* (3)
The background and development of English political economy up to 1848.

666 *History of Economic Thought II.* (3)
Main lines of controversy, reconstruction and development in economics since 1848 with an emphasis on the bibliography.

667 *Seminar in Historical Studies in Economic Change.* (3)
Growth and development hypotheses will be tested on a wide range of historical materials drawn from the experience of Western Europe and America as bases for comparative studies in the newer developing regions.

668 *American Economic Change in Historical Perspective.* (3)
A wide range of statistical and historical studies will be used as bases to test various hypotheses concerning economic growth and development in the United States since the Revolution. Prereq: ECO 360 and 361, or consent of instructor.

671 *International Economics Seminar I.* (3)
History and analysis of theories of international trade; theories of international equilibrium and mechanisms of equilibrium adjustments; theory of economic integration. Prereq: ECO 471.

672 *International Conflict and Conflict Resolution.* (3)
A research-oriented seminar on economic and demographic aspects of polemology and on selected topics in welfare economics. Prereq: ECO 360 and 361 or consent of instructor.

673 *Seminar in Economic Development I.* (3)
An intensive study of growth models, with special attention to problems associated with capital accumulation, balanced growth, and low-level equilibrium. Prereq: ECO 475 or equivalent.

674 *Agriculture and Economic Development.* (3)
Analytical consideration of role of agriculture in economic development in relation to overall development strategy at various stages of growth. Theoretical and policy issues of particular relevance to the agricultural development in underedeveloped agrarian economies with various resource, social, political and economic systems. Prereq: ECO 475 or consent of instructor. (Same as AEC 626)

676 *Labor Markets and Wage Determination.* (3)
Economic and social forces determining labor supply and demand, labor force, unemployment, labor mobility; economic and institutional forces determining wages, wage theories and impact of collective bargaining. Prereq: ECO 360 and 361 or consent of instructor.

679 *Seminar in Public Finance I.* (3)
Reading and discussion of current and standard literature on public finance problems and the theory of the public economy. Individual research reports. Prereq: ECO 479, 580 or consent of instructor.

682 *The Economics of Spatial Relations.* (3)
A study of the spatial aspects of the economy with emphasis on location theory in a static equilibrium and dynamic framework. Empirical evidence and public policy considerations are also included. Prereq: ECO 361 or equivalent.

683 *Economics of Growth and Development in Regions and Urban Areas.* (3)
A macroeconomic study of regional-urban growth and development with primary emphasis on the construction of income determination and growth models for an open economy. Prereq: ECO 360 or equivalent.

686 *Advanced Money and Banking.* (3)
A theoretical study of contemporary money and banking institutions with emphasis on central bank functions. Prereq: ECO 485 or equivalent.

687 *History and Theory of Money and Prices.* (3)
The evolution of money, the rise of banking processes, and the causes of fluctuations in the general price level. Prereq: ECO 485.

688 *Mathematical Economics–Micro Theory.* (3)
Consumer behavior and demand, theory of the firm, market equilibrium, optimality criteria and welfare maximization. Selected topics in dynamics. Prereq: ECO 361, MA 113 or equivalent.

692 *Econometrics I.* (3)
Foundations of econometrics. Analysis of linear regression models, including inferences involving linear transformations of random variables, individual degrees of freedom and the analysis of covariance. Statistical forecasting of economic magnitudes. Prereq: ECO 391 and 592 or equivalent.

696 *Soviet Area Economics Seminar.* (3)
Theory and implementation of central planning in Soviet Union and other socialist economies. Special emphasis on East European reform models of socialist planning. Prereq: ECO 360 and 361, or consent of instructor (completion of ECO 496 or equivalent desirable).

760 *Seminar in Microeconomic Theory.* (3)
Recent developments and major issues in contemporary microeconomic theory. Prereq: ECO 660 or consent of instructor.

761 *Seminar in Macroeconomic Theory.* (3)
Recent developments and major issues in contemporary macroeconomic theory. Prereq: ECO 661 or consent of instructor.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

771 *International Economics Seminar II.* (3)
Trade and economic development; determination of international payments equilibrium; econometric studies in world trade; computation of terms of trade; new developments in trade theory. Prereq: ECO 471.

773 *Seminar in Economic Development II.* (3)
Comprehensive survey of the literature on specific aspects of economic development, including industrialization, foreign trade policy, foreign aid, foreign investment, demographic problems, and stimulation and mobilization of savings. Prereq: ECO 475.

776 *Economics of Trade Unionism and Labor Law.* (3)
Origin and growth of labor organizations; trade union philosophy, organization and administration. Foreign labor movements. A detailed analysis of industrial relations and economic security legislation. Prereq: ECO 676 or consent of instructor.

779 *Seminar in Public Finance II.* (3)
Essentially a continuation of ECO 679. Individual research reports. Prereq: ECO 479, 580, or consent of instructor.

783 *Seminar in Regional Economics.* (3)
A critical study of recent extensions in regional economic analysis and regional policy programs. Individual research paper is required. Prereq: ECO 682 and 683.

786 *Seminar in Monetary Theory and Policy.* (3)
A comprehensive and critical analysis of contemporary monetary theory and policy. Prereq: ECO 686 and consent of instructor.

788 *Mathematical Economics-Macro Theory.* (3)
Selected aggregative models treated mathematically. Emphasis on maximization problems for linear systems. Leontief input-output models. Prereq: ECO 360, MA 113 or equivalent.

791 *Problems in Econometrics.* (3)
Empirical estimation of multi-equation models. Bayesian estimation theory and techniques. Non-linear estimation techniques. Supervised empirical work requiring a major research paper. Prereq: ECO 792.

792 *Econometrics II.* (3)
The application of statistical methods to problems of economic analysis. Building and measuring relationships among economic variables. Econometric models of the economy as a whole and of individual sectors. Prereq: ECO 692 or equivalent.

793 *Seminar in Econometrics.* (3)
Comprehensive consideration of current empirical literature. Individual dissertation progress reports and discussion. Prereq: ECO 791 or consent of instructor.

796 *Seminar.* (1-6)
An extended original investigation of some specific topic with a view to giving training in methods of research and studying intensively a particular subject in the field of economics. May be repeated to a maximum of six credits.

797 *Research Problems in Economics.* (1-6)
Students confer individually with the instructor. May be repeated to a maximum of six credits.

Dentistry

Director of Graduate Study—William R. Proffit

The program leading to the Master of Science in Dentistry degree is designed to provide the graduate dentist with clinical proficiency in a specialty area, research experience in a basic biological discipline, and exposure to the fundamentals of teaching in the field of dentistry. At the present time, students pursuing specialty training in the area of orthodontics are eligible for the Master of Science in Dentistry.

Only dental graduates of high academic standing will be accepted into this program, which requires two years of clinical training in orthodontics, integrated with additional basic science and research experience. The first year is largely devoted to clinical training, lectures and seminars. The second and later years will be a continuation of clinical orthodontics, with a high proportion of time devoted to basic science studies, research, and dental teaching techniques.

The program is interdisciplinary in scope and is taught by systems rather than the classic strict subject approach. The participating faculty is from all the clinical departments of the College of Dentistry, from the Medical Center departments of anatomy, pediatrics, psychiatry and behavioral science, and from the University Hospital.

Specific requirements for the Master of Science in Dentistry degree are: (1) satisfactory completion of the clinical certificate program; (2) 30 hours graduate credit, at least half of which must be basic science (non-clinical) courses; (3) submission of an acceptable thesis based on an individual research project and (4) passage of a comprehensive oral examination. Foreign language credit is not required.

ORT 610 *Cranio-Facial Form.* (3)
Applied radiographic anatomy for graduate students in dentistry. Prereq: Admission to graduate dental programs, D.D.S. or D.M.D. degree.

ORT 620 *Oral-Pharyngeal Function, Part I.* (2)
Basic and applied physiology for graduate students in dentistry. Two and a half class hours per week. Prereq: Admission to a graduate program of the College of Dentistry; D.D.S. or D.M.D. degree.

ORT 621 *Oral-Pharyngeal Function, Part II.* (2)
A continuation of ORT 620, emphasizing speech physiology and language development. Two and a half class hours per week. Prereq: Admission to a graduate program of the College of Dentistry; D.D.S. or D.M.D. degree.

ORT 660 *Orthodontic Seminar-Clinic.* (2)
Seminar, laboratory and clinical instruction in orthodontic theory and practice. One and a half class hours per week; 15 laboratory hours per week. Prereq: Admission to graduate program of College of Dentistry; D.D.S. or D.M.D. degree.

ORT 661 *Orthodontic Seminar-Clinic.* (3)
Seminar, laboratory and clinical instruction in orthodontic theory and practice. Three class hours per week; 15 laboratory hours per week. Prereq: ORT 660.

ORT 700 *Orthodontic Seminar.* (1)
Seminar in orthodontic theory and practice for advanced graduate and post-doctoral students in orthodontics; may be repeated to a maximum of five credits. Three class hours per week. Prereq: ORT 660, 661.

ORT 750 *Research in Orthodontics.* (1-5)
Research in orthodontics; maximum of five credits. Prereq: Admission to the orthodontic graduate program of the College of Dentistry, special permission.

ORT 768 *Residence Credit for Master's Degree.* (0)
(1-6 credits equivalence.) Prereq: Admission to the Orthodontic graduate program of the College of Dentistry, special permission.

CDS 550 *Research Methodology and Instrumentation.* (2)
Seminars and laboratory work involving methods of several modern research fields. One class hour, and two laboratory hours per week. Prereq: D.D.S. or D.M.D. degree; admission to graduate dental program; or special permission of instructor.

CDS 611 *Child Growth and Development, Part I.* (2)
A seminar course on nature and physiologic control of physical growth, for graduate students in dentistry. Prereq: Admission to a graduate program of the College of Dentistry; D.D.S. or D.M.D. degree.

CDS 612 *Child Growth and Development, Part II.* (1)
A seminar course for graduate students in dentistry covering emotional and intellectual growth of children, and diseases and congenital anomalies of children. One and one-half class hours per week. Prereq: Admission to graduate program of the College of Dentistry; D.D.S. or D.M.D. degree.

CDS 631 *Dental Care for the Chronically Ill and Handicapped Child.* (2)
A seminar course for graduate students in dentistry dealing with special problems of handicapped children. Two class hours per week. Prereq: Admission to dental graduate programs; D.D.S. or D.M.D. degree.

CD 655 *Practice Environment and Practice Management.* (1)
A seminar course for graduate and post-doctoral students in dentistry, concerning community needs, attitudes and programs for dental services, particularly those provided by specialists. One and one-half class hours per week. Prereq: Admission to graduate programs of College of Dentistry; D.D.S. or D.M.D. degree.

ODM 610 *Developments in Oral Medicine.* (2)
A seminar course for graduate students in dentistry, covering medical implications of dental treatment and current research in oral medicine. Two class hours per week. Prereq: Admission to graduate program of the College of Dentistry.

OP 651 *Patho-Physiology of Oral Disease.* (3)
Seminar course in advanced oral pathology. Three class hours per week. Prereq: Dental degree and enrollment in a graduate program of the College of Dentistry; or permission of the instructor.

OS 651 *Anatomical Relationships in Surgery.* (1)
A seminar course for dental graduate students in areas other than surgery, emphasizing anatomical and surgical principles applicable to all dental specialties. One class hour per week. Prereq: Admission to graduate or post-doctoral programs of College of Dentistry, D.D.S. or D.M.D. degree.

ODO 631 *Principles of Dental Occlusion.* (2)
This course is designed to give the student as broad as possible a view of the complex subject of dental occlusion. Two class hours per week. Prereq: Admission to dental graduate program, D.D.S. or D.M.D. degree.

PER 661 *Modern Concepts in Periodontics.* (2)
A seminar course designed to present the present understanding of the etiology of periodontal disease and current techniques for treatment of periodontal problems. Two class hours per week. Prereq: Admission to graduate programs of College of Dentistry, D.D.S. or D.M.D. degree.

Education

Coordinator of Graduate Study—Morris Cierley

General Statement of Regulations Governing Graduate Work in the College of Education

The College offers the following degrees: Master of Arts in Education, Master of Science in Education, Master of Science (only in the Department of Health, Physical Education, and Recreation), Specialist, and Doctor of Education.

Graduate work is also provided for persons seeking Rank I or II certification.

The two plans which lead to the degree of Master of Arts in Education or Master of Science in Education are Plan A and B.

Plan A

1. A minimum of 24 semester hours of graduate work must be completed and a thesis must be presented.
2. At least 12 semester hours of graduate work must be in education.
3. At least 12 semester hours of graduate work must be in courses numbered 600 or higher.
4. At least 12 semester hours must be outside the field of education, except for majors in higher education, counseling and guidance, and vocational education other than business and home economics education. It is expected that students in these areas will have six hours outside education.
5. No student may satisfy more than one-half of the residence requirements for advanced degrees by part-time work. This limitation does not apply to intensive courses.
6. The total number of credits presented in education, undergraduate and graduate, must be at least 30 semester hours. (Exception in Higher and Adult Education.)
7. A standing of 3.0 (an average of B) or better must be made on all graduate work.
8. Six semester hours (if approved by the graduate adviser) may be completed in off-campus study (that is, extension work from the University of Kentucky).
9. The Graduate Record Examination is required of all candidates for graduate degrees. It is to be taken the first semester the student is enrolled as a full-time student in the Graduate School. The National Teachers Examination is required of all candidates for the degree of Master of Arts in Education or Master of Science in Education except in the fields of Higher Education and Rehabilitation Counseling. In exceptional cases an additional examination, either written or oral may be required. These examinations are to be taken just prior to or during the session in which the degree is to be conferred.
10. Students should meet the requirements for a teaching certificate. If deficiencies are found, they should be overcome before proceeding with graduate work. The work required to overcome these deficiencies is in addition to the minimum graduate requirements for the degree. (Exception in Higher Education and Rehabilitation Counseling.)
11. Students must be admitted to full-graduate standing before or during the semester during which they have earned 15 hours of graduate credit. They will not be so admitted without satisfactory scores on the Graduate Record Examination.

Plan B

1. A minimum of 30 semester hours of graduate work must be completed.
2. At least 12 semester hours of graduate work must be in education.
3. At least 15 semester hours must be in courses numbered 600 or higher. (See requirements 4 through 11 in Plan A for remaining requirements.)

Each student's graduate curriculum must be a well-rounded program of courses related to the student's major interest and approved by the adviser. In cases of deficient preparation the adviser, with the approval of the Dean, determines prerequisite undergraduate courses to be taken. Each department has designated one or more faculty members to direct graduate studies in that department. Specific questions regarding programs may be referred to the Directors of Graduate Study listed in that section of this Bulletin.

Education 099—This is a non-credit seminar required of all graduate students in education the first semester or summer session they are registered for full-time study. This course meets for only one session.

Specialist Degree in Education

The Specialist Degree program is available to those students who wish to continue their graduate work for further specialization in a particular field. To be eligible for admission one must hold a Master's Degree, or equivalent in the field in which specialization is sought. The program is planned by a committee, and at least one-half the program must be completed **after** formal admission.

Application should be made to the Coordinator of Graduate Studies in Education, or to the department in which the applicant proposes to major.

Doctor of Education Degree

The Doctor of Education Degree provides for a major in one of seven fields as follows:

1. Administration and Supervision
2. Curriculum and Instruction
3. Educational Psychology and Counseling
4. Higher and Adult Education
5. Social and Philosophical Studies in Education
6. Special Education
7. Vocational Education

Each program shall provide for study in at least one supporting discipline outside education. A component of not less than nine hours in research tools is required.

Ph.D. Degree in Education

As materials for this Bulletin go to press two departments have Ph.D. program proposals going forward for review. Persons interested in this degree should inquire of the departments concerned.

Planned Fifth-Year Program

By action of the Council on Public Higher Education and the State Board of Education, all provisional teaching certificates issued after 1967 on the basis of a four-year program and a bachelor's degree are valid for an initial period of ten years and shall be renewed either upon completion of a master's degree or a planned Fifth-Year Program of college work. Conditions of the Planned Fifth-Year Program are outlined below.

Candidates for admission must be graduates of accredited four-year institutions and hold a valid teaching certificate.

The program must be completed within ten years. Grades of C or better are required in all work applied to the program.

Thirty-two semester hours must be completed under the supervision of an adviser.

At least 18 semester hours must be earned at the University of Kentucky.

At least 12 hours must be in graduate courses.

At least 12 semester hours must be in professional education.

At least 12 hours must be in disciplines other than education.

ADMINISTRATION AND SUPERVISION

Director of Graduate Study—Charles F. Faber

The Department of Administration and Supervision offers programs leading to the Specialist in Education (Ed.S.) degree and the Doctor of Education (Ed.D.) degree. These advanced degree programs are designed to prepare candidates for leadership positions in public schools and other educational agencies or for the professorship in educational administration.

In addition, the Department also offers programs leading to professional certification and to Rank I classification (for Kentucky salary purposes) for various types of administrative and supervisory positions, including superintendent of schools, elementary principal, secondary principal, supervisor of instruction, and director of pupil personnel. All certification programs require that the candidate must have earned a master's degree in an appropriate teaching field prior to completion of the program in administration and supervision.

For further information, write to the Director of Graduate Studies in the Department of Administration and Supervision for one or more of the following sets of materials.

1. Admissions Procedures and Forms
2. Requirements for Professional Certificate and Rank I Programs
3. Requirements for the Degree of Specialist of Education
4. Information on Doctoral Study in Administration and Supervision

5. Summer Workshops for Educational Leaders

502 *The Administration of Pupil Personnel.* (3)
Administrative problems relating to child accounting, including school census, attendance records and reports, social and economic factors affecting school attendance, and duties and responsibilities of school and non-school personnel and agencies.

601 *Administration of Educational Organizations.* (3)
A study of the historical development of educational administration, administrative processes, the application of theory and values in decision-making and an introduction to modern management methods applied to education.

602 *Organization and Administration of American Education.* (3)
An analysis of the administration of local, state and federal education agencies and their relationships. A study of the administrative tasks in these agencies.

603 *Constitutional and Legal Basis of Public School Administration.* (3)
A study of court decisions to discover the legal principles involved in practical problems of school administration. Prereq: Admission to program in Administration and Supervision.

604 *School Buildings and Equipment.* (3)
Measurement and evaluation of existing school building facilities, planning new buildings, determining suitable equipment, and financing the building program. Prereq: Admission to program in Administration and Supervision.

608 *Internship in Educational Administration and Supervision.* (3)
Field experiences are provided for prospective administrators under the cooperative supervision of University personnel and principals, supervisors, and superintendents in Kentucky public school systems. May be repeated once to a maximum of six credits. Prereq: Admission to program in Administration and Supervision.

628 *Field Studies in Educational Administration and Supervision.* (3)
Study and evaluation of the major areas of school operation in actual field situations. Emphasis upon the synthesis of knowledge through surveying, evaluating and developing recommendations for the improvement of the school operation. Prereq: Consent of instructor.

629 *The Principal.* (3)
An analysis of the building unit as a sub-system within a larger complex organization. Special emphasis on the changes in the role of the principal as a result of changes in society and in the schools. Prereq: Admission to Department program or consent of instructor.

633 *Administration and Supervision of Instructional Programs.* (3)
A study of the role of organizational leadership in the development of instructional goals, instructional programs, evaluation procedures and procedures for educational changes.

634 *Administration of Educational Personnel.* (3)
Consideration of the motivation and management of educational personnel with special emphasis on the professional in complex organizations. Attention is given to the theory and practice of collective bargaining in education.

635 *Business Administration and Finance of Public Education.* (3)
A course for prospective superintendents. Emphasizes school support, including state, local, and federal revenues; budgetary policy; procedures for purchasing, accounting, and reporting costs; management of funds, property, equipment, and supplies; payroll procedures, records and reports.

639 *The Supervisor.* (3)
A study of the role of the supervisor of instruction as part of administrative leadership in improving instructional programs with special emphasis on in-service education of staff. Prereq: Admission to program or consent of instructor.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (One to six credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (One to 12 credits quivalence.)

771 *Seminar in Administration.* (1-3)
A variable topic seminar on selected problems in school administration. Activities designed to improve skill in planning, decision-making, organizing, communicating, evaluating, negotiating, and resolving conflict will be provided as appropriate. Educational innovations and processes of implementing change may be analyzed. May be repeated to a maximum of six credits. Prereq: Admission to program or consent of instructor.

772 *Seminar in Education.* (1)
A course planned for graduate students majoring in education, given under the direction of the faculty of the College of Education. May be repeated once to a maximum of two credits.

785 *Independent Work in School Administration.* (3)
Includes research on a practical problem in school administration. Open only to students with at least one semester of graduate work in education. Prereq: Consent of instructor. May be repeated once to a maximum of six credits.

792 *Research in Educational Administration and Supervision.* (3)
Critical examination of representative research studies in administration and related fields. Emphasis upon the students' defining and delimiting an appropriate problem in Educational Administration and Supervision, generating a design appropriate to the problem and selecting appropriate techniques of analysis. Prereq: Admission to program.

CURRICULUM AND INSTRUCTION

Directors of Graduate Study
Harry Barnard—Secondary Education
James Moore—Elementary Education
Earl Rankin—Reading

Master of Arts Degree in Elementary Education

For a Master of Arts in elementary education, a minimum of 12 semester hours of graduate work shall be selected from at least three of the following areas of professional education in accordance with the needs of the individual teacher. This program qualifies the teacher for a Standard Certificate if he has completed the four-year undergraduate curriculum. The specific courses listed below under each area shall be used to meet the requirements:

Area I. Research Methodology
- EDP 522 Educational Tests and Measurement
- EDP 656 Methods of Educational Research
- EDP 657 Educational Statistics

Area II. The Psychology of Learning
- EDP 548 Educational Psychology
- EDP 658 Problems in Educational Psychology

Area III. Foundations in Education
- EDF 640 Philosophy of Education

EDF 645 Foundations in Education
EDF 650 History of Western Education
EDF 651 History of Education in the United States
EDF 661 Educational Sociology

Area IV. A Seminar in Instruction Devoted to the Method of Teaching. Any general course in methods or any specific course in methods in subject matter areas may be taken to meet this requirement.

Area V. A General Study of Curriculum Development.
EDC 712 The Elementary School
EDC 732 Principles of Curriculum Construction

Area VI. Advanced Study in Human Growth and Development
EDP 600 Human Development and Behavior
EDP 759 Identifying and Providing for Individual Student Needs

Area VII. Advanced Study in Reading (required unless waived on basis of previous advanced study in reading)
EDC 540 The Analysis and Correction of Reading Disabilities
EDC 619 Diagnosis of Reading Disabilities*
EDC 620 Reading Remediation*
EDC 641 A Study of Research and Theory in Teaching Reading in Elementary School
EDC 642 A Study of Research and Theory in Teaching Language Arts in the Elementary School

*Enrollment in these courses should be limited to reading majors only.

Master of Arts Degree in Secondary Education

For a Master of Arts degree in secondary education, a minimum of 12 semester hours of graduate work shall be selected from at least three of the following areas of professional education in accordance with the needs of the individual teacher. This program qualifies the teacher for a Standard Certificate if he has completed the four-year undergraduate curriculum.

Area I. Research and Methodology*
EDP 522 Educational Tests and Measurements
EDP 656 Methodology of Education Research
EDP 657 Educational Statistics

Area II. The Psychology of Learning**
EDP 548 Educational Psychology
EDP 602 Human Cognitive Learning
EDP 658 Problems in Educational Psychology

Area III. Foundations in Education*
EDF 640 Philosophy of Education
EDF 645 Foundations in Education
EDF 650
or
EDF 651
or
EDF 652 Any course in the History of Education
EDF 655 Education in Other Nations
EDF 661 Educational Sociology

Area IV. A Seminar in Instruction Devoted to the Method of Teaching*
Any general course in methods or any specific course in methods in subject matter areas may be taken to meet this requirement.

Area V. A General Study of Curriculum Development
EDC 714 The Secondary School (for secondary school teachers only)*
EDC 717 The Junior High School (for junior high school teachers only)
EDC 732 Principles of Curriculum Construction*
EDC 735 The Core Program in the Secondary Schools

Area VI. Advanced Study in Human Growth and Development**
EDP 600 Human Development and Behavior
EDP 601 Human Social Development
EDP 759 Identifying and Providing for Individual Student Needs

Area VII. Advanced Study in Reading
ERC 540 Analysis and Correction of Reading Problems in the Classroom
EDC 643 A Study of Research Theory in Teaching Reading in the Secondary School
EDC 646 Organizing Reading Programs
EDC 619 Diagnosis of Reading Disabilities
EDC 620 Reading Remediation

(Enrollment in EDC 619 or EDC 620 is normally limited to Reading majors; however, other students may be admitted by the consent of the instructor.)

* If a student's ultimate career objectives are in the areas of Administration and Supervision, a course from each of these areas is required.

** At least one course from either Area II or Area VI, or an equivalent course outside Education, is required for Administration and Supervision Programs.

Master of Arts Degree In Elementary Or Secondary Education with Reading As An Area of Concentration

Requirements for a Master of Arts degree in elementary or secondary education with reading as a field of concentration must meet the specifications for a Master of Arts degree in Education (Plan B). The requirements must also be in conformity with the general requirements for the Master of Arts Degree in Elementary Education, or the Master of Arts Degree in Secondary Education.

In addition to the previously mentioned requirements, a graduate student in elementary or secondary education who wishes to specialize in the area of reading instruction must meet the Kentucky certification guidelines for endorsement as a "reading specialist." This endorsement will be added to a classroom teaching certificate upon completion of a master's degree program with emphasis in reading which follows a specified period of preparation. The guidelines for this endorsement are as follows:

1. The prerequisites shall include:
   a. A teaching certificate based upon the completion of a four-year program of preparation.
   b. The completion of an approved master's degree program with emphasis in reading following the curriculum guidelines.
   c. A minimum of three years of successful classroom teaching; however, one year of equivalent work which includes clinical experience may be substituted for one year of classroom teaching.
2. The endorsement for reading specialists shall be valid for the same teaching level as the basic teaching certificate which is endorsed.
3. The curriculum shall include an emphasis in reading and a minimum of 30 semester hours preparation according to the following distribution:
   a. A minimum of 12 semester hours credit in graduate level reading courses with at least one course in each of the following:
      EDC 641 A Study of Research and Theory in Teaching Reading in the Elementary School (for elementary majors)
      or
      EDC 643 A Study of Research and Theory in Teaching Reading in the Secondary School (for secondary majors)
      EDC 619 Diagnosis of Reading Disabilities
      EDC 620 Reading Remediation
      One three credit hour reading course at the 600 or 700 level as an elective.
   b. A minimum of six semester hours credit in Education courses selected from the alternatives specified under two different areas (I through VI) as listed in the requirements for the Master of Arts Degree in Elementary Education, or the Master of Arts Degree in Secondary Education.
   c. A minimum of 12 semester hours credit in courses (400 level or above) taken from areas outside the College of Education. These courses must be taken from the following areas:
      (1) Sociology
      (2) Speech and Hearing
      (3) Learning Theories
      (4) Perception
      (5) Communication
      (6) Linguistics
      (7) Literature for Children (for elementary majors)
      or
      (8) Literature for Adolescents (for secondary majors)
      (9) Personality
      (10) Mental Hygiene
      (11) Tests and Measurements
      (12) Child or Developmental Psychology (for elementary majors)
      or
      chology (for secondary majors)
      (13) Adolescent or Developmental Psychology (for secondary major)

521 *Materials and Methods in Teaching Mathematics in the Secondary School.* (3)
A course emphasizing the methods and materials used in teaching secondary school mathematics, including simulated teaching of selected topics from arithmetic, algebra, geometry and upper level school mathematics. Prereq: EDC 344.

522 *Materials and Methods in Teaching Social Studies in the Secondary School.* (3)
A course for prospective secondary school social studies teachers in the utilization of materials, resources, equipment and techniques appropriate for modern teaching strategies. Prereq: EDC 344.

524 *Materials and Methods for Teaching Science in the Secondary School.* (3)
A course designed to provide practical experience in curriculum materials and methods for the development of teaching models in secondary school science. Prereq: EDC 344.

525 *Materials and Methods of Teaching English in the Secondary School.* (3)
A course designed to develop frames of reference from which to make appropriate selection of materials and methods for the teaching of secondary school English. Prereq: EDC 344.

533 *Teaching Reading in the Secondary School.* (3)
A study of current methods and materials useful in teaching reading in secondary schools with particular emphasis on the improvement of reading in the content areas.

538 *Advanced Arts and Crafts in the Elementary School.* (3)
Planned to give the elementary teacher an understanding of teaching methods involved in, and construction of, art activities which would enrich the classroom program.

539 *The Elementary Curriculum.* (3)
The philosophy and techniques of curriculum construction and some practical work in construction.

540 *Analysis and Correction of Reading Problems in the Classroom.* (3)
A study of current methods and materials useful in the analysis and treatment of reading problems in the classroom. Students will observe and participate in the diagnosis and treatment of corrective reading problems. Prereq: EDC 329 or 533.

542 *Children's Literature.* (3)
Planned to acquaint students with literature for children, kindergarten through grade eight. Review of interests at different ages. Discussion of types of literature—folklore, modern fairy tales, myths and legends, realistic stories, biography, and poetry.

543 *Teaching in the Kindergarten.* (3)
The nature, development, and education of the child of kindergarten age. Organization, equipment, curriculum, and procedures used with children of this age. Regular periods are scheduled for observing and participating in the kindergarten.

544 *Utilization of Educational Media.* (3)
Surveys the broad area of educational media with an emphasis on utilization and the advantages and disadvantages of the various media. Provides experience in relating educational technology to productive learning activity. (Same as LS 586.)

545 *Preparation of Instructional Materials.* (3)
Develops a basic pattern for the preparation of a wide variety of instructional materials. Laboratory practice is provided for the production of materials for projected and non-projected use. Sources of free and inexpensive materials will be identified and evaluated. Lecture, two hours; laboratory, two hours.

546 *Introduction to Early Childhood Education.* (3)
Survey of early childhood educational programs with emphasis on principles, purposes, values and contemporary problems. A study of current literature and research related to these aspects for developing programs for young children. Prereq: Permission of instructor.

549 *Sociological Aspects of Mass Communication.* (3)
The relationship between the organization of modern society and its communication media: Special emphasis is given the way in which cultural processes and social change have an impact upon the mass media, and upon the way in which the mass media influence cultural processes and social change. The social-psychological bases of communication are studied within a context of theory and research. Prereq: Six hours of Sociology; SOC 101. (Same as SOC 549.)

550 *Teaching the Disadvantaged.* (3)
A critical study of the concept of disadvantagement, relevant teaching practices, institutional programs, and curricula.

552 *Modern Educational Problems.* (3)
A brief survey of some of the problems in modern education.

562 *Modern Educational Problems.* (3)
A brief survey of some of the problems in modern education.

563-576 *Modern Educational Problems.* (3 ea.)
A brief survey of some of the problems in modern education. Subtitles for each course follow:

563 *Modern Educational Problems.*
(General Elementary Curriculum)

564 *Modern Educational Problems.*
(General Secondary Curriculum)

565 *Modern Educational Problems.*
(General Curriculum)

572 *Modern Educational Problems.*
(Vocational Education)

575 *Modern Educational Problems.*
(Unclassified)

576 *Modern Educational Problems.*
(Unclassified)

596 *Science in the Elementary School.* (3)
A background of elementary science usable with children in the first six grades. Includes planning units of work, organizing and using materials and references, making bibliographies for teachers and children, use of illustrative materials, and excursions.

600 *Workshop in Reading.* (1-3)
An intensive workshop dealing with materials and techniques in teaching reading. Study of new techniques, examination of materials; lectures by specialists. Class hours per week one to three weeks, eight hours per day. May be repeated for a maximum of three hours. Prereq: Undergraduate degree.

606 *Instructional Television in the Classroom.* (3)
Emphasizes the classroom utilization of instructional television. Includes the psychology of listening; problems of evaluation; the writing, producing, and scheduling of school telecasts; and the sources of telecasting for school use. Research studies in the area will be investigated.

607 *Programmed Instruction in the Classroom.* (3)
Investigates aspects of programmed instruction in its various levels of complexity. Studies programmed books, "teaching machines", computerized instruction, and the systems approach to instruction. Emphasis is placed upon research in the area.

619 *Diagnosis of Reading Disabilities.* (3)
Clinical techniques for the diagnosis of reading disabilities. A course designed to develop both theoretical understandings and operational skills in clinical diagnosis of reading problems. Lecture, two hours, laboratory, two hours. Prereq: EDC 540 or permission of instructor.

620 *Reading Remediation.* (3)
Clinical techniques used in the remediation of reading problems. A course designed to develop individualized remedial procedures related to diagnosis. Lecture, two hours, laboratory, two hours. Prereq: EDC 619, or permission of instructor.

641 *A Study of Research and Theory in Teaching Reading in the Elementary School.* (3)
A systematic study of the research and theory and their application to the teaching of reading in the elementary school. Attention will be given to new developments in the field. Prereq: EDC 329; work in linguistics.

642 *A Study of Research and Theory in Teaching Language Arts in the Elementary School.* (3)
A systematic study of the research and theory and their application to the teaching of listening, oral and written communication, spelling,

and handwriting in the elementary school. Attention will be given to new developments in the field. Prereq: EDC 329; work in linguistics.

643 *A Study of Research and Theory in Teaching Reading in Secondary Schools.* (3)
A systematic study of the research and theory and their application to the teaching of reading in the secondary schools. Attention will be given to new developments in the field. Prereq: EDC 533; work in linguistics.

646 *Organizing Reading Programs.* (3)
Procedures in establishing and administering reading programs in elementary and secondary schools. Lecture, two hours; laboratory, two hours. Prereq: Nine hours of graduate reading courses.

650 *A Study of Research and Theory in Teaching the Disadvantaged.* (3)
An ordered examination of the research and theory developed for teaching disadvantaged children and adolescents. Particular emphasis will be placed on research and theoretical developments in the field. Prereq: EDC 550.

670 *Advanced Study in the Teaching of Elementary School Mathematics.* (3)
New developments in modern elementary mathematics for teachers in the elementary schools will be reviewed. Special emphasis will be given to a study of new teaching methods, application of published research, techniques and trends in mathematics in the elementary school. Prereq: Graduate standing.

680 *Internship in Teacher Education.* (6)
A required component of the special Five Year Program for elementary, junior high and senior high teachers, this course is an on-the-job laboratory experience in which a teacher with a Provisional Certificate works under the direct supervision of a coordinator from the Department of Curriculum and Instruction. May be repeated once to a maximum of 12 credits. Prereq: Graduate student; admission to a specially designed program in Teacher Education.

712 *The Elementary School.* (3)
Recent research and modern trends in teaching the skills and content subjects in the elementary school. Planned for supervisors, superintendents, principals, and teachers for better understanding of a modern elementary school.

714 *The Secondary School.* (3)
A course designed to acquaint the secondary teacher and the administrator with the nature and function of the secondary school.

717 *The Junior High School.* (3)
A study of the unique functions of the junior high school. Scope and sequence of the curriculum, school organization and guidance as related to the young adolescent will be considered. A course for principals, supervisors, teachers.

724 *Organization and Supervision of Student Teaching.* (3)
A course designed for teachers preparing to become supervising teachers. The basic principles apply both to elementary and secondary education. Includes a presentation of the experiences deemed important in developing students into effective teachers.

730 *Problems of the School Curriculum.* (3)
Problems in the field of the school curriculum and in the preparation of instructional materials. Students enrolling in this course are required to leave on file with the College of Education a complete report to each problem studied. May be repeated once to a maximum of six credits.

732 *Principles of Curriculum Construction.* (3)
Study of basic principles of curriculum development. Relationship of social and psychological factors to curriculum change. Survey of current approaches to curriculum organization. Consideration of means of curriculum development in school systems.

735 *The Core Program in the Secondary Schools.* (3)
Deals with the philosophical and psychological bases of the core program and gives major emphasis to problems of teaching in the core class. A course designed for teachers, principals, supervisors.

740 *Practicum in Teaching Reading and Related Language Arts.* (3)
Supervised practicum in analyzing problems in reading and related language arts and providing remedial work. Requires six hours per week in practicum with individual children or groups, plus two hours per week in seminar. May be repeated once to a maximum of six credits. Prereq: EDC 619 and 620.

745 *Administration of Educational Media Programs.* (3)
Stresses the operation of educational media programs considering budgeting, training of personnel, duties of staff, sources of materials, and the purchase of equipment. Previews are made of many educational media and attention is given to the special needs of the Instructional Materials Center.

746 *Motion Pictures in Education.* (3)
The history of the educational motion picture, technique in the use of films, educational scenario writing, grading and scoring films, and motion picture appreciation.

747 *Seminar in Reading.* (3)
A seminar for advanced graduate students. Critical discussion of theory and research under investigation by graduate students and faculty. Prereq: Twelve hours of graduate reading courses. May be repeated once.

748 *Psychology of Reading.* (3)
A systematic examination of the psychological basis of the reading process. A study of psychological theory and research related to reading. Prereq: Twelve hours of graduate reading courses.

750 *Administration and Supervision of Public School Music.* (3)
A study of current trends in school music, curricula, testing programs, and other supervisory procedures. Offered either as an education course or as a music course using same number. (Same as MUS 750.)

751 *History and Philosophy of Music Education.* (3)
A historical survey of thought concerning the place and significance of music in the education of the individual and the group. (Same as MUS 751.)

757 *College and Adult Reading.* (3)
The study of the reading process as it pertains to college students and adults. Emphasis will be placed on principles and procedures for teaching reading to this age group. Prereq: Permission of instructor.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (One to six credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely (One to 12 credits equivalence.)

777 *Seminar in Curriculum and Instruction (Subtitle required).* (1-3)
A critical analysis of recently developed materials and techniques in Curriculum and Instruction for pre-college education. Includes analysis of evaluative research related to new materials and techniques. May be repeated for a total of nine credits. Prereq: Consent of instructor.

780 *Independent Work in Elementary Education.* (2)
An independent work course for students who have done a minimum of twelve semester hours of graduate work including EDC 712 or EDA 629. May be repeated once to a maximum of four credits.

781 *Independent Work in Secondary Education.* (3)
An independent work course for students who have done a minimum of twelve semester hours of graduate work including EDC 714; EDA 630. May be repeated once to a maximum of six credits.

790 *Research Problems in Secondary Education.* (3)
An independent research course. Students confer individually with the instructor. Prereq: One year of graduate work. May be repeated once to a maximum of six credits.

791 *Research Problems in Elementary Education.* (3)
An independent research course. Students confer individually with the instructor. Prereq: One year of graduate work. May be repeated once to a maximum of six credits.

EDUCATIONAL PSYCHOLOGY AND COUNSELING

Director of Graduate Study—James Barclay

Master of Arts Degree In Education—Guidance and Counseling

The introductory statement pertaining to the Master of Arts degree for teachers does not apply in Guidance and Counseling. However, any person who has the master's degree in Guidance and Counseling and who wishes to qualify as a school administrator must first meet all requirements for the Master of Arts for teachers.

The Elementary and Secondary Guidance and Counseling Programs are designed to prepare individuals with a teaching certificate for guidance and counseling work. Ordinarily, applicants for these programs will have a regular teaching certificate at the elementary or secondary level, and one year of teaching experience. Applicants lacking these qualifications should expect to complete teacher education and a one-year internship at the appropriate level. The degree will be a Master of Arts in Education.

The curriculum for the master's degree matches the State guidelines in the areas of elementary counseling, secondary counseling, and psychometrists. These programs provide learning experiences in each of the required competency areas. They vary from 33 to 34 graduate hours in addition to six to nine hours of course prerequisites in introductory psychology, testing, and in some instances, personality theory.

For further information contact the Director of Graduate Studies in the Department of Educational Psychology and Counseling.

The Ed.S. Degree Program Counseling and Guidance

(30 semester hours required)

Required: 15-21 hours from the following, in addition to the courses required for the master's degree in Counseling and Guidance.

EDP 640 Practice in Testing: Intelligence Tests 3
EDP 657 Educational Statistics 3
EDP 661 Supervised Practice in Counseling (May be repeated to a maximum of nine hours) 3
EDP 666 Occupational and Educational Information in Guidance 3
EDP 762 Organization and Administration of Guidance Services 3
EDP 763 Research and Evaluation in Guidance 3
EDP 777 Seminar in Counseling and Guidance (May be repeated to a maximum of six hours) 3

Electives: Six to nine hours outside of Education (to be approved by adviser).

Research: Three to six hours in independent research as approved by adviser.

Master's Degree Program in Rehabilitation Counseling

This curriculum was designed in accordance with guidelines provided by the national professional associations in rehabilitation counseling. Successful completion of the program fulfills the Kentucky certification requirements in rehabilitation counseling. It does not meet certification requirements for school counseling.

Required courses:

ANA 206 Elementary Anatomy
EDS 527 Survey of Physical and Neurologi- Defects
EDP 521 Introduction to Vocational Rehabilitation
EDP/PSY 640 Practice in Intelligence Testing
EDP/PSY 641 Psychological Measuring Instruments
EDP 652 Counseling Theory and Techniques
EDP 657 Educational Statistics
Either EDP 656 Methodology of Educational Research
or
EDP 659 Advanced Educational Measurement
EDP 661 Supervised Practice in Counseling
EDP 664 Psycho-Social Aspects of Disability
Either EDP 666 Occupational and Educational Information in Counseling
or
EDP/EDV 702 Career Development: Research, Theories, Practices
EDP 665, EDP 777, EDP 782 } Internship Block to be Taken in the Last Semester

Electives: These include nine hours outside Education to be approved by adviser, generally to make up an area of personality, social, and

abnormal psychology. If the student already has an adequate background in those courses, he may choose from related courses such as sociology, social work, or anthropology.

518 *Mental Hygiene.* (3)
A general orientation to the subject of mental hygiene, its historical development, its scope and relation to various sciences. The individual and cultural determinants of behavior will be discussed. Prereq: PSY 104 and 106, or 210, or EDP 202. Not open to students who have had CH 520. (Same as PSY 518.)

519 *The Elementary School Pupil.* (2)
The psychology of the child in the primary and intermediate grades. Prereq: One course in Psychology.

520 *The Secondary School Pupil.* (3)
The psychology of the pupil in junior and senior high school. Prereq: One course in Psychology.

521 *Introduction to Vocational Rehabilitation (Counseling and Guidance).* (3)
Survey of vocational rehabilitation: historical, legal, and administrative aspects of rehabilitation services; survey of rehabilitation services; and the role of the counselor in rehabilitation process.

522 *Educational Tests and Measurements.* (3)
Problems of measurement in the school program with special emphasis on standardized tests. General principles of test construction, teacher-made tests, examinations, criteria of evaluation and marking systems.

548 *Educational Psychology.* (3)
An introduction to the application of principles of psychology to classroom learning and teaching problems.

600 *Human Development and Behavior.* (3)
Child and adolescent study as related to the physiological, social and psychological bases of human behavior. Critical evaluation of current theories of human development.

601 *Human Social Development.* (3)
Survey of current research and theory regarding motor skills, social development, initiation, dependency, aggression, affiliation, moral development and peer group behavior. Prereq: EDP 600 or consent of instructor.

602 *Human Cognitive Learning.* (3)
Development of cognitive processes. Review and evaluation of current research in attentional processes, concept-formation, perception, and problem-solving. Prereq: EDP 600 or equivalent.

605 *Fundamentals of Guidance.* (3)
A survey of guidance philosophy, procedures and practices; role of the counselor in relation to guidance services in the educational setting.

640 *Practice in Testing: Intelligence Tests.* (4)
This course provides theoretical material and advanced laboratory practice in the measurement of intelligence by individual techniques. Lecture, three hours; laboratory, two hours. Prereq: PSY 535 or EDP 653 or equivalent and consent of instructor. (Same as PSY 640.)

641 *Psychological Measuring Instruments.* (3)
A study is made of a wide variety of psychological tests including group intelligence tests, personality and interest inventories, area aptitude tests, and special aptitude tests. (Same as PSY 641.) Prereq: PSY 201 or EDP 522 and EDP 657.

649 *Group Guidance Problems and Practices.* (3)
An overview of the theoretical bases and practical procedures used in the selection, organization, and effective use of group dynamics in the facilitation of educational goals. Prereq: EDP 605 and consent of instructor.

650 *Diagnosis and Counseling in Counseling Psychology.* (3)
An advanced course in diagnosis and application of theories, techniques and tools in counseling psychology. Prereq: A graduate major in Psychology or Educational Psychology and Counseling and consent of instructor. (Same as PSY 650.)

652 *Counseling Theory and Techniques.* (3)
Study of principles, techniques and theoretical bases of the counseling process. Practice in interviewing, use of case studies, simulated problems, observational techniques and tests. Prereq: EDP 600, 605 and PSY 501 or equivalent.

653 *Appraisal Procedures in Guidance Practice.* (3)
Introduction to assessment procedures utilizing observational and group testing techniques. Study of use and interpretation of group guidance instruments. Prereq: EDP 605.

656 *Methodology of Educational Research.* (3)
An introduction to research methods applicable to education; the scientific method, research designs, measurement techniques, statistical analysis, and writing the research report.

657 *Educational Statistics.* (3)
A study of the applications of statistical and graphical methods to educational data. Basic descriptive statistics, correlation, the normal distribution, and hypothesis testing will be covered.

658 *Problems in Educational Psychology.* (3)
A critical survey of the psychological theories and research applicable to educational practices. Prereq: One year of Psychology.

659 *Advanced Educational Measurement.* (3)
Theory and application in educational measurement with emphasis on the appropriate selection, administration, and interpretation of standardized tests used in educational assessment. Prereq: EDP 522 or equivalent.

660 *Research Design and Analysis in Education.* (3)
A study of the research methodologies applicable in the several aspects of education. Emphasis is on the design of research and analysis of accumulated data. Prereq: EDP 657.

661 *Supervised Practice in Counseling.* (3)
Supervised practice in counseling in the setting in which the student plans to work. Requires eight hours a week in actual counseling plus a minimum of two hours weekly in seminar. May be repeated twice to a maximum of nine credits. Prereq: EDP 600, 605, and consent of instructor.

664 *Psycho-Social Aspects of Disability.* (3)
Investigation of psychological and social reactions to the onset of disability and adjustments as related to personality variables and minority group membership. Implications for job placement and vocational adjustment counseling. Two hours of lecture; three hours of laboratory. Prereq: EDP 521.

665 *Practicum in Counseling Psychology.* (3)
Supervised experience in application of diagnostic and interviewing techniques in a counseling service. May be repeated three times to a maximum of 12 credits. Prereq: PSY 522.

666 *Occupational and Educational Information in Guidance.* (3)
Collective, evaluation, organization and information retrieval processes in counseling regarding current job information, supply and demand, working conditions, entry requirements and career fields.

701 *Behavior Modification in Education.* (3)
A comprehensive theoretical review and practical experience in behavior modification techniques; observational, strategy formation approaches, and evaluative procedures stressed. Prereq: 15 hours of work in Educational Psychology or Counseling, or consent of instructor.

702 *Career Development: Research, Theories and Practices.* (2-3)
Overview of theories of career development and current research. Emphasis on use of vocational assessment techniques in counseling and decision-making. Prereq: EDV 523. (Same as EDV 702.)

707 *Multivariate Analysis in Educational Research.* (3)
A study of several techniques for the analysis of educational outcomes utilizing multiple variables. Prereq: EDP 660 or equivalent.

759 *Identifying and Providing for Individual Student Needs.* (3)
Research studies and reports on individual differences in the physical, intellectual, social, and emotional development of students, and of ways that have proved effective in meeting individual needs, especially in secondary schools. To be taken only with EDP 600 in the First Professional Block of the counselor preparation program. Not offered separately.

762 *Organization and Administration of Guidance Services.* (3)
A study of the problems of staffing, supervision, finances, interpersonal relationships, community participation, in-service education and evaluation of guidance programs. Prereq: 12 hours of guidance and counseling work and consent of instructor.

763 *Research and Evaluation in Guidance.* (3)
Research methods applied to the formulation, development, and evaluation of guidance services. Critical evaluation of current research trends.

765 *Independent Work in Counseling and Guidance.* (2)
An independent work course for advanced graduate students who desire to investigate special problems in counseling and guidance. Prereq: One year of graduate work in Counseling and Guidance, including EDP 600 (or PSY 610) and approval of instructor. May be repeated once to a maximum of four credits.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (One to six credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (One to 12 credits equivalence.)

777 *Seminar in Counseling and Guidance.* (3)
Topical consideration of philosophical, technical and theoretical positions in counseling theory and practice. Prereq: Doctoral standing, EDP 665, or consent of instructor.

778 *Seminar in Educational Psychology.* (3)
Intensive study of selected topics in human learning and development. Particular emphasis on research topics. Students will design sample studies in their areas of interest. Prereq: Doctoral standing in the College of Education or consent of instructor.

782 *Independent Work in Educational Psychology.* (3)
An independent work course for students who have done a minimum of twelve semester hours of graduate work including EDP 522, 520 or 658. May be repeated once to a maximum of six credits.

HEALTH, PHYSICAL EDUCATION AND RECREATION

Director of Graduate Study—Don Kirkendall

The Department of Health, Physical Education and Recreation offers graduate work toward the Master of Science Degree with an area of concentration in one of the following: health and safety education, physical education, or recreation and park administration. Candidates may select, subject to the approval of the department, either a thesis (Plan A) or a non-thesis option (Plan B). Within each of these options the student, depending on background and interest, will be guided into either a pre-doctoral program or into a program geared to increase proficiency as a practitioner in one of the professional fields. Both plans are geared in part to promote a commitment to systematic inquiry and the utilization of research findings.

Applicants for the Master's program in health and safety or physical education are expected to have the equivalent of a 21 hour minor in their respective field. In addition, their undergraduate background should reflect experiences in anatomy, physiology, psychology and sociology. Those interested in recreation and park administration should likewise have the equivalent of a minor in recreation. Appropriate experiences in business administration, sociology, psychology and social work should be reflected in their undergraduate preparation. Students who have a strong background in related biological or behavioral science fields may be considered for admission providing they satisfy prerequisites established in each field. Applicants lacking these prerequisites will be expected to satisfy them via directed readings, competency examinations or prescribed course work. This is in addition to the normal 30 hours master's program.

GENERAL REQUIREMENTS

Students possessing a valid Kentucky provisional teaching certificate may have it renewed for another ten years by completing the M.S. degree with a concentration in health and safety education or physical education. Students desiring the Standard Certificate should complete the M.A. degree in Education rather than the departmental M.S. degree. Students should consult the director of graduate study in the department for various degree requirements.

Regardless of whether the student concentrates in health and safety education, or physical education, or recreation and park administration, (certificate or non-certificate) all candidates are required to complete the following.

PLAN A

EDP 657	Educational Statistics	
	or	
STA 670	Basic Statistical Analysis	
HPR 645	Measurement Theory	
HPR 644	Research Techniques Applied to Health and Recreation	
Supporting Elective		3 hours
HPR—Area of Concentration		12 hours
Thesis Problem in Area of Concentration		6 hours
		30 hours

PLAN B

EDP 657	Educational Statistics	
	or	
STA 670	Basic Statistical Analysis	
HPR 664	Research Techniques Applied to Health, Physical Education and Recreation	

HPR 782 Independent Research Project

Supporting Electives	6 hours
HPR—Area of Concentration	15 hours
	30 hours

For additional information, write to the Director of Graduate Studies, Department of Health, Physical Education and Recreation.

COURSES GENERIC TO ALL THREE AREAS OF CONCENTRATION

545 *Introduction to Tests and Measurements.* (3)
The construction and grading of essay and objective tests; construction and analysis of achievement tests; and testing and measuring in health and physical education. Lecture two hours and laboratory, two hours per week.

575 *Interpretations of Leisure and Recreation.* (3)
Designed to provide students interested in recreation as a profession, as an adjunct to other work, or as informed citizens with a basic understanding of the significance of leisure and the objectives of recreation.

644 *Research Techniques Applied to Health, Physical Education and Recreation.* (3)
A critique of research procedures for purposes of developing more efficient research designs applicable to problems in Health, Physical Education and Recreation. Should be preceded or accompanied by basic statistics and introduction to measurement.

645 *Measurement Theory in Health, Physical Education and Recreation.* (3)
An analysis of the various procedures employed in constructing and using measuring instruments in teaching and research programs in health, physical education and recreation. Should be preceded or accompanied by basic statistics and introduction to measurement.

650 *Curriculum and Program Development.* (3)
A study of fundamental principles basic to the development of the over-all curriculum in phsyical education with special emphasis upon the proper selection and organization of physical education activities to meet the educational and recreational needs of all students. Prereq: HPR 343, 344, 540.

741 *Current Studies and Trends in Health and Physical Education.* (3)
A study of modern trends in health and physical education and standards of evaluation in relation to the history of the various systems, including a review of the principles and objectives.

782 *Independent Research.* (3)
Systematic investigation of a problem selected from the areas of health, safety, physical education or recreation. Satisfies the research requirement for the Master's Degree in Plan B. Repeatable with new problem. May be repeated to a maximum of nine credits.

PHYSICAL EDUCATION

491 *Dance in Education.* (3)
An introduction to the creative approach to dance for elementary, secondary and college levels. The principles of kinesthetics and rhythmical forms applied to the practice of fundamental movement techniques. Two hours lecture and four hours laboratory. Prereq: PGY 206, HPR 572, and a beginning course in dance, or consent of instructor.

520 *Physiology of Exercise.* (3)
A comprehensive survey of the physiological and clinical aspects of exercise. Lectures and demonstrations, three hours. Prereq: ANA 206 and PGY 206, 207 or equivalent, and consent of instructor.

530 *Administration of Health and Safety Education.* (3)
Consideration is given to the administration, organization and function of the total school health and safety program. Textbook evaluation and materials suitable for school health and safety instructor will be stressed. The role of school public health will be defined.

540 *Organization and Administration of Physical Education.* (3)
Policies and procedures of administration on the secondary school and collegiate levels. Special emphasis on construction and care of facilities, equipment, and supervision of personnel. Prereq: HPR 344 or equivalent.

546 *Physical Education Workshop.* (2)
A concentrated study in a specific sport or activity or field of emphasis in physical education. May be repeated for a maximum of six credits. Lecture, one hour per week; laboratory, two hours per week.

547 *Psychology of Sport and Physical Activity.* (3)
Prerequisite: Undergraduate Psychology course and accompanied by basic statistics.

572 *Kinesiology and Its Application.* (3)
A study of basic principles of bodily movement and their application to sports, rhythmical activities and the correction of functional defects. Three hours lecture and two hours laboratory. Prereq: ANA 206 and PGY 206, 207.

579 *Adapted Physical Education.* (3)
A study of programs of physical education for atypical students, with emphasis upon specific postural faults and other abnormalities commonly found in a school population. To include training and experience in procedures, adapting the physical education program to accommodate these students. Lecture, two hours per week; laboratory, two hours per week. Prereq: HPR 343, PE 572.

592 *Choreography for Groups.* (2)
The building of dances for groups in Ballet, Modern, and Theater dance forms. Lecture, one hour per week; laboratory, two hours per week. Prereq: HPR 491.

593 *Dance Production.* (3)
A consideration of the problems of the dance production for audience appreciation. Theory and practical experience in costuming, building scenery, lighting, and make-up. Financial and publicity aspects will be studied. Lecture, two hours per week; laboratory, four hours per week. Prereq: HPR 191, 192, 291, 292, 390, 391, 392, 393, 592.

646 *Integrated Development.* (3)
An analysis of the literature in the area of integrated development. Emphasis on development of skills in the use of research techniques, materials and resources in investigating potential problems in this area in depth. Prereq: HPR 546 and 643.

651 *Facilities, Construction, and Equipment.* (2)
Principles and standards for maintaining facilities, and planning construction; purchase and care of equipment. Prereq: HPR 540.

690 *Organization and Administration of the Dance in Education.* (3)
Special emphasis is placed upon the organization and administration of the program in dance to meet the needs of students from elementary through college levels. Some attention will be given to dance production, festivals and social dance functions in schools. Prereq: HPR 290, 491, 592, 595.

720 *Sports Medicine.* (3)
A study of the basic areas covered in sports medicine with readings and discussions of current international trends in the research and practice in this field. Prereq: Twelve semester hours, credit in the field of biological science; consent of instructor.

768 *Residence Credit for Master's Degree.* (0)
(One to six credits equivalence.) May be repeated once.

770 *Seminar in Physical Education.* (3)
Each semester some contemporary topic in the field of physical education will be studied intensively. May be repeated to a maximum of nine credits.

HEALTH AND SAFETY EDUCATION

430 *Methods of Teaching Health Education.* (3)
Basic organization and planning of elementary and secondary school health and safety programs for the classroom teacher. Major emphasis on curriculum development and teaching techniques. Prereq: HPR 330.

507 *Driver and Traffic Safety Education.* (3)
Analysis of traffic accidents, attitude factors, essential knowledge of automobile operation and traffic laws and regulations. Laboratory experience is devoted to improvement of the students' driving skill and an understanding of how to structure laboratory lessons in the dual control automobile.

509 *Workshop in Health and Safety.* (2)
Designed as a short course in current aspects of school health or safety education with emphasis upon the needs of teachers.

607 *Advanced Topics in Safety Education.* (3)
Designed for safety education supervisors, school administrators and teachers. An in-depth study of the psychological and sociological aspects of safety and research in all aspects of safety education. Prereq: Background in safety education.

609 *Seminar in Health and Safety Education.* (3)
Overview of the problems confronting persons in these fields and selected research findings applicable to these areas. Emphasis is given to gaining a better understanding of research data and to a greater utilization of research findings in both school and community health and safety endeavors. May be repeated to a maximum of nine credits. Prereq: Consent of instructor.

RECREATION AND PARK ADMINISTRATION

471 *Outdoor Education Through Camping.* (2)
The theory and practice of the use of camping as an adjunct to the classroom in achieving educational objectives. Prereq: HPR 370 or consent of instructor.

478 *Senior Seminar in Recreation.* (3)
Readings and reports on special topics in recreation and parks. Required of all senior recreation majors.

570 *Landscape Design of Park and Recreation Areas.* (3)
A study of standards, principles, and procedures of planning and design for recreational needs with emphasis on resource development for human use. Lecture. one hour; studio, four hours. Prereq: HOR 331 or permission of instructor. (Same as HOR 570.)

571 *Therapeutic Recreation.* (4)
A study of the principles and practices involved in recreation in a hospital or institutional setting. This would include types of therapeutic situations, program planning, financing of program opportunities, execution and evaluation. Lecture, three hours per week; laboratory, two hours per week.

573 *Administration and Organization of Recreation.* (3)
This course is designed to equip students and community leaders with workable procedures for developing and operating recreation programs in communities of various sizes and with varying political and social structures.

577 *Practicum in Recreation.* (3-9)
Extensive practical work experiences under the immediate supervision of qualified practitioners and recreation faculty coordinator. Prereq: Recreation Major only.

610 *Implementation of Recreation Services for the Ill or Disabled.* (3)
The organization, coordination and administration of recreation programs designed to meet the needs of ill or disabled persons in treatment centers and those residing in the community. Prereq: HPR 571, 575 or consent of instructor.

611 *Therapeutic Applications of Recreation.* (3)
A study of recreation as a therapeutic agent in the management of ill and/or disabled persons, including the mentally ill, physically handicapped, medically incapacitated and mentally retarded. Prereq: HPR 571, 575 or consent of instructor.

676 *Current Issues in Recreation.* (3)
An in-depth analysis into the pertinent issues and challenges confronting the recreation profession.

685 *Administrative Practices in Recreation.* (3)
A study of administrative functions concerned with policy determination, public relations, personnel practices, and routine details confronting the chief recreation officer and his staff associates. Prereq: HPR 580 or consent of instructor.

780 *Seminar in Recreation.* (3)
Each semester some contemporary topic in the field of recreation will be studied intensively. May be repeated to a maximum of nine credits.

HIGHER AND ADULT EDUCATION

Director of Graduate Study—Charles F. Elton

Master of Science Degree in Higher and Adult Education

This degree is intended for persons interested in working with teachers and administrators who desire to prepare for administrative positions in higher education, or who desire a background in higher education as a supportive area to college teaching. The department's basic purpose is to work with qualified persons who are moving toward career goals in administration in two-year or four-year colleges and universities. The department welcomes qualified students regardless of their primary disciplines and recognizes that course experiences from other disciplines may make a very important contribution to the graduate student's understanding of higher and adult education. Since certification is not typically required for teaching or administration in most colleges and universities, this is a non-certificate program.

Minimum Requirements for a Master of Science Degree in Higher and Adult Education:

	Hrs.
Higher and Adult Education	15
Research Design and Statistics	3
Electives in Education (outside major)	6
Work outside Education	6

099 *Orientation for Graduate Students.* (0)

500 *Clinical and Laboratory Teaching.* (4)
Includes learning theories, motivational concepts, review of research, developing instructional objectives, human relations in the classroom, teaching methodologies, clinical instruction, performance evaluation and preparation of instructional units. This course is designed primarily for students in Allied Health, Education, Library Science, Home Economics and Social Professions.

501 *Teaching Internship.* (6-12)
Supervised practice under competent leadership. Observation, instruction, independent study which parallels field experience, and conferences with supervising instructor included. May be repeated for total of 12 hours. This course is designed primarily for students in Allied Health, Education, Library Science, Home Economics and Social Professions. Prereq: EDH 500, or permission of instructor.

718 *Trends in Higher Education.* (3)
A survey of modern tendencies in higher education: scope and development, objectives, organization, administration, curricula, finance, faculty and student personnel. Designed primarily for prospective college administrators, teachers, and registrars.

719 *College Teaching and Learning.* (3)
A study of all phases of instruction at the college level. The course will include methods and principles of teaching, utilization of materials in teaching, a consideration of the teaching-learning process as it relates to the individual student, and the evaluation of student progress. A comprehensive course for prospective college teachers.

722 *College Student Personnel.* (3)
A study of college student behavior, relationship of student personnel to total college program, organization and administration, evaluation, and research of college student personnel.

733 *Organization and Administration of Higher Education.* (3)
Purposes and scope of higher education, organization, general administration, faculty administration, inter-institutional cooperation, allocation of financial resources, state systems of higher education.

734 *The Junior College.* (3)
History, philosophy, programs, and teaching-learning climate at the junior college; patterns of control and support; a consideration of the private as well as the community junior college.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (One to six credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (One to 12 credits equivalence.)

798 *Seminar in Higher Education.* (3)
A critical study of selected problems in higher education. The seminar topic will be varied from one semester to another. Prereq: EDH 718 and 733, or by permission of the instructor.

799 *Research Problems in Higher Education.* (3)
An independent research course for the study of special problems in higher education. Prereq: One year of graduate work. May be repeated once to a maximum of six credits.

SOCIAL AND PHILOSOPHICAL STUDIES IN EDUCATION

Director of Graduate Study—David Denton

532 *Intergroup Relations.* (3)
Analysis of relationships between groups which differ in religious, ethnic, or sociocultural backgrounds; the development of educational and social techniques for reduction of tensions. May be repeated once to a maximum of six credits. Prereq: SOC 101. (Same as SOC 532.)

533 *Introduction to the Philosophic Study of Education.* (3)
An introduction to the philosophic analysis of major concepts in education. The course is designed primarily as an elective for students in teacher-education and students in other colleges. Does not apply toward teacher certification. Prereq: Junior or senior status, not on academic probation.

599 *International Studies in American Education.* (3)
Place and purpose of study of other cultures, world problems and relations between nations, in American schools, colleges and universities. Implications of this study for curriculum planning, teaching, and administration of schools, colleges, and universities, and organization of intercultural experiences.

640 *Philosophy of Education.* (3)
An advanced course dealing with the philosophy of democratic education and applications to some of the larger educational problems of today. Prereq: Twelve semester hours in education. May be repeated once to a maximum of six credits.

645 *Foundations in Education.* (3)
An intensive study in various foundational fields which contribute to the development of educational theory and practice. Prereq: 12 semester hours in education at the undergraduate level. May be repeated once to a maximum of six credits.

646 *Analysis of Thinking.* (3)
An interdisciplinary analysis of thinking, the central process of education. Topics studied include psychological, logical and semantic aspects of thought. Prereq: EDP 548 and EDF 640, or permission of instructor.

650 *History of Western Education.* (3)
A study of the development of the "institution" of education in relation to social and political reality, ideas, and ideals of successive periods in Western culture.

651 *History of Education in the United States.* (3)
A history of the growth and development of education in the United States from earliest Colonial times to the present, including recent movements and trends.

652 *History of Educational Thought.* (3)
A study of the lives and writings of the world's great educators to acquaint the student with their major contributions to society and education.

655 *Education in Other Nations.* (3)
Analytical and comparative study of contemporary education in selected countries, with emphasis on the historical development and total cultural context of educational programs. Informal as well as formal agencies and programs will be studied with particular attention to recent reforms and innovations.

656 *International Development Education.* (3)
Critical study of the role of education in the social, cultural, political and economic development of countries in Asia, Latin America, and Africa with particular emphasis on interdisciplinary-interprofessional planning. Problems of change in education and international cooperation for educational development.

661 *Educational Sociology.* (3)
A course in sociological foundations of education. Prereq: SOC 101. (Same as SOC 661.)

662 *Analysis of Educational Change.* (3)
The history, nature, processes, and problems related to educational change, drawing upon the literature in several disciplines.

663 *Field Research in Educational Change.* (3)
A field study of a particular problem relating to educational change will be made, using appropriate conceptual strategies and procedures. Prereq: EDF 662.

665 *Education and Culture.* (3)
An analysis of the cultural role and function of educational institutions and processes. Topics considered include: schooling as cultural transmission, the community context of education, cross-national studies of schools, and implications of anthropological approaches for teacher training.

724 *Epistemological Problems in Education.* (3)
A study of knowledge and inquiry as they relate to problems of formulating educational policy and curriculum design. Prereq: EDF 640.

725 *Analysis of Value Questions in Education.* (3)
A study of the nature of value as it relates to formulating and justifying aims and policies, curriculum design and the teaching-learning process. Materials in ethics, value theory, and aesthetics are used in the appraisal of educational theory. Prereq: EDF 640 or equivalent.

750 *Problems in Educational Sociology.* (3)
An advanced course in the application of sociological findings to education including consideration of Southern regional problems and potentialities. Prereq: twelve semester hours of graduate work including EDF 661 or equivalent; SOC 101.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (One to six credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (One to 12 credits equivalence.)

773 *Seminar in Foundations of Education.* (3)
A critical study of selected problems in the foundations of education areas.

778 *Seminar in History of Education in Kentucky.* (3)
A seminar for graduate students in education who are interested in developing a background and perspective upon educational problems by study of the history and development of education in Kentucky.

785 *Independent Study in Social and Philosophical Problems in Education.* (3)
This course will allow advanced students to study, in depth, individualized problems and issues related to social and philosophical foundations. May be repeated to a maximum of nine hours. Prereq: EDF 661 or its equivalent.

SPECIAL EDUCATION

Director of Graduate Study—
A. Edward Blackhurst

Students may enroll for either degree or non-degree graduate programs in Special Education. Non-degree programs are designed primarily for those who are seeking Kentucky Provisional, Rank II or Rank I Teacher Certification in the following areas:

1. Certification in teaching the:
   - Educable Mentally Retarded
   - Trainable Mentally Retarded
   - Orthopedically Handicapped
   - Neourologically Impaired (Learning Disabilities)
   - Emotionally Disturbed
2. Certification in Speech Pathology and Audiology
3. Certification in Administration and Supervision of Special Education

The Degree programs that are offered lead to the Master of Arts, Educational Specialist and Doctor of Education Degrees. Within the framework of College and University requirements, all graduate degrees are individually planned. This flexibility makes it possible to structure an appropriate program for each student, based upon his previous background and career aspirations. It should be noted, however, that graduate degree programs emphasize a non-categorical approach to Special Education. That is, although students may pursue one of the above mentioned teaching certification areas (number 1 above) in greater depth as part of their degree programs, they also receive training that will enable them to diagnose and remediate learning problems of other types of exceptional children, regardless of the handicapping condition. Following are brief descriptions of the various graduate degree programs.

Minimum requirements for the Master of Arts Degree are either (a) the completion of 30 semester hours of course work under Plan II or (b) 24 hours of course work and a thesis under Plan I as outlined at the beginning of the Education section of this Bulletin. These **minimum** course credit requirements are distributed as follows:

Special Education	12
Electives in Education	6
Course work outside the College of Education	12

(At least 15 semester hours must be earned in courses at the 600 or 700 level.)

Students without a teaching certificate must meet deficiencies, including certification requirements, as outlined by their adviser, in addition to completing the 30 semester hours. Depending upon their educational background, students may obtain Rank II Certification concurrently with their Master's Degree. Students preparing for positions not requiring certification may petition for waiver of certification requirements upon application for admission to the program.

Candidates for the M.A. degree in Education with concentration in speech pathology and audiology are encouraged to meet the academic and clinical requirements for the Certificate of Clinical Competence from the American Speech and Hearing Association. Briefly, these requirements include: (1) 18 semester hours in courses that provide fundamental information applicable to the normal development and use of speech, hearing and language, (2) 42 semester hours in courses that provide information about and training in the management of speech, hearing and language disorders and that provide information supplementary to these fields, and (3) completion of 275 clock hours of supervised, direct clinical experience with individuals presenting a variety of disorders of communication. All 125 hours of requirement (1) and of requirement (3) may be fulfilled on the undergraduate level. However, 30 of the 42 hours of requirements (2) must be in courses acceptable toward a graduate degree. M.A. candidates in speech pathology must complete at least 12 hours from the 600-700 level courses in speech pathology listed under Special Education.

See requirements for the Specialist in Education (Ed.S.) degree. Ed.S. programs are individually planned for in-depth study in an area of Special Education. An Ed.S. program that is unique to the University of Kentucky is a program to train administrators of Special Educational Materials Centers. Students who hold a Kentucky Rank II Certification are awarded Rank I Certification upon completion of this degree.

The Doctor of Education (Ed.D.) program is designed to prepare leadership personnel for the field of Special Education. Although various programs of study can be planned, primary emphasis is placed upon training persons for positions in higher education and administration of special education programs. The requirements for this

program are described in the Doctor of Education section.

Two major types of financial assistance are available, on a competitive basis, to graduate students in special education.

1. Students may apply for graduate assistantships at all levels of graduate study. These are awarded from funds granted to the Department by the U.S. Office of Education.
2. WHAS Crusade for Children traineeships for full-time study during summer school are available only to Kentucky teachers who are in the process of obtaining Provisional Certification in an area of Special Education.

Assistantships and traineeships are awarded on the basis of (a) commitment to the field, as evidenced by previous work experience, references, and/or volunteer service; (b) prior academic record; and (c) financial need. Applications for financial assistance may be obtained from the Departmental Director of Graduate Studies.

500 *Speech Analysis and Perception.* (3)
Physics of sound; acoustic and structural properties of speech and their relationship to speech perception; analysis of speech intensity, fundamental frequency, wave composition, and time (rate, duration, and transitional change). (Same as SP 500.)

501 *Speech and Language Development.* (3)
The normative aspects of speech and language acquisition; application of linguistic and learning theory concepts; communication in lower animals; language and cognition.

502 *Development and Evaluation of Instructional Materials in Special Education.* (3)
Survey and principles of instructional materials in special education with emphasis on development and critical evaluation. Discussion of characteristics of effective instructional material and means of determining effectiveness. Determining need and means of developing new instructional material. Prereq: Consent of instructor.

505 *Education of the Trainable Mentally Retarded.* (3)
A study of modern classroom techniques for working with the trainable, or severely mentally retarded. Private and public day and residential school programs are considered. Attention is given to educational significance of multiple disabilities of retarded children.

523 *Language Disabilities of the Mentally Retarded.* (3)
Topics related to research on delayed language development, linguistics, teaching techniques for mentally retarded children with language disabilities will be covered. Use of materials for language development training will be presented. Prereq: EDS 375 or consent of instructor.

524 *Programs for the Adolescent Mentally Retarded.* (3)
A study of the philosophy, organization, and principles of education and rehabilitation programs for the adolescent mentally retarded. Emphasis is placed on the respective roles of educational and rehabilitation agencies and their interaction in the preparation of retarded youth for successful post-school adjustment. Prereq: EDS 530.

525 *Education of the Orthopedically and Neurologically Handicapped.* (3)
A study of educational techniques, materials, and equipment used in teaching crippled, brain-injured and chronically ill children. Curriculum for both classroom and individual clinical teaching is included.

526 *Education of the Educable Mentally Retarded.* (3)
A study of modern classroom techniques for working with the educable, or mildly mentally retarded. Major emphasis is on curriculum development and teaching techniques.

527 *Characteristics of the Orthopedically and Neurologically Handicapped.* (3)
A survey of causes, treatment, and educational implications of physical and neurological disabilities in school-age children. Attention given to rehabilitation and life adjustment problems of individuals with single and multiple handicaps.

530 *Characteristics of the Mentally Retarded.* (3)
A critical examination of pertinent research in reference to the educational, physical, and psychological nature and needs of the educable and trainable mentally retarded child, including interpretation of psychological tests. Evaluation of the physical, social, emotional and mental characteristics of the retarded, to assist the classroom teacher to recognize the social potential of each child to the degree that the child with retarded mental development may become less of a burden to himself and society.

558 *Problems in Special Education: (Variable Topic).* (1-9)
In-depth study of a current and topical problem or issue in the education of exceptional children and youth. Course may be repeated to a maximum of nine credits. A title is assigned each time the course is offered.

570 *Characteristics of Emotionally Disturbed Children.* (3)
The problems of emotionally disturbed school children are considered in the context of normal child development with emphasis on psychological factors correlated with behavior deviations. A survey of the major diagnostic categories include identification, description, and etiology, with material drawn from clinical, theoretical and research sources. Approaches to remediation cover both community resources and the roles of various professional personnel. Lecture, two hours, laboratory, two hours. Prereq: EDS 375, or permission of instructor.

577 *Speech Pathology: A Survey.* (3)
An introduction to the nature, causes, and treatment of the major disorders of speech: articulation, voice, cleft palate, hearing, cerebral palsy and aphasia.

578 *Speech Pathology: An Introduction to Therapy.* (3)
Observation and discussion of and limited supervised experience with therapeutic techniques and procedures of speech therapy. Prereq: EDS 577.

579 *Stuttering.* (3)
The nature, causes, and treatment of stuttering, with emphasis on therapeutic procedures. Prereq: EDS 577. (Same as PSY 579.)

583 *Speech Mechanisms.* (3)
A detailed investigation of the speech musculature: respiration, phonation, resonation, and articulation. Voice disorders and cleft palate will be given special emphasis. Prereq: EDS 577.

584 *Introduction to Audiology.* (3)
A survey of the profession of audiology; anatomy, physiology and acoustics of hearing; principal types of hearing disorders.

587 *Audiometry.* (3)
Basic clinical techniques for assessing hearing acuity. Topics include: identification audiometry, methods of puretone threshold determination, interpretation of audiograms and speech audiometry. Prereq: EDS 584 or consent of instructor.

591 *Aural Rehabilitation.* (3)
Principles and methods of speech and hearing therapy including speech reading, auditory training, speech conservation and hearing aid counseling for children and adults. Prereq: EDS 584 or consent of instructor.

592 *Problems and Needs of the Hearing Impaired.* (3)
Effects of hearing impairment on mental development, language acquisition, and personality adjustment; current research and clinical trends in auditory rehabilitation and the education of the deaf.

600 *Survey of Special Education.* (3)
A survey of current status of the field of special education. Emphasis is on analysis of the major research literature pertaining to exceptional children and their education. Prereq: Graduate standing.

601 *Behavioral Management of Exceptional Children.* (3)
Principles of behavioral management are reviewed. Techniques of observation, recording, and implementation of management programs with exceptional children are stressed through case work with individuals and groups of children. Lecture, two hours; laboratory, two hours. Prereq: Consent of instructor.

602 *Administration and Supervision in Special Education.* (3)
The organization, management and supervision of programs for exceptional children at the local, state and national levels. Roles and functions of the special education administrator are considered. Experiences drawn from special residential, private and public day schools are studied. Prereq: Certification in Special Education. Six hours of course work in Educational Administration and Supervision.

610 *Educational Evaluation of Exceptional Children.* (3)
An intensive study of, and laboratory experience in, the assessment of educational problems of exceptional children. Special emphasis is given to the relationship of physical, intellectual, emotional and social handicaps to performance in the individual or group setting. Class hours per week, two; laboratory hours per week, two. Prereq: EDP 522 and consent of instructor.

611 *Educational Remediation of Learning Disabilities of Exceptional Children.* (3)
The study of, and laboratory experience in, the remediation of educational problems of exceptional children. Attention is given to the amelioration of learning disabilities in individual cases. Class hours per week, two; laboratory hours per week, two. Prereq: EDS 610 or consent of instructor.

612 *Advanced Practicum in Special Education.* (3-6)
Intensive clinical experience with exceptional children in day and residential schools, hospitals and private agencies. Students engage in prescriptive teaching with handicapped children in individualized, small group and special class settings. Laboratory hours 6-12 per week. Prereq: Graduate standing; major in Special Education.

613 *Articulation and Articulation Disorders.* (3)
Research and clinical findings on articulation and articulation disorders. Topics include articulation testing and prediction, variables related to articulation performance and articulation programming (therapy).

614 *Voice and Voice Disorders.* (3)
Research on voice and voice disorders. Topics include a review of voice physiology and organic and functional voice disorders.

617 *Cleft Palate and Cerebral Palsy.* (3)
Description, assessment and interdisciplinary management of organic speech disorders, particularly those associated with orofacial anomalies and dysarthria. Review of relevant research.

627 *Practicum in Speech Therapy.* (3)
Practical case work in speech therapy in speech clinic, hospitals, and public schools. Training in diagnostic examinations, case history methods, and group therapy. Prereq: EDS 577, 578. May be repeated once for a maximum of six credits.

647 *Disorders of Language.* (3)
Emphasis on adult aphasia and developmental language disabilities, theories, research findings, assessment procedures, and therapy approaches. (Same as PSY 647).

671 *Education of Emotionally Disturbed Children.* (3)
A study of educational techniques, materials, and equipment used in teaching emotionally disturbed children. Curriculum for both classroom and individual clinical teaching is included. Lecture, two hours; laboratory, two hours. Prereq: EDS 570.

672 *Theories of Educating Emotionally Disturbed Children.* (3)
A systematic review of various teaching philosophies related to the education of emotionally disturbed children. Observation and participation in educational settings reflecting these philosophies will be provided. Lecture, two hours; laboratory, two hours. Prereq: Consent of instructor.

702 *Seminar in Speech Pathology.* (3)
Advanced coverage of the clinical and research literature on the etiology, description, assessment, and management of specific speech and language disabilities. The semester topic will be rotated. Topics will include stuttering, developmental language disabilities, cleft palate, cerebral palsy, etc. May be repeated twice for a maximum of nine hours.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (One to six credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (One to 12 credits equivalence.)

779 *Seminar in Special Education (Variable Topic).* (3)
Study of philosophy, principles, trends and research in education of exceptional children. Students will carry on an extensive study of a problem dealing with education of the exceptional child. May be repeated twice to a maximum of nine credits.

789 *Independent Study in Special Education.* (1-6)
An independent study course for advanced graduate students with an interest in a specific problem in special education. By appointment. Prereq: Minimum of 12 semester hours in graduate work and approval of instructor.

799 *Research Techniques in Special Education.* (3)
A study of the basic research techniques and their application to special education. Unique problems in special education will be discussed with emphasis on designing and conducting a research study. Computer usage will be discussed and students encouraged to use the computer as a research tool. Prereq: 12 graduate semester hours in special education including EDP 657 or equivalent.

VOCATIONAL EDUCATION

Master's Degree Programs in Vocational Education

For a master's degree in Vocational Education (Agricultural Education, Business Education, Distributive Education, Home Economics Education, Industrial Education, or Vocational Education) a minimum of 12 semester hours of graduate work must be taken in professional education. One course shall be taken from three of six areas—I through VI. This program qualifies the teacher for a Standard Certificate if he has completed a four-year undergraduate curriculum.

All Program Service Areas

Area II: Research
- EDP 522 Educational Tests and Measurements
- EDP 656 Methodology of Educational Research
- EDP 657 Educational Statistics

Area III: Advanced Study in Human Development
- SOC 521 Industrial Sociology
- SOC 542 Human Relations in Administration
- EDP 739 Survey of Research in Human Development and Education
- EDP 755 Human Development and Behavior
- EDP 759 Identifying and Providing for Individual Student Needs

Area IV: Psychology of Learning
- PSY 540 Industrial Psychology
- EDP 548 Educational Psychology
- EDP 658 Problems in Educational Psychology

Area VI: Foundations in Education
- EDF 640 Philosophy of Education
- EDF 645 Foundations of Education
- EDF 651 History of Education
- EDF 655 Comparative Education
- EDF 661 Educational Sociology (Same as SOC 661)

Agricultural Education

Area I: Curriculum Development
- EDV 672 Determining Content in Vocational Agriculture
- EDC 732 Principles of Curriculum Development

Area V: A Seminar in Instruction Devoted to Method in Teaching
- EDV 670 Method in Teaching Vocational Education
- EDV 675 Modern Problems in Agricultural Education
- EDV 678 Selecting Trading Materials
- EDV 679 Adult-Farmer Schools
- EDV 680 Directing Occupational Experience in Agriculture
- EDV 681 Teaching Farm Shop
- EDV 682 Education in Agriculture for Young Adults

Business Education

Area I: Curriculum Development
- EDV 615 Problems in Business Education
- EDV 621 The Business Curriculum
- EDV 626 Classification and Possible Use of Community Resources in Business Education
- EDC 714 The Secondary School
- EDC 732 Principles of Curriculum Department

Area V: A Seminar in Instruction Devoted to Method of Teaching
- EDV 511 Teaching Secretarial Subjects
- EDV 512 Teaching Bookkeeping and Accounting
- EDV 513 Teaching Office Practice, Clerical Practice, and Office Appliances
- EDV 615 Problems in Business Education
- EDV 618 The Social Business Subject in High School
- EDV 779 Seminar in Vocational Education

Distributive Education

Area I: Curriculum Development
- EDV 517 Determining Content in Distributive Education
- EDC 732 Principles of Curriculum Development

Area V: A Seminar in Instruction Devoted to Method of Teaching
- EDV 528 Techniques of Teaching Distributive Education
- EDV 526 Organization and Operation of Adult Programs in Distributive Education
- EDV 610 Simulated Occupational Experience Programs in Distributive Education
- EDV 670 Method in Teaching Vocational Education
- EDV 671 Youth Organizations in Vocational Education
- EDV 693 Supervision in Vocational Education
- EDV 695 Special Problems in Vocational Education
- EDV 779 Seminar in Vocational Education

Home Economics Education

Area I: Curriculum Development
- EDV 685 Home Economics Curriculum Construction
- EDC 732 Principles of Curriculum Construction

Area V: A Seminar in Instruction Devoted to the Method of Teaching
- EDV 683 Current Problems in Home Economics Education
- EDV 686 Evaluation in Home Economics Education
- EDV 693 Home Economics Supervision in Vocational Education
- EDV 687 Home Economics Supervision
- EDV 684 Current Trends in Home Economics Education
- EDV 779 Seminar in Vocational Education
- EDV 789 Independent Work in Vocational Education

Industrial Education

Area I: Curriculum Development
- EDV 678 Selecting Teaching Materials

EDC 732 Principles of Curriculum Construction

Area V: A Seminar in Instruction Devoted to the Method of Teaching

EDV 534 Organization and Operation of Part-time and Evening Classes
EDV 518 Methods in Industrial Education (4 hours)
EDV 529 Evaluation in Industrial and Distributive Education
EDV 570 Method in Teaching Vocational Education
EDV 537 Special Problems in Industrial Education
EDV 693 Supervision in Vocational Education
EDV 694 The Administration in Vocational Education
EDV 779 Seminar in Vocational Education

Vocational Education

Area I: Curriculum Development

EDV 517 Determining Content in Distributive Education
EDV 621 The Business Curriculum
EDV 672 Determining Content in Vocational Agriculture
EDV 685 Home Economics Curriculum Construction
EDC 732 Principles of Curriculum Development

Area V: A Seminar in Instruction Devoted to the Method of Teaching

EDV 516 Problems of the Coordinator in Vocational Education
EDV 518 Methods in Industrial Education
EDV 523 Vocational Guidance
EDV 528 Techniques of Teaching Distributive Education
EDV 615 Problems in Business Education
EDV 670 Method in Teaching Vocational Education
EDV 693 Supervision in Vocational Education
EDV 694 The Administration of Vocational Education

Certification of Administrators, Supervisors, and Coordinators of Vocational Education

For certification as an administrator, coordinator, or supervisor of Vocational Education one must complete a minimum of 15 semester hours of graduate level courses **above and beyond** the course requirements for the 10-year teaching certificate. Courses are to be selected from those listed below, including at least one course in each of the four curriculum areas.

Curriculum Areas and Courses		Sem. Hrs.
Organization and Administration of Vocational Education		
EDV 535	Principles and Philosophy of Vocational Education	2
EDV 694	Administration of Vocational Education	3
EDV 779	Seminar in Vocational Education	1-3
Administration and Supervision of Education Personnel		
EDA 634	Administration of Educational Personnel (Required in this area)	3
EDA 633	Administration and Supervision of Instructional Programs	3
EDV 608	Internship in Vocational Education	3
EDV 693	Supervision in Vocational Education	3
Program Planning, Research, and Evaluation in Vocational Education		
EDV 529	Evaluation on Industrial and Distributive Education	2
EDV 695	Special Problems in Vocational Education	3
EDP 656	Methodology in Educational Research	3
EDP 660	Research Design and Analysis in Education	3
Vocational Guidance, Industrial Psychology, Human Relations		
EDV 523	Vocational Guidance	2-3
EDV 702	Career Development, Research Theories and Practice	2-3
PSY 540	Introduction to Industrial Psychology	3
PSY 541	Psychology of Industrial Personnel Procedure	3
PSY 545	Small Group Behavior	3
SOC 521	Industrial Sociology	3
SOC 542	Human Relations in Administration	3

EDP 764 Using Occupational and Educational Information in Counseling 3

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Note: Not more than three hours may be taken by appointment.

AGRICULTURAL EDUCATION

Director of Graduate Study—Harold Binkley

580 *Materials and Methods for Teaching Vocational Agriculture.* (3)
Designed to develop teacher competency in methods of teaching with emphasis on the problem-solving procedure and use of demonstrations, field trips, and audio-visual materials. Evaluation of teaching-learning is emphasized. A study of facilities and instructional materials needed by a Department of Vocational Agriculture is made.

581 *Adult-Farmer Schools and Young-Farmer Courses in Agriculture.* (3)
A general introduction to adult-farmer schools and young-farmer courses with some observation of work in both of these fields.

583 *Experience Programs in Vocational Agriculture.* (3)
Designed to develop teacher competencies to guide students to select, plan, carry out, and evaluate supervised experience programs in vocational agriculture, both production and off-farm. Prereq: Second semester senior.

672 *Determining Content in Vocational Agriculture.* (3)
Interpretation of local data as a basis for course building. Each student works out the content of a four-year course in vocational agriculture.

673 *Program Development in Vocational Agriculture.* (3)
A course in program and curriculum development for the specialized vocational areas in agriculture; a study of the occupational opportunities and the training needs for specific areas (farm operation, agricultural business, agricultural mechanics, horticulture, forestry, park management, etc.). Each student makes a study of local or area needs and works out a one or two year course of study for a senior high or post-high school program. Prereq: EDV 580 or consent of instructor.

675 *Modern Problems in Agricultural Education.* (3)
Class work (not individual-problem work) on modern problems in agricultural education. (May be repeated twice to a maximum of 9 credits.)

679 *Adult Education in Agriculture.* (3)
Preparation for teaching adult classes in agriculture with emphasis on improvement of established agricultural businesses including farming; organization of classes, development of curriculum, and methods of teaching.

680 *Directing Occupational Experience in Agriculture.* (3)
Supervised farming and agricultural employment as a method of teaching; standards, planning, supervision, and records.

681 *Teaching Farm Shop.* (3)
A study of necessary content for shop, plans for securing and equipping the shop, and methods of teaching farm shop.

682 *Education in Agriculture for Young Adults.* (3)
Preparation for teaching young people who are becoming established in an agricultural occupation; including farming, farm service operators, and agricultural employees. Curriculum content and method of teaching applicable to each group is emphasized.

BUSINESS EDUCATION

Director of Graduate Study—Vernon Musselman

511 *Teaching Secretarial Subjects.* (3)
A study of effective teaching in shorthand, transcription, business communication, and secretarial office practice.

512 *Teaching Bookkeeping and Accounting.* (3)
Methods, materials, and techniques used in the teaching of bookkeeping and accounting. Required of business education majors.

513 *Teaching Typewriting and Clerical Practice.* (3)
A study of effective teaching in typewriting and clerical office practice including the machines commonly used in business offices.

514 *Teaching General Business Subjects in the Secondary Schools.* (3)
The aims and purposes of the general business course are studied. Analysis is made of the objectives of the general subjects, and methods and materials used in teaching them are emphasized.

615 *Problems in Business Education.* (3)
A study of advanced problems of interest to business teachers such as testing in business subjects, guidance, job studies, placement and follow-up, equipment, and supervision. May be repeated three times to a maximum of 12 credits.

618 *The Social Business Subjects in High School.* (3)
An examination of the various social business subjects, to determine their contribution ot the objectives of business education.

623 *Administration and Supervision of Business Education.* (3)
Duties and responsibilities of city and state supervisors, department heads, and others engaged in directing business education.

626 *Classification and Possible Use of Community Resources in Business Education.* (3)
Course provides for community analysis, and the development of possible ways and means to supplement the business education course in the secondary school with a study of vital community resources.

BUSINESS AND OFFICE EDUCATION

(*BOE is the abbreviation for these courses.*)

445 *Office Administration and Services.* (3)
A study of the theory, principles, and techniques of modern office administration and services with emphasis on data processing systems and information handling.

519 *Records Management.* (3)
The underlying principles and procedures of records management; information storage and retrieval systems; integration and control of records systems and programs. Prereq: BOE 219, or consent of instructor.

556 *Business Research Reports.* (3)
Current problems in selected interest areas investigated by various research procedures with major emphasis placed upon sources of data, compilation and arrangement of data, documentation, bibliography, and effective presentation. Prereq: BOE 117 or its equivalent.

HOME ECONOMICS EDUCATION

Director of Graduate Study—Marjorie Stewart

586 *Teaching Home Economics in the Secondary School.* (3)
A course emphasizing methods of teaching; utilization of resources; evaluation; and professional responsibilities of the teacher as they apply to vocational home economics.

588 *Adult Education in Home Economics.* (3)
Problems in teaching vocational homemaking in day, part-time, and evening schools. Prereq: EDV 586; concur: EDV 362.

590 *Problems in Home Economics Education.* (3)
Problems in teaching home economics for high school students and adults. May be repeated twice to a maximum of nine credits.

610 *Simulated Occupational Experience Program in Distributive Education.* (2-4)
Designed primarily for teachers interested in developing programs utilizing simulated occupational experience. Demonstration teaching and use of actual facilities and equipment in business and industry by the students will be stressed. Instruction will be provided in the selection of equipment and teaching aids utilized in a simulated program. Class hours, two to four per week; laboratory hours, three per week. Prereq: EDV 517 or 528, or consent of instructor.

683 *Current Problems in Home Economics Education.* (3)
Recent developments in home economics education. Prereq: EDV 586 and 362; experience in teaching.

684 *Current Trends in Home Economics Education.* (3)
Class work in current trends and significant developments in home economics education. May be repeated to a maximum of nine credits.

685 *Home Economics Curriculum Construction.* (3)
A study of the underlying principles of curriculum building for junior and senior high school and adult education in home economics. Prereq: EDV 586; 362.

686 *Evaluation in Home Economics Education.* (3)
A course to acquaint teachers of home economics with techniques used in measuring attainment in home economics in the junior and senior high school and college. Prereq: Teaching experience.

687 *Home Economics Supervision.* (3)
A course planned primarily to help prepare teacher-trainers and supervisors of home economics education. Prereq: EDV 586; 362; experience in teaching; approval of instructor.

VOCATIONAL EDUCATION

Director of Graduate Study—Harold Binkley

516 *Problems of the Coordinator in Vocational Education.* (2-3)
A course to prepare coordinators of vocational education programs, including planning of local or area programs, use of advisory committees, selection of instructional materials and equipment, organizing instructional programs, and over-all planning and operating of the program.

523 *Vocational Guidance.* (2-3)
A study of the philosophy of guidance, aims and purposes of vocational guidance, individual student inventory (as revealed by tests, surveys, records, case studies, interviews, and observations), and counseling techniques. Emphasis is given to securing and using occupational information, student guidance, placement, evaluation of occupational performance, and organizing and administering vocational guidance programs.

535 *Principles and Philosophy of Vocational Education.* (2-3)
Study is made of philosophy, accepted principles, and legislation affecting programs in vocational education. May be repeated to a maximum of six credits.

641 *Appraisal of Current Literature in Vocational Education.* (3)
A critical study of the issues and trends as reported in the current literature. Course designed to enable students to read more widely in the field of vocational education, to read more critically, to interpret research findings and to formulate generalizations from studying the literature.

670 *Method in Teaching Vocational Education.* (3)
The principles of method applied to teaching in the field of vocational education. Prereq: Experience in teaching vocational education.

671 *Youth Organizations in Vocational Education.* (3)
A study of the underlying philosophy and principles for organizing and advising youth organizations in vocational education. Emphasis to be placed on activities which will enrich and motivate the instructional programs and which will develop leadership, cooperation and citizenship.

678 *Selecting Teaching Materials.* (3)
Selection and organization of specific references and other instructional materials to be used in teaching an area of vocational education.

693 *Supervision in Vocational Education.* (3)
This course includes practice in teaching for observation by others, student teaching, and school visiting. Prereq: Two years of teaching experience and EDV 687.

694 *The Administration of Vocational Education.* (3)
A course designed for superintendents, high-school principals, and other administrators. Its purpose is to train for administering and supervising vocational education in schools.

695 *Special Problems in Vocational Education.* (3)
An independent work course for students interested in vocational education. Students make individual investigations and report on special problems.

702 *Career Development: Research, Theories and Practices.* (2-3)
Overview of theories of career development and current research. Emphasis on use of vocational assessment techniques in counseling and decision-making. Prereq: EDV 523. (Same as EDP 702.)

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (One to six credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (One to 12 credits equivalence.)

779 *Seminar in Vocational Education.* (1-3)
A critical study of selected problems in vocational education. The course is open only to students with experience in the field. May be repeated to a maximum of nine credits.

789 *Independent Work in Vocational Education.* (1-3)
An independent work course for students who have completed a minimum of 12 semester hours of graduate work, one-half of which must have been in vocational education. May be repeated for a total of nine hours.

799 *Research in Vocational Education.* (1-3)
Individual research of importance to vocational education. May be repeated for a total of nine credits.

DISTRIBUTIVE EDUCATION

515 *Problems in Distributive Education.* (2-3)
Problems in teaching vocational distributive education in day, part-time, and evening schools. The problems are selected in accordance with the needs and desires of the students. May be repeated to a maximum of six credits.

517 *Determining Teaching Content in Distributive Education.* (2-3)
Course construction in the field of distributive education. This course is planned to meet the needs of persons engaged as instructors in the field of distributive education. May be repeated to a maximum of six credits.

526 *Organization and Operation of Adult Programs in Distributive Education.* (3)
The organization and administration of adult classes; development of curriculum, personnel, instructional materials, and methods of teaching. Prereq: EDV 516 or 528, or consent of instructor.

528 *Technique of Teaching Distributive Education.* (2-3)
A study of the methods of teaching as applied to distributive education. The purpose of the course is to train prospective teachers to teach in the field of distributive education. May be repeated to a maximum of six credits.

INDUSTRIAL EDUCATION

518 *Methods in Industrial Education.* (2)
A study of various principles and concepts of learning and how they relate to teaching in vocational industrial education. Emphasis is given to methods and techniques used in shop teaching and how these activities are associated with the principles and concepts of learning. May be repeated once to a maximum of four credits.

524 *Modern Industrial Analysis.* (2)
Modern industrial organizations; trends in industrial educational policies; the proper approach to and analysis of these problems as they affect the industrial vocational teacher.

525 *Supervised Work Experience in Business or Industry.* (3)
For students planning careers as vocational teachers and directors. Includes education and experience under the supervision of college personnel and personnel in business and industry. May be repeated three times to a maximum of 12 hours.

529 *Evaluation in Industrial and Distributive Education.* (2)
The theory and practice of standardized, classroom and performance testing as a means of measuring student achievement. Opportunity to practice will be provided in keeping with each teacher's work assignment. Prereq: Must be employed as teacher in Trade or Distributive Education.

534 *Organization and Operation of Part-time and Evening Classes.* (2)
A course for administrators, coordinators, and teachers in part-time and evening industrial education. Covers the duties of a coordinator in cooperative training programs.

536 *Surveys in Industrial Education.* (2)
This course deals with the basic methods and techniques used in making a survey to determine the needs for trade and industrial education. Emphasis is placed on gathering, evaluating, and interpreting the data.

537 *Special Problems in Industrial Education.* (2)
A study of the problem-solving process and its relationship to the solutions of the problems faced by vocational industrial teachers. Students learn to identify teaching problems and engage in activities that lead to their solutions. May be repeated to a total of six credits.

540 *Supervision of Student Teaching in Industrial Education.* (2)
Designed to prepare supervising teachers in industrial education. Includes philosophy of the job in relation to total program of teacher preparation, making teaching assignments, conferencing, evaluation and development of a list of experiences deemed necessary for developing students into effective teachers. Prereq: Hold a ten-year teaching certificate in Industrial Education.

Engineering

Coordinator of Graduate Education—James E. Funk

Requirements for Advanced Degrees in Engineering

The masters' degree in engineering may be obtained by satisfying the following requirements:

1. Twenty-four semester hours in graduate courses with an average standing of 3.0 or better.
2. An acceptable thesis.
   (With departmental approval, a student may substitute six credits of graduate level course work for the thesis.)
3. Two-thirds of the work must be in the major subject.
4. There is no language requirement for these degrees.

The candidate must hold the B.S. degree in engineering or the equivalent. A thorough working knowledge of chemistry, physics, and mathematics is necessary. The degrees offered are Master of Science in Agricultural Engineering, Master of Science in Chemical Engineering, Master of Science in Civil Engineering, Master of Science in Electrical Engineering, Master of Science in Engineering Mechanics, Master of Science (major in Engineering Mechanics), Master of Science in Mechanical Engineering, Master of Science in Metallurgical Engineering, Master of Science in Nuclear Engineering.

Requirements for the Ph.D. Degree

Doctoral work is offered in Agricultural Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Engineering Mechanics, Mechanical Engineering, and Metallurgical Engineering and Materials Science. See the general requirements for the degree of Doctor of Philosophy.

One modern foreign language is required for the Ph.D. degree in Engineering.

AGRICULTURAL ENGINEERING

Director of Graduate Study—Blaine F. Parker

The Agricultural Engineering Department offers programs leading to the M.S. in Agricultural Engineering and the Ph.D. degree.

The agricultural engineering graduate program has as its objectives the development of:

1. The ability to plan and conduct research and design involving the application of the engineering science to biological and agricultural systems.
2. The understanding of the mathematical, physical, and biological sciences to permit the reading and understanding of the present and future literature in these and related fields.
3. The skills required to use precision instruments, techniques and computers useful in research and design.
4. The ability to make sound engineering and management decisions relative to our soil and water resources.
5. The ability to teach college level courses in agricultural engineering, particularly at the doctoral level.

In the attainment of the above objectives the graduate student will combine courses in agricultural engineering, the physical sciences, other engineering fields, and the biological sciences in developing his program of study. The advanced degrees, however, are primarily research degrees awarded for significant creative research or design accomplishment, not for the completion of a specified number of courses. Therefore, the program concentrates on a strong thesis or dissertation problem done under the supervision of the graduate faculty of the department. This does not mean that the course program is not important. Strong course support is essential if the thesis or dissertation problem is to be properly undertaken and completed.

400 *Farmstead Planning and Mechanization.* (3)
Analysis of systems for handling of feed, water, and waste products in agriculture. The processing and storage of farm products. Farmstead layout and design. Structural and environmental design. Lecture, two hours; laboratory, two hours. Prereq: Junior standing or consent of instructor.

405 *Properties of Soils and Biological Materials as Related to Engineering.* (3)
A study of the properties of soil and biological materials which are needed in the engineering design of systems to produce, store, and process agricultural products. Lecture and recitation, two hours; laboratory, two hours. Prereq: Junior standing in Agricultural Engineering or consent of instructor.

406 *Environment for Plants and Animals as Related to Engineering.* (3)
A study of the thermal, moisture, light, and gaseous components of plant and animal environment with emphasis on interactions between these biological systems and their environment. Lecture and recitation, two hours; laboratory, two hours. Prereq: AEN 405 or consent of instructor.

410 *Farm Power and Machinery.* (3)
A study of farm tractors and implements. Operating principles of valves, carburetion, ignition, and lubrication of the engine. Use and care of selected tractor-mounted implements. Emphasis on maintenance. Class and laboratory work on tractors and implements. Lecture, two hours; laboratory, two hours.

417 *Energy Sources and Machinery for Agriculture.* (3)
The use of fundamental concepts of energy and materials in analytical and experimental approaches to the development and design of energy converters and machinery for agriculture. Lecture, two hours; laboratory, two hours. Prereq: Senior standing in engineering or consent of instructor.

427 *Functional Design of Agricultural Structures.* (3)
Functional requirements of farm buildings and structures; planning for plant and process efficiency; selection and utilization of environmental control equipment and structural materials; preparation of plans and designs. Lecture, two hours; laboratory, two hours. Prereq: AEN 406, ME 220, MET 301.

430 *Farm Water Management.* (3)
Elementary surveying, mapping, and determination of land areas; consideration of precipitation, runoff and soil erosion relationships; planning terraces, waterways, drainage systems, farm reservoirs, pond water treatment and irrigation systems. Lecture, two hours; laboratory, two hours.

431 *Watershed Hydrology.* (3)
A study of that part of the hydrologic cycle pertaining to the principles of water movement into and through agricultural and forest watersheds. The effects of natural and man induced changes in watersheds on their hydrology and that of downstream areas. Prereq: Three hours of college mathematics; three hours of college physics.

437 *Design of Engineering Systems for Soil and Water Management.* (4)
Application of engineering principles to the management of surface and soil water for agricultural production. Surveying and mapping for the layout of water control facilities. Design and construction of facilities for runoff and erosion control, water storage, drainage, and irrigation. Lecture, two hours; laboratory, four hours. Prereq: ME 330.

447 *Agricultural Processing and Electrification.* (3)
Application of engineering principles to the processing and storage of agricultural products. The utilization of electricity in agriculture. Instrumentation and control of agricultural processes. Analysis of processing systems. Lecture, two hours; laboratory, two hours. Prereq: AEN 406, EE 305, ME 330.

450 *Special Problems.* (1-3)
An intensive study of some phases of Agricultural Engineering in which the student is particularly interested. Approval of the instructor is required. May be repeated to a maximum of six credits.

505 *Engineering Analysis.* (3)
A study of the professional method of dealing with engineering problems and the application of this method to problems encountered in the agricultural industry. Lecture, two hours; laboratory, two hours. Prereq: AEN 416, 425, 435 or consent of instructor. Prereq: Senior standing in Engineering or consent of instructor.

519 *Plant, Soil and Machinery Relationships.* (3)
Advanced concepts in the use of biological and soil parameters in the design of machinery for agriculture and agriculturally related industries. Lecture, two hours; laboratory, two hours.

525 *Environmental Design for Biological Systems.* (3)
The influence of environmental factors on biological efficiency, design and selection of equipment and controls for providing environmental requirements of biological systems. Lecture, two hours; laboratory, two hours. Prereq: AEN 427 or consent of instructor.

535 *Soil and Water Conservation Engineering.* (3)
Consideration of elements of hydrology related to agriculture; functional analysis, economic analysis and design of more complex systems for soil and water control and management. Prereq: AEN 437 or consent of instructor.

548 *Advanced Agricultural Processing.* (3)
Analytical study of engineering problems dealing with the handling and processing of agricultural products, such as grading, sorting, drying, and curing, and the preparation of plans for these operations. To be offered as a formal class or as a problems course. Lecture, two hours; laboratory, two hours. Prereq: AEN 447.

606 *Micrometeorology.* (3)
A study of the processes occurring at the earth-atmosphere boundary, including heat and energy balance, which are important to biological systems. Lecture, three class hours per week. Prereq: STA 521 or STA 523, one course in Thermodynamics, or consent of instructor.

618 *Advanced Plant, Soil, and Machinery Relationships.* (3)
A consideration of fundamental concepts of energy and materials in the identification and mensuration of parameters needed in the development of new machines for agriculture. Lecture, two hours; laboratory, two hours. Prereq: AEN 417 and 505.

628 *Advanced Design of Structures for Biological Systems.* (3)
The use of similitude, dimensional analysis, and statistical theory in the analysis of selected agricultural structural problems. The prediction of system performance as environmental conditions change; and the analysis of system reliability. Lecture, two hours; laboratory, two hours. Prereq: AEN 525 or consent of instructor.

635 *Advanced Soil and Water Conservation Engineering.* (3)
A consideration of advanced techniques useful in research, analysis, and design related to soil and water conservation facilities. Mathematical and statistical techniques and theory of models are included. Prereq: Consent of instructor.

645 *Electromagnetic Radiation in Agricultural Engineering.* (3)
An advanced study of the theory and engineering aspects of electromagnetic radiation as applied to the Agricultural Sciences. Consideration is given to the ultraviolet, visible, infrared and radiofrequency types of electromagnetic radiation. Prereq: AEN 548 or consent of instructor.

648 *Energy and Mass Transfer in Agricultural Processing.* (3)
A comprehensive and in-depth study of the principles of energy and mass transfer as they apply to the processing of agricultural and biological materials. Prereq: AEN 548 or consent of instructor.

658 *Instrumentation in Agricultural Engineering Research.* (3)
The principles and applications of measuring instruments and devices for obtaining experimental data. Prereq: Consent of instructor.

660 *Similitude in Engineering.* (3)
An advanced approach to engineering problems through the theory of similitude and its application to models. The use of geometrically similar, distorted, and dissimilar models will be discussed. Prereq: Graduate standing.

750 *Special Problems in Agricultural Engineering.* (1-3)
Independent work on selected research problems in one of the various fields of Agricultural Engineering. Consultation and laboratory by appointment. Prereq: Approval of Chairman of Department.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

775 *Seminar.* (0)
Weekly meetings with members of the staff for reports and discussions on research and current trends and practices in agricultural engineering. May be repeated twice. One class hour.

795 *Thesis.* (0)
May be repeated twice.

BIOMEDICAL ENGINEERING

Under the auspices of the Colleges of Engineering and Medicine, the University offers graduate training in Biomedical Engineering. The program is operated by a committee, representing both colleges, which is appointed by the Dean of the Graduate School. Doctoral programs are available in the areas of physiology and biophysics, electrical engineering, mechanical engineering, chemical engineering, and metallurgical engineering and materials science.

Research programs now underway include the study of physiological and behavioral responses to environmental stress (i.e., acceleration, rotation, etc.), characteristics and modeling of biological tissue and systems, development of instrumentation for biological monitoring, and related problems. Research is conducted in the laboratories of the Medical Center and the College of Engineering. Coordination of the program is facilitated by the proximity of the two colleges.

Students participating in the biomedical engineering program are enrolled in the department of their major interest. Further information may be obtained by writing to the Director of Graduate Studies in the student's area or to the Chairman of the Biomedical Engineering Program.

CHEMICAL ENGINEERING

Director of Graduate Study—Robert B. Grieves

The Department of Chemical Engineering provides programs leading to the M.S. in Chemical Engineering and Ph.D. degrees. For the M.S. in Chemical Engineering, 24 hours of course work plus an acceptable thesis are required. In certain exceptional cases, the thesis may be replaced by six additional hours of course work. Unique and highly specialized M.S. programs are available in air quality engineering and water quality engineering. There is no language requirement for the M.S. in Chemical Engineering. For the Ph.D., a reading knowledge of German or Russian is required.

The doctoral student may specialize in one or more of the following areas:

Atmospheric pollution control
Biomedical mass transfer and kinetics
Electrochemical engineering
Transfer processes
Non-Newtonian fluid mechanics
Process control
Environmental engineering
Chemical reactor design
Thermodynamics
Water pollution control

A wide selection of thesis topics is available under the direction of the Chemical Engineering faculty. For further information on financial aid, requirements, and departmental laboratories and facilities, contact the Department Chairman.

422 *Mass Transfer.* (3)
Fundamentals of diffusional and convective transport operations with applications to distillation, absorption, extraction and air-water contact operations. Prereq and/or concur: ME 330.

430 *Advanced Problems in Chemical Engineering.* (2)
Lectures and problems presenting fundamental principles and design procedures for several selected operations from the broad areas of mass, momentum, and heat transfer. Prereq: CME 422.

431 *Chemical Engineering Laboratory I.* (2)
A lecture-laboratory course emphasizing experimental work in fluid flow, heat transfer, evaporation, mass transfer, etc., with special consideration to mathematical and statistical data treatment, measurement techniques and report writing. Lecture, one hour; laboratory, three hours. Prereq: CME 422.

432 *Chemical Engineering Laboratory II.* (2)
Continuation of CME 431, covering diffusional operations such as distillation, absorption, and drying. Laboratory, six hours. Prereq: CME 422, 431.

455 *Chemical Engineering Process Design.* (4)
A lecture and problem course dealing with the application of engineering fundamentals and applied economics to the analysis and design of chemical process systems. Lecture, three hours; laboratory, three hours. Prereq: CHE 442, ME 325, CME 422.

505 *Analysis of Chemical Engineering Problems.* (3)
The application of numerical methods, differential equations, and transforms to complex chemical engineering problems. Prereq: MA 432 or consent of instructor.

515 *Air Pollution Control.* (3)
Kinetics and equilibria of photochemical and "dark" atmospheric reactions. Atmospheric statics and dynamics including lapse rates, inversions, and vertical and horizontal air motion. Single and area source diffusion. Stack meteorology. Prereq: CME 220 or ME 220.

520 *Equilibrium Thermodynamics.* (3)
The criteria for physical and chemical equilibria, including: predictive equations, solution theory, chemical activity, coupled chemical equilibria, and external constraints. Emphasis may be on vapor-liquid equilibrium, chemical reaction equilibrium, or complex ionic equilibria in dilute aqueous solutions and suspensions. Prereq: CHE 442 and CME 220 or consent of instructor.

530 *Transport I.* (3)
A unified study of physical rate processes in liquids and vapors, including: mass, energy, and momentum transport, transport in chemically reacting systems, and similarities.

550 *Chemical Reactor Design.* (3)
A lecture and problem course dealing with interpretation of kinetic data and application in the design of chemical reactor systems. Prereq: CME 220 or ME 321.

552 *Polymeric Materials.* (3)
Relating properties to structure; properties of polymer materials; mechanical, electrical and thermal properties of amorphous and crystalline polymers, molding and fabrication, polymers as additives, biomedical application, selection of polymers, design. Prereq: MET 301 or CHE 230 or CHE 236, or consent of instructor. (Same as MET 552.)

562 *Process Control.* (3)
The theory of automatic control devices and their application in industrial chemical plants. Prereq: Consent of instructor.

570 *Chemical Separation and Measurement for Chemical Engineers.* (3)
An engineering-oriented survey of modern topics in chemical measurement to include discussions of liquid extraction; liquid and gas chromatography; optical absorption; magnetic resonance absorption, including NMR and ESR; microwave spectroscopy. Prereq: CME 520, or consent of instructor.

580 *Design of Rate and Equilibrium Processes for Water Pollution Control.* (3)
The design of chemical and physical processes for the removal and concentration of organic, inorganic, and particulate pollutants from aqueous solution/suspension: adsorption, destabilization, disinfection, membrane processes, thermal processes, flow through beds of solids, etc. Prereq: CME 455, 550 and CHE 442 or consent of instructor.

Prerequisite for graduate work: Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics and mathematics. For major work, a candidate must hold a bachelor's degree in Chemical Engineering or its equivalent.

615 *Advanced Air Pollution Control.* (3)
Principles and techniques of the control of atmospheric pollution, including process design for the removal of gaseous and particulate pollutants from air streams. Legal and administrative aspects of control. Prereq: CME 515 or consent of instructor.

617 *Air Sampling and Analysis.* (3)
Theory and techniques of air sampling, including aerosol sampling. Instrumental, gravimetric, and volumetric analysis of gaseous and particulate air pollutants with emphasis on the most modern methods of instrumental analysis. Lecture, two hours; laboratory, three hours. Prereq: Concur with CME 515, consent of instructor.

619 *Community Health Aspects of Air Pollution Control.* (3)
Effects of specific air pollutants such as sulfur dioxide, particulates, and "smog" constituents on humans, materials, and on the environment. Solid waste disposal by incineration. Air pollution control and water pollution control interrelationships. Prereq: CME 515 or consent of instructor.

621 *Nonequilibrium Thermodynamics.* (3)
An introductory course in the thermodynamics of irreversible processes, including: phenomenological equations relating flows and forces, Onsager's law, and entropy production in continuous processes. Prereq: CME 520, or ME 620, or consent of instructor.

625 *Properties of Gases and Liquids.* (3)
Development, discussion and application of intermolecular force laws as they apply to gases, liquids and mixtures: Chapman-Enskog kinetic theory, virial theorem, Buckingham (6-exp) potential, and theoretical and semi-theoretical predictive equations. Estimation of thermodynamic and transport properties. Prereq: CME 520 and CME 530, or consent of instructor.

631 *Transport II.* (3)
A continuation of Transport I. Interphase transport of mass, energy, and momentum is discussed. Boundary Layer theory is applied to combined transport and chemical reaction. Theories of turbulent transport are examined. Prereq: CME 530 or consent of instructor.

633 *Diffusional Mass Transfer Operations.* (3)
An advanced course in diffusional processes depending upon the current literature for much of its content. Multicomponent diffusional processes. Turbulent diffusion. The modelling of diffusion in biological systems. Prereq: CME 530 or consent of instructor.

635 *Staged Mass Transfer Operations.* (3)
Design and performance of vapor-liquid or liquid-liquid, and solid-liquid systems, particularly for multicomponent mixtures. Emphasis will depend upon student interest. Prereq: CME 422.

637 *Biomedical Mass Transfer.* (3)
Derivation of the transport equations for application to biomedical systems, diffusion and the mechanism of mass transport in the body, membrane transport, convective mass transfer in biomedical systems, discussion of mass transfer in artificial organs. Prereq: Consent of instructor.

638 *Transport Phenomena in Packed and Fluidized Beds.* (3)
A course dealing specifically with the dynamics of heat, mass and momentum transport in packed and fluidized beds. Current experimental findings and transport theories, and bed characterizations are discussed. Analytic and difference methods are used to solve model problems. Prereq: CME 530 or consent of instructor.

642 *Advanced Process Control I.* (3)
Linear and nonlinear automatic control theory, dynamics of chemical process systems, design of systems. Prereq: CME 562.

643 *Advanced Process Control II.* (3)
A continuation of CME 642. Prereq: CME 642.

650 *Advanced Chemical Reactor Design.* (3)
Rate expressions for heterogeneous reaction kinetics; energy and mass transport within and external to reacting porous catalysts; design equations for fixed-moving, and fluidized-bed reactors. Prereq: CME 530 and CME 550 or consent of instructor.

671 *Basic Electrode Processes in Electrochemical Engineering.* (3)
Provides engineers with an introduction to electrochemical theory and measurement techniques, including relaxation methods. Selected topics in equilibrium electrochemistry, generalized theory of reversibility, double layer structural effects on charge transfer rates, organic redox reactions, chemical power systems, and biomedical engineering. Prereq: CME 520, or consent of instructor.

680 *Biochemical Engineering.* (3)
Principles and design of processes involving bio-chemical reactions, including aerobic and anaerobic respirations and fermentations, and involving pure and mixed cultures. Energy considerations, heat and mass transfer, biochemical kinetics, and application to biological waste treatment. Prereq: CME 530, 550 and CHE 442, or consent of instructor.

768 *Residence Credit for the Master's Degree.* (0)
(1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
(1-12 credits equivalence.)

771 *Seminar.* (0)
Review of current literature in the field of chemical engineering, general discussion and presentation of papers on departmental research. Lecture, one hour. Required for all graduate students in chemical engineering.

780 *Special Problems in Chemical Engineering* (3)
Independent study, design, or research in chemical engineering topics. Six laboratory hours per week. May be repeated to a maximum of 12 credits. Prereq: Approval of the Departmental Director of Graduate Studies.

CIVIL ENGINEERING

Director of Graduate Study—Don J. Wood

The Department of Civil Engineering offers the M.S. and Ph.D. with specialization in the following areas:

Environmental, sanitary and water resource engineering
Fluid mechanics, hydraulics and hydrology
Mining and rock mechanics

Planning and management of engineering systems

Soil mechanics, soil dynamics and foundation engineering

Structural engineering and structural systems

Transportation engineering and transportation systems

These programs utilize courses from other departments and such inter-departmental programs are encouraged. Engineering Mechanics, Mechanical Engineering, Chemical Engineering, Agricultural Engineering, Mathematics, Geology, Biology, and Chemistry are some of the departments whose offerings contribute to the programs in Civil Engineering.

The Department of Civil Engineering has a program with local engineering firms under which support for the student is available in return for the students' services. The students gain both practical experience and financial support through this program. The department also offers training grants in the area of pollution control.

A non-thesis option for the M.S. degree is available for students with acceptable previous research or design experience. If a student wishes to pursue this option, he should submit a request to the Director of Graduate Studies.

425 *Soil Mechanics.* (3)
A study of soil and its utilization in foundations for structures and subgrade for highways. Stabilization and improvement of bearing values. Lecture, two hours; laboratory, three hours. Prereq or concur: GLY 240, EM 302.

435 *Mine Plant and Machinery.* (3)
Theory and practice of mine haulage, hoisting, drainage, pumping and compressed air as power. Application of engineering principles to the mineral industries. Lecture, two hours; laboratory, three hours. Prereq: CE 231, or consent of instructor.

480 *Structural Mechanics II.* (3)
Continuation of CE 380 with emphasis on sophisticated methods of analyzing complex structures. Prereq: CE 380.

515 *Geometronics.* (3)
Fundamental principles of geodesy, engineering astronomy and precise survey procedures; triangulation, trilateration and adjustment computations; theory of electronic distance measurement; applications to the horizontal and vertical control of engineering construction and photogrammetric mapping. Lecture, two hours; laboratory, three hours. Prereq: MA 214, CE 215.

523 *Photogrammetry.* (3)
Fundamentals of the photogrammetric method including: geometry of the single photographs and terrestrial photographs; planning the photographic mission and ground control for mapping and an introduction to analytic photogrammetry, stereo-photogrammetric plotting instruments, photo interpretation and remote sensing. Applications to problems in engineering. geography, geology and other disciplines are emphasized. Lecture, two hours; laboratory, three hours. Prereq: MA 113 and consent of instructor.

531 *Coal Preparation I.* (3)
Principles and practice of coal preparation and associated operations. Lecture, two hours; laboratory, three hours. Prereq: CE 231, or consent of instructor.

532 *Coal Preparation II.* (3)
A continuation of CE 531. Lecture, two hours; laboratory, three hours. Prereq: CE 531.

533 *Rock Mechanics.* (3)
An engineering science course leading to an understanding of the stresses in the earth, properties of the materials resisting these stresses and methods of determining these stresses. Stability of excavations. Prereq: MET 301, EM 302, GLY 240, or consent of instructor. (Same as GLY 533.)

540 *Pavement Analysis and Design.* (3)
Pavement types and wheel loads; stresses in flexible and rigid pavements; effect of climate and subgrade soils on pavement performance; evaluation of strength and other properties of soils, base courses, and paving materials; structural design of flexible and rigid pavements; pavement performance. Prereq: CE 340.

543 *Development of Transportation Facilities.* (3)
Analysis of factors affecting development of transportation facilities; history of transportation development; problems of highway geometrics, design standards and traffic estimates and assignment; basic planning and location principles; programming improvements, maintenance and new construction, concepts of highway management, finance and public relations. Prereq: CE 340.

550 *Engineering Hydraulics.* (3)
Analysis of flow in closed conduits and natural and artificial open channels. Design of hydraulic structures. Prereq: ME 330.

553 *Hydrology.* (3)
A study of the factors affecting the occurrence, movement and utilization of water including meteorological considerations, evaporation, transpiration, runoff relationships, hydrograph analysis, and ground water management. Prereq: ME 330 or consent of instructor.

555 *Engineering Economy.* (3)
Economic evaluation and financial analysis of engineering alternatives in which the goal of economic efficiency is applied to engineering design. Prereq: ECO 261 or consent of instructor.

566 *Public Health Engineering.* (3)
Application of engineering principles to the control of the environment, as used by sanitary engineers in federal, state or international health agencies. Prereq: Consent of instructor.

568 *Sanitary Engineering Laboratory.* (3)
Lectures and laboratory practice in principles, application and interpretation of analytical tests used in sanitary engineering research and plant control. Lecture, two hours; laboratory, three hours. Prereq: Consent of instructor.

580 *Theory of Structures III.* (3)
Plastic design of steel. Introduction to the theory of arches. Theory and design of continuous trusses. Prereq: CE 480, MA 214.

***Prerequisite for graduate work**: Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics and mathematics. For major work, a candidate must hold a bachelor's degree in Civil Engineering or its equivalent.*

621 *Engineering Aspects of Surficial Soils and Landforms.* (3)
Techniques of terrain analysis for civil engineering purposes through the use of air photo interpretations (quantitative and qualitative) and other sources of pedologic, geologic and topographic information. Prereq: GLY 240.

624 *Experimental Methods in Soil Mechanics.* (3)
A comprehensive study, including literature review, and experimentation of the instrumentation, methods, and problems associated with the measurement of the behavior and the properties of soil. Laboratory and field methods used in research and practice. Lecture and recitation, two hours; laboratory, three hours. Prereq or concur: CE 625 or consent of instructor.

625 *Advanced Soil Mechanics.* (3)
Detailed study of the particulate and macroscopic behavior of soils. The applicability of surface chemistry, particulate mechanics, elasticity, viscoelasticity, and plasticity as means of describing soil strength and deformational behavior. Prereq: CE 425 or consent of instructor.

626 *Groundwater and Seepage.* (3)
Permeability and capillary flow in soils, mathematical theory of flow through porous media. Flow through anisotropic, stratified and composite sections. Solution by flow net, conformal mapping and numerical methods. Seepage toward wells. Dewatering and drainage of soils. Prereq: CE 425 or consent of instructor.

627 *Soil Engineering for Transportation Facilities.* (3)
Study of frost action and moisture movement in soils and of soil compaction and stabilization. Study of engineering analysis and design for the stability of earth slopes and embankments. Prereq: CE 425 or consent of instructor.

628 *Advanced Foundation Engineering.* (3)
Application of the principles of soil mechanics to the design and analysis of foundations. Prereq: CE 625 or consent of instructor.

629 *Soil Dynamics.* (3)
A study of the response of soils to dynamic loads including foundation vibration problems and the response of footings to impulse loads. Theories of wave propagation in granular and porous media and methods of measurement of the dynamic properties of soils in the laboratory are included.

631 *Advanced Prospecting.* (3)
Study of the principles involved in the geophysical investigation of the minerals of the earth's crust. Lecture, two hours; laboratory, three hours. (Same as GLY 631.)

633 *Mine Organization.* (3)
Detailed study of the structure and function of a mining enterprise from both the financial and the engineering standpoints.

634 *Advanced Mine Engineering.* (3)
Procedure and methods of collecting and recording data for the systematic development and exploitation of a mining property. Lecture and recitation, three hours; drawing and mapping, six hours. May be repeated for a total of six credits.

639 *Air Transport Engineering.* (3)
Planning, location, and design of airports, STOL ports, and heliports. Air traffic operations, performance and control as related to facility requirements. Role of governmental agencies. Prereq: CE 342 or consent of instructor.

640 *Highway Administration, Economics and Finance.* (3)
A study of highway administration, economics and finance; including organization of highway departments, sources and types of revenue, road costs, classification of roads, benefits from improvements, and program planning. Prereq: CE 340.

641 *Highway Traffic Characteristics.* (3)
Vehicle operating characteristics; driver, pedestrian and roadway characteristics as they individually, and collectively as traffic stream characteristics, are related to the planning design and operation of highway facilities. Prereq: CE 340.

642 *Highway Location Analysis.* (3)
Optimization of highway location through a study of the effects of terrain, traffic, geometrics, standards and specifications, earthwork, structures, pavement, drainage, right of way acquisition, maintenance and road-user costs; application of computer-oriented methods of volumetric computations and economic analysis. Prereq: CE 340.

643 *Urban Transportation Planning.* (3)
A detailed review of the transportation planning process; inventory methodologies; trip generation, distribution and assignment with associated mathematical models and theories; prediction of future travel; land and use models; modal split; developing and testing proposed systems; simulation. Prereq: CE 543 or equivalent and STA 381, or STA 681 or equivalent statistics course. (Same as GEO 643.)

644 *Operational Effects of Geometrics in Transportation.* (3)
Operational effects of the geometry of transportation facilities includes capacity, safety, and economic considerations prompting current and impending changes in geometric design of intersections, interchanges, horizontal and vertical alignment, clearances, cross section elements and interfaces between elements of the transportation system. Prereq: CE 340.

645 *Highway Design, Construction and Maintenance.* (3)
A study of highway design, construction and maintenance; including physical aspects of design, drainage, road types, structural pavement design, construction methods and supervision and maintenance methods. Prereq: CE 340 or consent of instructor.

646 *Bituminous Paving Materials.* (3)
Origin, production, use-classifications and significant engineering properties of bituminous materials; design of bituminous concrete pavements and highway wearing surfaces. Includes the most recent developments of practical and potential significance in the highway industry. Covers specifications and materials testing. Lecture, two hours; laboratory, three hours. Prereq: CE 540 and CE 302 or consent of instructor.

647 *Cements, Concretes and Aggregates.* (3)
Origin, production, use-classifications and significant engineering properties of portland cements, concretes and mortars. Covers: precise methods of design and control of mixes; durability considerations; pozzolans; additions and admixtures; mineral aggregates; structural, paving and mass concretes; specifications and materials testing. Lecture, two hours; laboratory, three hours. Prereq: CE 540 and CE 302 or consent of instructor.

652 *Open Channel Flow.* (3)
The hydraulics of free surface flow including such topics as uniform flow, varied flow, unsteady flow, the hydraulic jump flow transitions, spillways and channel delivery. Prereq: ME 330.

653 *Advanced Hydrology.* (3)
Advanced discussion of special topics relating to hydrology including sediment transport, flow through culverts and bridges, frequency analysis, waves, infiltration, and computer models. Prereq: CE 553.

654 *Hydraulic Structures.* (3)
Structural and hydraulic analysis required for the design of concrete and earth dams and appurtenant structures. Prereq: CE 550.

655 *Water-Resources Planning.* (3)
Presentation of techniques for evaluating water-resources projects to meet social objectives with specific reference to such purposes as flood control, drainage, water supply, hydropower, navigation and recreation. Prereq: CE 555.

659 *Advanced Sanitary Engineering Design* I. (3)
Application of theory of water treatment processes to the functional and hydraulic design of water treatment facilities. Lecture, two hours; laboratory, three hours.

660 *Advanced Sanitary Engineering Design II.* (3)
Application of theory of waste treatment processes to the functional and hydraulic design of waste treatment facilities. Lecture, two hours; laboratory, three hours.

662 *Fundamentals of Water Quality Control I.* (3)
Theory of water purification and waste water treatment with emphasis upon the physical and chemical process which are particularly applicable to municipal and industrial waste treatment. Prereq: CE 568.

663 *Water Quality Control Laboratory.* (3)
Laboratory studies of pollution control processes and techniques discussed in CE 662 and 664. Lecture, one hour; laboratory, six hours. Prereq: CE 568 or consent of instructor.

664 *Fundamentals of Water Quality Control II.* (3)
Continuation of CE 662 with emphasis upon biological processes. Prereq: CE 568.

668 *Advanced Instrumentation for Water Resources Research.* (3)
The theory and application of advanced techniques of analysis to water resources research.

669 *Water Quality in Surface Waters.* (3)
Water quality requirements for various beneficial uses. Analysis of dispersion, advection, evaporation, natural aeration, biological oxidation and photosynthesis; their effects on the physical, chemical and biological quality of waters in streams, lakes, reservoirs, estuaries and other surface waters. Eutrophication. Prereq: MA 214 and CE 355, or consent of instructor.

674 *Mechanics of Liquid Flow in Pipes.* (3)
Steady and unsteady one-dimensional pipe flow. Water hammer and surge tank analysis. Steady two-dimensional pipe flow. Digital and analog computer applications. Prereq: CE 550.

678 *Fluid Dynamics of Multiphase Systems.* (3)
A study of the dynamics of multiphase systems consist of mixtures of solid particles, liquid droplets, or bubbles in fluids. Prereq: ME 330; MA 214.

681 *Dynamics of Structures.* (3)
Behavior of materials under dynamic stresses, dynamic response of multidegree of freedom—concentrated mass systems, dynamic response of distributed mass structures, design of structures for earthquake, wind, traffic and machinery loads. Prereq: EM 513 or permission of instructor.

682 *Experimental Structural Analysis.* (3)
Theory and practice of model analysis to facilitate the solution of unusual problems in structural engineering. Dimensional analysis, similitude requirements, materials, fabrication, loading and instrumentation of models, and interpretation of results. Lecture, one hour; laboratory, six hours.

686 *Advanced Metal Structures.* (3)
Plastic analysis and design; shear, local and lateral buckling, compression members, welded, riveted and bolted connections, deflections and shakedown. Light gage cold-formed steel design. Strain hardening and stress concentrations; residual stresses, brittle fracture; fatigue. Torsion, thin-walled sections, multicell sections. Prereq: CE 480. Prereq and concur: EM 531.

690 *Suspended Structures.* (3)
Theory and application of stress analysis and design as applied to suspended structures and suspension systems. Lecture, two hours; laboratory, two hours. Prereq: Consent of instructor.

691 *Advanced Reinforced Concrete Theory.* (3)
Background and origin of modern reinforced concrete design procedures and codes. Comparison of American and foreign methods of analysis. Review of current research and projection to anticipated future changes in design and construction practices. Prereq: EM 531.

692 *Slab and Folded Plate Structures.* (3)
Design and analysis of reinforced concrete floor slabs and folded plate roofs. Elastic and inelastic methods. Prereq: CE 480, EM 531, or consent of instructor.

693 *Shell Structures.* (3)
Design and analysis of reinforced concrete shell structures, including domes, barrel shells, hyperbolic paraboloids and cylindrical tanks. Prereq: CE 692 or consent of instructor.

694 *Advanced Structural Analysis I.* (3)
Theory and application of classical methods for the solution of complex planar structural systems. Prereq: CE 480 or consent of instructor.

695 *Advanced Structural Analysis II.* (3)
Theory and application of matrix methods of analysis to complex plane and space structures. Prereq: CE 694.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

771 *Seminar.* (0)
Review of current literature in the field of Civil Engineering, general discussion and presentation of papers on departmental research. Required of all graduate students. Two hours.

780 *Special Design Problems in Civil Engineering.* (1-6)
Individual work on some selected problems in one of the various fields of Civil Engineering. Laboratory, six hours. May be repeated to a maximum of nine credits. Prereq: Approval of the chairman of department.

790 *Special Research Problems in Civil Engineering.* (1-6)
Individual work on some selected problems in one of the various fields of Civil Engineering. Laboratory, six hours. May be repeated to a maximum of nine credits. Prereq: Approval of the chairman of department.

ELECTRICAL ENGINEERING

Director of Graduate Study—Earl L. Steele

The Department of Electrical Engineering offers programs leading to M.S. and Ph.D. degrees. Areas of current research interests include: energy conversion; modern control theory; automata theory; radio-frequency spectroscopy; microwave absorption studies; solid-state electronics; biomedical engineering; and electromagnetics.

The laboratories are well-equipped for research in the above areas under the direction of the electrical engineering faculty. For further information on financial aid and other details, write to the Department Chairman.

401 *Electronic Analog Computation.* (3)
Analog computer components and their interconnection. Time and amplitude scaling. Simulation of linear and non-linear physical systems. Simulation of continuous systems using a digital computer. Lecture, two hours; laboratory, three hours. Prereq: MA 214 or consent of instructor.

415 *Electromechanics I.* (3)
Study of idealized electromechanical systems and rotary energy converters with emphasison their dynamical behavior. Prereq: EE 221 and 467. Concur: EE 416.

416 *Electrical Engineering Laboratory III.* (2)
Laboratory practice and experimental studies related to EE 415. Lecture, one hour; laboratory, three hours. Concur: EE 415.

420 *Engineering Analysis I.* (3)
A study of engineering analysis stressing fundamental mathematical and physical principles; electrical-mechanical analogs; time domain and frequency domain analysis; Fourier series and integral; series solutions of Bessel's and Legendre's equations. Prereq: MA 214.

435 *Circuits III.* (3)
Fundamentals of network theory in communications circuits; Laplace transforms and wave filters. Prereq: EE 221.

461 *Electronic Circuits I.* (3)
Analysis and design of electronic circuitry incorporating nonlinear electronic elements such as transistors, FET's, and vacuum tubes. Applications to amplifiers. Prereq: EE 221. Concur: EE 462.

462 *Electrical Engineering Laboratory II.* (2)
Experimental exercises in the design and analysis of useful electronic circuits incorporating semiconductor devices: transistors, tunnel and zener diodes; also, vacuum tubes, integrated circuits and operational amplifiers. Lecture, one hour; laboratory, three hours. Prereq: EE 222. Concur: EE 461.

467 *Electric and Magnetic Fields.* (3)
Field laws and theorems in vector form; fields in dielectric and magnetic media. Forces, moments, energy power. Brief introduction to time-varying fields. Prereq: PHY 232, MA 213.

468 *Fields and Waves.* (3)
Maxwell's equations; vector and scalar wave equations; bounded solutions (transmission lines, waveguides); unbounded solutions (antennas); Poynting's theorem; fields in moving media. Prereq: EE 420 and 467.

507 *Electrical Controls I.* (3)
Block diagram and transfer function representation of linear control systems. Basic servo characteristics; stability and frequency response. Analysis and synthesis by Nyquist diagram, Bode diagram and root-locus method. Prereq: EE 435.

508 *Electrical Engineering Laboratory IV.* (2)
Laboratory study of control methods and systems employing magnetic

and electronic components; analog computers. Lecture, one hour; laboratory, three hours. Prereq or concur: EE 507.

511 *Information Theory.* (3)
Time and frequency domains; sampling theorems; review of AM and FM; pulse modulation; probability and random signal theory; autocorrelation; noise. Prereq: EE 420.

517 *Electromechanics II.* (3)
A continuation of EE 415 including energy conversion in continuous media and realistic considerations. Prereq: EE 415.

520 *Engineering Analysis II.* (3)
Investigation of transient and steady-state conditions in electrical and mechanical systems, using Laplace transforms, vectors, complex variables: network analysis and synthesis. Feedback system stability criteria. Prereq: EE 420.

523 *Electrical Equipment Problems.* (2)
A creative design study of comprehensive engineering problems, primarily electrical but related to engineering in general. One class hour, five hours by appointment. Prereq: Senior classification.

537 *Electric Power Systems I.* (3)
Application of symmetrical components to power system fault studies, calculation of transmission line parameters. Prereq: Consent of instructor.

538 *Electric Power Systems II.* (3)
Introduction to modern power system practices, basic transient and steady-state stability analysis with emphasis on digital techniques. Prereq: EE 537.

560 *Semiconductor Device Design.* (3)
Theory, development and discussion of equivalent circuit models of transistor devices, negative resistance, semi-conductor devices and praetersonic devices based on electronic processes in solid state elements. High and low frequency, as well as the Ebers-Moll and charge control switching models and their application in computerized electronic circuit analysis will be developed. Prereq: CS 220; EE 461 or equivalent.

562 *Electronic Circuits II.* (3)
Feedback amplifiers, tuned and untuned amplifiers, oscillators, AM and FM transmitters. Prereq: EE 461.

564 *Electronic Circuits III.* (3)
Timing, scanning, trigger, logic and pulse circuits; video and broadband R-F amplifiers. Prereq: EE 461.

565 *Electrical Engineering Laboratory V.* (2)
Laboratory practice and experiment exercises relating to studies in EE 564. Lecture, one hour; laboratory, three hours. Concur: EE 564.

569 *Microwave and Coherent Optics Measurement.* (3)
Theory and practice of measurement of coherent microwave and optical radiation from waveguides, lasers, and antennas, including analysis of errors. Laboratory measurement of frequency, power, impedance, polarization and patterns of coherent waves. Lecture, two hours; laboratory, three hours. Prereq: EE 468.

572 *Electrical Controls II.* (3)
Analysis and design of non-linear feedback control systems. Phase plane, describing function and piecewise linear techniques are developed. Stability of non-linear feedback systems is studied. Prereq: EE 507.

580 *Logical Design of Analog and Digital Systems.* (3)
Computation elements; analysis and synthesis of systems, Boolean functions and applications to relay and electronic circuits; circuit logic, memory elements; prime implicate synthesis of iterative networks; sequential circuits, digital devices. Prereq: EE 221.

581 *Advanced Logical Design.* (3)
Boolean Matrices; Boolean trees, design of sequential circuits. Design a digital and hybrid computers. Prereq: EE 580.

585 *Molecular Engineering.* (3)
Molecular approach to the behavior of gaseous conductors, semiconductors, dielectrics and magnetic materials; emphasis on modern semi-conductor electronic devices such as masers, lasers, Esaki diodes, Zener diodes, and micromodules. Lecture, two hours; laboratory, three hours. Prereq: EE 420, 467.

595 *Independent Problems.* (1-3)
For electrical engineers. A problem, approved by the Chairman of the Department, provides an objective for study and research. May be repeated to a maximum of six credits. Prereq: 2.5 standing.

Prerequisite for graduate work: Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics and mathematics. For major work, a candidate must hold a bachelor's degree in Electrical Engineering or its equivalent.

601 *Electromagnetic Energy Conversion I.* (3)
Generalized electric machine theory; parameter determination. Energy conversion in continuous media including magnetohydrodynamics. Prereq: Consent of instructor.

602 *Electromagnetic Energy Conversion II.* (3)
Continuation of EE 601 with special reference to energy conversion in nonlinear media; numerical methods; irregular boundaries. Prereq: Consent of instructor.

606 *Electric Power Transmission.* (3)
The theory underlying the calculation and operation of long distance transmission circuits. Special attention to relay control. Prereq: EE 538.

611 *Linear Circuit Analysis I.* (3)
Laplace and Fourier transform methods of analysis of linear lumped constant systems under transient and steady state conditions; feedback amplifiers; filter networks; stability and physical realizability. Prereq: EE 520.

612 *Linear Circuit Analysis II.* (3)
Continuation of EE 611 with an introduction to non-linear systems. Prereq: EE 611.

613 *Optimal Control Theory.* (3)
State-space modeling of control systems; variational techniques; system optimization by maximum principle, dynamic programming; Hamilton-Jacobi equations, design of linear optimal systems; computational methods for solving boundary value problems. Prereq: EE 611.

614 *Sampled-Data Control Systems.* (3)
Z transforms, Nyquist criterion, Bode and root locus plots, error constants, finite settling-time design, sensitivity, state variables. Prereq: EE 520 or consent of instructor.

615 *Stability Theory of Control Systems.* (3)
Stability theorems are studied with emphasis on application to closed-loop control systems. Prereq: EE 572.

616 *Advanced Topics in Control.* (3)
Current research and design practices in control devices and systems. May be repeated twice. Prereq: EE 613, 614 or consent of instructor.

621 *Introduction to Antennas.* (3)
Fundamental Antenna concepts, Array Theory, Linear Radiators, Loops, Helices, Mutual Coupling, Reflectors, Measurement Theory. Prereq: EE 468.

622 *Advanced Antennas.* (3)
Traveling wave concepts, line sources, Huygen's Principle, Babinet's Principle, synthesis techniques, traveling wave antenna design, practical traveling wave antennas, non-uniform arrays, supergain, Brillouin Diagrams. Prereq: EE 621.

623 *Lines and Wave Guides.* (3)
Open-wire and coaxial lines, standing waves, stub matching; impedance transformation, rectangular and circular wave guides. Prereq: EE 435, 467, 564.

624 *Solid-State Electronics.* (3)
Bose and Fermi statistics. Semiconductor theory; solid-state devices; electrical properties of insulators; theory and applications of magnetic materials, including ferrites.

625 *Electromagnetic Propagation and Scattering.* (3)
Theory of electromagnetic wave propagation in anisotropic and inhomogeneous media; ionospheric radio propagation; waves in plasmas. Prereq: EE 468 or consent of instructor.

626 *Microwave Engineering.* (3)
Generation, detection and measurement of microwave energy; vacuum tubes at ultra-high frequencies, the klystron, the magnetron, travelling wave tube and ferrite devices. Lecture, two hours; laboratory, three hours. Prereq or concur: EE 468.

627 *Electromagnetic Fields.* (3)
Advanced studies in electromagnetic fields; radiation and propagation of electromagnetic waves; propagation in anisotropic media; diffraction theory; electrodynamics of moving media. Prereq: EE 468.

631 *Discrete Information Theory I.* (3)
Entropy, Markov sources, algebra of codes, classification of codes, Shannon's theorems, compact codes, linear codes, error detection and error correction, syndrome vectors. Prereq: Consent of instructor.

632 *Discrete Information Theory II.* (3)
Plotkin, Gilbert and other bounds, Hamming codes, Reed-Muller and other linear codes, cyclic codes, Bose-Chandhuri codes, sequential decoding, convolution encoding. Prereq: EE 631.

633 *Advanced Information Theory.* (3)
Shannon type information theory regarding channel capacity, entropy, band-limited systems for both memory and memoryless channels. Prereq: EE 511, STA 523 or consent of instructor.

635 *Pattern Recognition.* (3)
Introduction to and equivalence of approaches to pattern recognition, matched filtering, decision theoretic methods, sequential approach and learning machines. Prereq: EE 640.

640 *Continuous Stochastic Processes I.* (3)
Random variables, stochastic processes, stationary processes, correlation and power spectrum, mean-square estimation, filter design, decision theory, Markoff processes, simulation. Prereq: STA 523.

641 *Continuous Stochastic Processes II.* (3)
Continuation of EE 640. Prereq: EE 640.

645 *Communication Systems I.* (3)
The formulation, optimization, and implementation of digital and analog communication systems. Topics include signal representation and design, optimal detection methods, modulation, channel modeling, and diversity techniques. Prereq: EE 511 and EE 640, or consent of instructor.

646 *Communication Systems II.* (3)
Communication channel capacity and the formulation and implementation of systems that approach the channel capacity. The design and optimization of analog modulation and demodulation systems. Prereq: EE 645.

650 *Electro-Optical Properties of Materials.* (3)
The effects of electric fields upon light propagation in media. Lasers, electro-optic modulation, non-linear optics, laser noise, optical parametric oscillator, stimulated Raman emission, coherent scattering. Prereq: EE 670.

653 *Optical Processing.* (3)
Emphasis on both the mathematical modeling and the use of optical equipment in the solution of diverse physical problems which lend themselves to a "photographic" type output. Lecture, two hours; laboratory, three hours. Prereq: PHY 508.

660 *Electronic Device Design.* (3)
An integrated treatment of the theory and application of electronic devices with emphasis on methods of engineering analysis and design. Prereq: EE 585 or consent of instructor.

665 *Integrated Circuits.* (3)
Theory and analysis of integrated circuits will be developed and the relations between process variables and electrical performance parameters established. Modern semiconductor techniques will be described for silicon and other microcircuit materials and the theory and rationale behind their application developed. The use and application of computer aided design will be introduced. Prereq: MET 532, EE 461 or consent of instructor.

670 *Quantum Electronics.* (3)
The interaction of electromagnetic radiation fields and atomic systems and devices that make use of such interactions. Prereq: EE 624.

672 *Molecular Properties in Electronic Devices.* (3)
The study of molecular properties and the application of these properties in electronic devices. Correlation of molecular energy states with infrared and Raman spectra; selection rules and intensities of transitions; instrumentation for molecular investigation; applications. Prereq: Consent of instructor.

683 *Automata Theory.* (3)
Decomposition of Sequential Machines, State Assignment, Finite Memory Machine, Shifting Operators as applied to Structural Machines, Turing Machines, Pattern Classification by State Machines. Prereq: EE 580, MA 561.

711 *Network Synthesis I.* (3)
The first of a two-semester sequence of courses giving a comprehensive treatment of modern network synthesis. Prereq: EE 611.

712 *Network Synthesis II.* (3)
The second of a two-semester sequence of courses giving a comprehensive treatment of modern network synthesis. Prereq: EE 711.

768 *Residence Credit for the Master's Degree.* (0)
(1-6 credits equivalence.) May be repeated once.

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1 to 12 credits equivalence).

771 *Seminar.* (0)
Review of current literature in the field of Electrical Engineering, general discussion and presentation of papers on departmental research. Required of all graduate students. One class hour.

783 *Special Problems in Electrical Engineering.* (1-3)
Open to graduate students only. Individual work on an assignment approved by the Chairman of the Department. May be repeated to a maximum of nine credits.

ENGINEERING MECHANICS

Director of Graduate Study—D. C. Leigh

The Department of Engineering Mechanics provides programs for study and research leading to the Master of Science in Engineering Mechanics and the Doctor of Philosophy. The master's degree requires 24 credit hours of course work and a thesis, or in some circumstances with departmental approval, 30 hours of course work without a thesis. In addition to the general information on the Ph.D. degree at the front of this Bulletin, note that the Department requires a reading knowledge of one foreign language.

Most engineering disciplines exist to serve society directly. Such disciplines are recognized by and often named for the products associated with them, e.g., aircraft, structures, metals, ceramics, etc. Engineering Mechanics, on the other hand, exists to serve all of these disciplines by concerning itself with the fundamental laws, mathematical apparatus, and basic experimental methods common to all those phases of engineering which are based on mechanics. Students enter the graduate program in Engineering Mechanics from all branches of engineering as well as from mathematics and physics.

Fields of concentration for study are (1) continuum mechanics, (2) materials and (3) dynamics. Typical areas in which research has been carried out in the Department include infinitesimal and finite elasticity, viscoelasticity, plasticity, non-Newtonian fluids, rigid- and flexible-body dynamics, and particle dynamics. Investigations in

these areas have included theoretical, experimental and numerical methods and wave propagation and stability analyses.

For further information contact the Director of Graduate Study.

503 *Introduction to Continuum Mechanics.* (3)
An introduction to the mathematical description and continuum concepts of deformable materials. Review of linear algebra and Cartesian tensor analysis. Finite deformation and rate of deformation. Balance principles. Principle of material indifference. Study of constitutive equations of linear elasticity, Newtonian fluids, linear viscoelasticity, hyperelastic materials and special non-Newtonian fluids. Sample problems. Prereq or concur: MA 433 or consent of instructor.

513 *Mechanical Vibrations.* (3)
Vibrations of systems of one and several degrees of freedom, critical speeds and torsional and lateral vibrations of shafts. Prereq: EM 313.

531 *Advanced Strength of Materials.* (3)
Unsymmetrical bending of beams, thin plates, stress analysis of thick walled cylinders, and rotating discs. Theory of elastic energy, curved beams, stress concentration and fatigue. Prereq: EM 302.

532 *Experimental Stress Analysis.* (3)
Experimental stress analysis from an engineering viewpoint. Preliminary optics; stress-optic law; isoclinic and stress trajectories; strain gauges; rosettes; miscellaneous experimental techniques. Prereq: EM 531.

533 *Aircraft and Missile Structural Analysis.* (3)
Analysis of semi-monocoque structures in bending and torsion. Energy and approximate methods; shear lag; and thermal effects. Introduction to creep and plasticity. Prereq: EM 313.

585 *Fourier Series and Boundary Value Problems.* (3)
An introductory treatment of Fourier series and its application to the solution of boundary value problems in the partial differential equations of physics and engineering. Orthogonal sets of functions, Fourier series and integrals, solution of boundary value problems, theory and application of Bessel functions and Legendre polynomials. Prereq: MA 432 or equivalent. (Same as MA 485.)

603 *Theoretical Plasticity I.* (3)
An introductory mathematical treatment of the perfectly plastic solid. Real and idealized materials; yield criteria; flow rules; experimental basis of the theory; contained plastic flow; some two-dimensional problems. Connection with dislocation theory. Prereq: MA 433 or consent of instructor.

604 *Theoretical Plasticity II.* (3)
Continuation of EM 603. Limit analysis; plastic bending and torsion; structures and shells; thermoplasticity; plastic wave propagation. Prereq: EM 603.

605 *Foundations of Inelasticity.* (3)
A critical and constructive discussion of the assumptions and experimental evidence for inelastic material response from a viewpoint of the mechanist. Prereq: EM 604 and 662.

606 *Theoretical Elasticity.* (3)
A mathematical account of the linear elastic solid as special continuum. Solution of boundary value problems; two-dimensional examples; torsion and bending; stress concentrations; strain energy; thermoelasticity. Some direct methods of solution for difficult problems, and introduction to dynamic elasticity. Prereq: EM 503 or consent of instructor.

607 *Advanced Inelasticity.* (3)
A continuation of EM 605 with a study of the latest research results in the area inelasticity. Prereq: EM 605.

613 *Nonlinear Oscillations.* (3)
Analysis of various nonlinear oscillatory mechanical systems. Solutions of the differential equations of motion; response curves for forced oscillations; determination of stability criteria. Prereq: EM/ME 646 or permission of instructor.

614 *Mechanics of Space Vehicles.* (3)
Description of rigid body orientation, angular velocity, and angular acceleration in terms of Euler angles, Euler parameters, and direction cosines. Gravitational forces and torques and their effect on the attitude motions of symmetrical and unsymmetrical near-earth satellites. Effects of gyroscopic devices, energy dissipation, and elastic flexibility on the stability of space vehicles. Prereq: EM 613 or consent of instructor.

632 *Theory of Elastic Stability.* (3)
Buckling of centrally compressed bars. Detailed consideration of elastic and plastic buckling of prismatic bars under simultaneous action of axial and lateral loads. Buckling of frames, lateral buckling of beams, shear effect, energy methods. Prereq: EM 531.

644 *Advanced Dynamics I.* (3)
Generalized rigid body kinematics, concept of reference frames, generalized forces for holonomic and non-holonomic systems, inertia properties of rigid bodies, and energy functions. Lagrange's form of D'Alembert's principle for holonomic and non-holonomic systems. Prereq: Consent of instructor. EM 313, MA 432. (Same as ME 644.)

646 *Advanced Dynamics II.* (3)
Continuation of EM/ME 644. Application of Lagrange's equations in deriving equations of motion; first integrals and conservation theorems; Hamiltonian formalism. Applications to engineering systems. Prereq: EM or ME 644. (Same as ME 646.)

651 *Numerical Methods in Potential Theory.* (3)
A modern numerical treatment of some classical problems in potential theory. Prereq: MA 433.

652 *Numerical Methods in Elasticity.* (3)
Continuation of EM 651. A modern numerical treatment of some difficult problems in classical elasticity. Prereq: EM 651.

653 *Methods of Applied Differential Equations.* (3)
Integrals of nonlinear partial differential equations; similarity variables and other transformations; perturbation methods; weighted residual methods; numerical methods; selected topics. Prereq: MA 432 or consent of instructor.

661 *Nonlinear Continuum Mechanics I.* (3)
An introduction to the continuum physics and mathematical theory of the nonlinear mechanical behavior of materials. Review mathematical background. Principles of continuum mechanics. Principles of constitutive equations. Prereq: EM 503 or MA 462 or consent of instructor.

662 *Nonlinear Continuum Mechanics II.* (3)
Continuation of EM 661. Classes of materials. Finite elasticity and hyper-elasticity. Nonlinear fluids with memory. Approximation theory for memory functionals. Approximations to memory materials. Thermodynamics of memory materials. Prereq: EM 661.

768 *Residence Credit for the Master's Degree.* (0)
(1-6 credits equivalence.) May be repeated.

769 *Residence Credit for the Doctor's Degree.* (0)
(1-12 credits equivalence.) May be repeated indefinitely.

780 *Special Problems in Engineering Mechanics.* (3)
A forum for the presentation and discussion of a wide range of timely topics of interest to Engineering Mechanics. May be repeated to a maximum of nine credits. Prereq: Approval of Director of Graduate Study.

MECHANICAL ENGINEERING

Director of Graduate Study—John H. Lienhard

The Department of Mechanical Engineering provides programs for study and research leading to the Master of Science in Mechanical Engineering, the Master of Science in Nuclear Engineering, and the Doctor of Philosophy. In the master's plan without thesis, the department requires 30 hours of course work plus two formal

reports, usually survey papers. The language requirement for the Ph.D. may be satisfied with either German or Russian.

Areas of concentration for research and study are (1) thermal sciences comprising heat transfer, thermodynamics and fluid mechanics, (2) design, (3) biomedical engineering, (4) nuclear engineering, (5) air pollution and (6) systems and controls.

Preparation for graduate study in the department normally consists of a bachelor's degree in engineering. It is not necessary that this degree be in mechanical engineering. An undergraduate degree in chemistry, physics or mathematics combined with a strong interest in engineering topics is excellent preparation for graduate study in mechanical engineering.

The master's degree can be completed in one academic year plus a summer, but students holding assistantships usually find it necessary to spend about two years to complete all of the requirements. The Ph.D. degree has no formal course requirement. Generally students take a number of courses to prepare for the qualifying examinations and usually need to spend two years to complete a suitable dissertation. Most students find one year of course work beyond the master's degree necessary preparation for the qualifying examination.

Laboratories for research are located in Anderson Hall and the Wenner-Gren Aeronautical Research Laboratories. The latter is wholly devoted to research in biomedical engineering. The departmental laboratories are well-equipped with instrumentation and facilities for study in the areas of fluid mechanics, heat transfer, nuclear engineering and air pollution.

475 *Introduction to Nuclear Engineering.* (3)
Introduction to basic topics of nuclear science. Interaction of radiation with matter. Design and operation of nuclear reactors, shielding, instrumentation, health physics, fuel cycles, use of radiosotopes. Prereq: PHY 232; MA 214.

480 *Thermal Environmental Engineering.* (3)
An introductory course emphasizing the engineering systems aspects of thermal environmental design. A case study approach treats measurement problems, modeling, and equipment specification for design of environmental systems. Examples drawn from terrestrial, space and marine environments. Prereq: Consent of instructor.

514 *Nuclear Reactor Analysis I.* (3)
Neutron cross-sections, the fission process. Infinite medium criticality calculations, the four factor formula. Neutron diffusion and slowing down theory. Age theory, criticality calculations for the homogeneous reactor, elementary reactor kinetics. Reflected reactors multigroup methods. Control rod theory, heterogeneous reactors. Prereq: PHY 554, MA 432.

515 *Fuel Management and Economics of Nuclear Reactors.* (3)
Nuclear fuels, fuel element claddings, burnup, fission products and waste handling, processing and recycling of fissile materials, isotope separation, and applications. Fuel cycle performance of typical reactors. Uranium resources and cost, nuclear plant costs and the interrelation between convectional and nuclear power costs. Prereq: ME 475 or ME 514.

517 *Instrumentation for Research.* (3)
An exploration of modern instrumentation techniques and problems; transducer principles; analysis of dynamic response of instrumentation systems; theory of measurements; random processes; pressure; temperature, strain gages and inertial measurement techniques; magnetic, optical, electrostatic and other recording systems; automatic data reduction; measurement of errors. Prereq: Consent of instructor.

530 *Gas Dynamics.* (3)
Consideration of the mass, energy and force balances applied to compressible fluids. Isentropic flow, diabatic flow, flow with friction, wave phenomena, and generalized one-dimensional gas dynamics. Prereq: ME 321.

532 *Fluid Transients and Power Control.* (3)
A course in the analysis of fluid transients and the theory and design of fluid power controls and their application in engineering systems. Prereq: ME 330.

564 *Propulsion System Design.* (3)
Design of systems for aircraft or missile propulsion. Centrifugal compressors, axial-flow compressors, turbine and exhaust systems, and combustion chambers. Prereq: ME 530.

567 *Air Pollution Engineering and Economics.* (3)
The Mechanical Engineering aspects of Air Pollution resulting from Combustion processes. Lecture, two hours; laboratory, three hours. Prereq: MA 214, ME 321 or equivalent, ME 330 or equivalent.

583 *Biotechnology.* (3)
The human body as a mechanical system responding to sustained and transient forces and pressures, such as occur in flight, space flight and industrial environments. The physical and behavioral reaction of organisms to dynamic, thermal, radiative and gravitational stresses. Mechanical, hydraulic and pneumatic performance of body subsystems. Use of the human parameters in the design of protective and prosthetic devices and life support systems. Prereq: Consent of instructor.

590 *Elements of Aero-Space Technology.* (3)
Flight performance of airborne and ballistic vehicles. Space vehicle propulsion and structures. The space environment. Man in space. Prereq: ME 321 and 330.

592 *Aero-Space Component Design.* (3)
Preparation of a formal proposal on a given requirement in the aerospace field. Execution of the design. Testing of a prototype under proper environmental conditions. Prereq: ME 590.

Prerequisite for graduate work: Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics and mathematics.

611 *Nuclear Reactor Analysis II.* (3)
Advanced topics in reactor analysis. The Boltzman equation, spherical harmonic methods and other approximate solutions of the Boltzman equation. Perturbation theory, neutron importance. Introduction to neutron thermalization. Special topics. Prereq: ME 514, PHY 555 or concur.

615 *Plasma Dynamics.* (3)
Discussion of the properties of ionized gases in magnetic and electric fields. Topics covered include motion of charged particles, statistical behavior of plasmas, conduction and diffusion in ionized gases, ionization phenomena, electromagnetic waves and radiation in plasmas, and derivation of the fundamental magnetogasdynamic equations: continuity momentum and energy. Prereq: ME 620.

620 *Advanced Engineering Thermodynamics I.* (3)
Critical treatment of the laws of thermodynamics, relations among thermodynamic properties; stability of systems; thermodynamic processes; selected special topics. Prereq: ME 321.

621 *Advanced Engineering Thermodynamics II.* (3)
Broad coverage of statistical mechanics, kinetic theory and theory of fluctuations. Relations between quantum and classical statistics; Boltz-

mann integro-differential equation and its consequences; applications to reaction equilibrium, property evaluation, and other topics. Prereq: ME 620.

622 *Dynamics and Thermodynamics of the Atmosphere.* (3)
The thermodynamics of air and the dynamics of gaseous, liquid and solid diffusion and subsequent movement in the atmosphere. Prereq: MA 214, ME 321 or equivalent, ME 330 or equivalent.

625 *Advanced Heat Conduction.* (3)
Comprehensive study of heat conduction; derivation of governing equations; discussion of the various boundary conditions; review of classical heat conduction solutions; discussion of current problems, methods of solution and engineering applications of heat conduction. Prereq: MA 432.

626 *Advanced Heat Convection.* (3)
Comprehensive study of heat convection; derivation of equations of convection of mass, momentum, and energy; boundary layer equations; classical solutions of laminar convection problems; turbulent convection; analogies between momentum and energy. Prereq: ME 625.

627 *Radiation Heat Transfer.* (3)
Principles of thermal radiation, the determination of radiation properties, and the analysis of radiation heat transfer. Results of recent radiation researches are included in the discussions. Prereq: ME 325 or equivalent.

628 *Convective Mass Transfer.* (3)
A unified treatment of convective mass transfer; theory of mass transfer; Reynolds flow; calculation procedures; application to systems; simultaneous heat and mass transfer. Prereq: ME 325, 530.

630 *Fluid Dynamics I.* (3)
Stress at a point (introduced as a tensor of rank two). Equation of conservation of mass, rate of strain tensor, derivation of Navier-Stokes equation, source-sink flows, motion due to a doublet, vortex flow, two- and three-dimensional irrotational flow due to a moving cylinder with circulation, two-dimensional airfoils. Prereq: ME 330, MA 432.

631 *Fluid Dynamics II.* (3)
A continuation of ME 630 with emphasis on viscous flow. Exact and approximate solutions, boundary layer theory. Jets, wakes, rotating systems, compressible boundary layer and hydrodynamic stability. Prereq: ME 630 or consent of instructor.

632 *Compressible Fluid Flow.* (3)
Review and extension of one-dimensional gas dynamics. Subsonic flow, Hodograph method. Supersonic flow, perturbation method, method of characteristics, oblique shocks. Unsteady wave motion and shock waves. Compressible boundary layers and interacting wave motion and shock waves. Prereq: ME 330, MA 432.

633 *Rarefied Gas Dynamics.* (3)
Dynamics of Rarefied Gases: Solution of Boltzmann and Krook equations moment methods, integral iteration, boundary layer in hypersonic flow of a slightly rarefied gas, shock wave structure, Fokker-Planck and Vlasov equations. Prereq: ME 621 and ME 630 concurrent. (Offered every other year.)

634 *Turbulent Flows.* (3)
Physical and analytical description of turbulent flows, isotropic turbulence, boundary layers and shear flows, free turbulence in jets and wakes. Measurement techniques. Prereq: ME 631 or consent of instructor. (Offered every other year.)

642 *Advanced Kinematics of Machinery I.* (3)
Fundamentals in the analysis and synthesis of mechanisms including coupler curves, guided plane systems and linkage design. Prereq: Approval of director of graduate study.

643 *Advanced Kinematics of Machinery II.* (3)
A continuation of ME 642, dealing with the motion of rigid planes passing through multiple positions. Theory and application. Prereq: ME 642.

645 *Systems Concepts and Analysis.* (3)
Conceptual development and study of complex systems; their synthesis and design; analysis and optimization of system parameters. Input-output relationships; formulation of mathematical models, parameters and constraints on physical systems. Prereq: Consent of instructor.

647 *System Optimization.* (3)
A course in the theory and application of optimization techniques with emphasis on large engineering systems. Prereq: MA 433 or CS 220.

649 *Dynamic Analysis of Mechanical Systems and Components.* (3)
The analysis of actual dynamic devices with emphasis on the selection of valid and meaningful engineering techniques and prediction of performance for reliable operation of these mechanical systems. Prereq: MA 432.

650 *Fluidic Systems.* (3)
Introduction to combinational, threshhold and sequential logic design; digital fluidic devices and sensors, proportional fluid amplifiers, fluidic digital control system design. Prereq: ME 532 or consent of instructor.

651 *System Optimization II.* (3)
Introduction to optimal control and its applications, calculus of variations, dynamic programming, maximum principle, differential game theory, adaptive control systems, learning systems. Prereq: ME 647.

662 *Propulsion Systems.* (3)
Theory of propulsion by jet; efficiencies, specific consumption; specific impulse. Primary jet devices; turbojet, ducted fan, ramjet, rocket, ram rocket, nuclear power plants. Secondary jet devices for space propulsion; solar propulsion, arc heating devices, ion drive, electromagnetic drive. Prereq: ME 530.

663 *Energy Conversion Processes.* (3)
Basic considerations of direct conversion of thermal to electrical energy. Thermodynamic and performance characteristics of solid state conversion devices including thermoelectric, thermionic, and photovoltaic systems. Thermodynamic principles and operating characteristics of fuel cells. Analysis of MHD generators and accelerators. Space application of direct energy conversion devices and sources of power. Prereq: ME 325.

664 *Experimental Methods in Nuclear Engineering.* (3)
A lecture and laboratory course covering the utilization of radiation in engineering, measurement and analysis of parameters pertient to reactor design and operation, and radiation shielding; reactor response and control studies using analog computer. Prereq or concur: ME 514.

665 *Nuclear Reactor Dynamics.* (3)
Analysis of dynamic behavior of nuclear reactor systems; transfer function methods applied to nuclear reactor operation and control, stability and analysis from Nyquist and Bode plots, effects of feedback and compensation; instrumentation for reactor start-up and operate conditions. Prereq: ME 343, ME 514.

666 *Radiation Damage and Shielding.* (3)
A study of the effects of radiation on reactor materials and instrumentation. Macroscopic study of radiation absorption applied to radiation shielding and heat generation in reactors. Prereq: PHY 554.

667 *Nuclear Reactor Design.* (4)
The development of a reactor design from a set of specifications. The synthesis of reactor theory, heat transfer, properties of materials and economics. Prereq: ME 514.

685 *Biofluid Mechanics.* (3)
Rheology of biological fluids with special emphasis on blood; hemodynamics and related blood trauma; biological flow instrumentation; fundamental investigation of circulatory processes; and engineering implication of biological flow processes. Lecture, two hours; laboratory, three hours. Prereq: ME 330.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

772 *Bio-Mechanics Seminar.* (1)
A weekly meeting of the staff and graduate students in Engineering, Physiology Science, Biophysics, Psychology, etc.; for the discussion of research and recent developments in Biomedical Engineering such as Biodynamics. May be repeated two times. Prereq: Consent of instructor.

780 *Special Problems in Mechanical Engineering.* (3)
This course consists of individual work in one of the various fields of Mechanical Engineering. Laboratory, six hours. May be repeated three times for a total of twelve credits. Prereq: Approval of instructor.

781 *Special Problems in Bioengineering.* (3)
Discussion of advanced and current topics in Bioengineering. Individual work on research problems of current interest. May be repeated to a maximum of nine credits.

782 *Advanced Topics in Heat Transfer.* (3)
Contemporary topics in heat transfer will be discussed using the current literature. May be repeated to a maximum of nine credits. Prereq: Consent of instructor.

783 *Topics in Advanced Systems Theory.* (3)
A survey and evaluation of current research results in systems theory. A course designed to permit full utilization of specialized abilities of individual and visiting faculty. May be repeated to a maximum of nine credits. Prereq: Consent of instructor.

METALLURGICAL ENGINEERING AND MATERIALS SCIENCE

Director of Graduate Study—Hans Conrad

The Department offers programs of study leading to the Master of Science in Metallurgical Engineering, or in Materials Science, and the Doctor of Philosophy. The graduate program in the Department has as its aim the development of skills and techniques which are conducive to independent thought, learning and investigation. Degree programs can be selected by the student from a wide variety of topics in the following and other areas: Physical Metallurgy; Mechanical, Chemical and Electronic Properties; Metal Deformation Processing; Electron, X-ray and Field Ion Microscopy; Ultrahigh Vacuums and High Pressures; Metals, Ceramics, Polymers and Dental Materials. Extensive and modern laboratory facilities located in Anderson Hall are available for experimental investigations in these areas.

Preparation for study in this department normally consists of a bachelor's degree in metallurgical engineering. However, an undergraduate degree in chemistry, physics, mathematics or another engineering discipline provides excellent preparation if coupled with a strong interest in the behavior of materials.

The Master's degree may be obtained by satisfying the usual college requirements. Only students with outside practical experience in metallurgy will ordinarily be allowed to substitute six credits of graduate level course work for the thesis. There is no language requirement for this degree.

The degree of Doctor of Philosophy is conferred upon a candidate who, after completing not fewer than three years of graduate work devoted to study in the broad field of Metallurgical Engineering or Materials Science, presents a satisfactory thesis, passes a comprehensive examination on his subject and chosen field and shows sufficient promise of scholarly attainment. It is intended to represent the attainment of independent and comprehensive scholarship in the field. Reading knowledge of one modern foreign language and demonstrated competence in a minor area from the fields of engineering, mathmatics, physical or biological sciences is required for the Ph.D. degree.

The Department of Metallurgical Engineering and Materials Science does not require the candidate to complete a specified number of academic courses. However, a special program is usually recommended to fulfill each student's specific need by his Thesis Advisory Committee. Admission to the doctoral program requires the passing of a comprehensive preliminary examination, the nature of which is set by the student's Thesis Advisory Committee.

443 *Minerals Beneficiation.* (3)
Principles and mechanics of beneficiation involved in the preparation of mine products, principles of plant design and current developments. Prereq: PHY 232.

444 *Minerals Beneficiation Laboratory.* (1)
Application of the principles studied in MET 443. Laboratory, three hours. Prereq or concur: MET 443.

451 *Metallurgical Thermodynamics II.* (3)
Application of fugacity, activity and equilibrium constants to metallurgical systems. Analysis of ideal, non-ideal and regular solutions and their relation to non-metallic solutions at elevated temperatures, molten salt solutions and slags. Discussion and application of the phase rule to metal systems. Prereq: CME 220.

453 *Metallurgical Kinetics.* (3)
Rate processes in heat and mass transfer, nucleation and growth. Fluid flow in molten metal systems. Prereq: CME 220.

461 *Physical Metallurgy II.* (3)
High purity metals, nuclear alloys, powder metallurgy techniques. Lecture, two hours; laboratory, three hours. Prereq or concur: MET 361.

463 *Structure of Alloys II.* (3)
Age hardening and diffusion in metal systems. Laboratory concerned with senior thesis type problems. Lecture, two hours; laboratory, three hours. Prereq: MET 363.

521 *The Casting of Metals.* (3)
Ferrous and non-ferrous foundry practice. Theory and metallurgy of metal castings. Application of engineering principles to the design and production of castings. Prereq: MET 301 or 303.

531 *Powder Metallurgy.* (3)
Study of the principles of powder metallurgy relating to alloys of unusual compositions, metal and non-metal combinations, porous and laminated products, composite metals, and high-melting alloys. Prereq: Consent of instructor.

532 *Materials Science I.* (3)
Modern ideas on the engineering properties of solids. Crystallography; properties; relations of properties to structure; thermodynamics; solid state reactions. Prereq: Consent of instructor.

535 *Advanced Mechanical Metallurgy I.* (3)
Elastic and plastic deformation of metallic crystalline solids; crystallographic nature of slip and twinning; work hardening, fracture and recovery. Prereq: Consent of instructor.

536 *Ceramic Engineering.* (3)
The nature of ceramic materials. The forming and thermal treatment of ceramic products. Consideration of the various properties usually encountered and required of ceramic materials inclusive of cements. Prereq: Consent of instructor.

539 *Nuclear Metallurgy.* (3)
The metallurgy of such materials as are used in the various components of nuclear reactors with special emphasis on their physical metallurgy. Scientific principles in their broadest sense are emphasized. Material applicable to nuclear-reactor components in the ceramics, metal-ceramics, and other fields. Prereq: B.S. in Metallurgical Engineering or permission of instructor.

550 *Corrosion.* (3)
The fundamental principles of corrosion control and the basic mechanisms related to a better understanding of the causes of corrosion. The application of principles to practical situations. Prereq: Consent of instructor.

551 *Advanced Chemical Metallurgy I.* (3)
Study of reactions occurring during refining, based on principles of ferrous metallurgy. Prereq: Consent of instructor.

552 *Polymeric Materials.* (3)
Relating properties to structure; properties of polymer materials; mechanical, electrical and thermal properties of amorphous and crystalline polymers, molding and fabrication, polymers as additives, biomedical application, selection of polymers, design. Prereq: MET 301 or CHE 230 or CHE 236, or consent of instructor. (Same as CE 552.)

566 *Crystallography and X-ray Metallography.* (4)
Elements of crystallography, nature of x-rays, diffraction by crystal lattice, the structure factor and crystal structure determinations in metallic lattices, x-ray camera and diffractometer techniques and application of these to determination of phase diagrams, preferred orientation and residual stresses. Lecture, three hours; laboratory, three hours. Prereq: MET 361.

Prerequisite for graduate work: Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics and mathematics. Degrees offered are a Master of Science in Metallurgical Engineering and a Doctor of Philosophy in Physical Metallurgy.

632 *Materials Science II.* (3)
Continuation of MET 532. Classification of solids; atomic structure and bonding; relation of structure to properties; deformation behavior and failure. Prereq: MET 532.

633 *Special Purpose Alloy Steels.* (3)
Fundamental principles of the more complicated and special alloy steels and their heat treatment. Carbon, mild alloy, N.E., S.A.E., tool and super alloys are included. Alternate alloy steels for application are considered. Prereq: Consent of instructor.

635 *Advanced Mechanical Metallurgy II.* (3)
Theory of dislocations in crystals and their role in strength, plasticity, work hardening and fracture of crystalline solids. Prereq: MET 535.

637 *Materials Engineering.* (3)
Factors in specification and testing of materials. Materials for lightweight construction, mechanical and electrical applications, and severe service conditions are treated. Material failures, trouble shooting and testing are discussed. Lecture, two hours; laboratory three hours. Prereq: Consent of instructor.

641 *Advanced Production Metallurgy.* (3)
Principles and practices used in the production of alloys with special stress upon any particular group of alloys that the student may choose. Reference reading and laboratory work are emphasized. Lecture, two hours; laboratory, three hours. Prereq: Consent of instructor.

650 *Advanced Chemical Metallurgy II.* (3)
Study of reactions of materials with chemical environments. Introduction to irreversible thermodynamics. Emphasis on current literature. Prereq: MET 551.

659 *Advanced Phase Diagrams.* (3)
Review of thermodynamic fundamentals and application to binary pressure-temperature-composition diagrams. Construction and interpretation of ternary temperature-composition diagrams. Review and discussion of important ternary diagrams. Prereq: MET 451 or equivalent.

661 *Advanced Physical Metallurgy I.* (3)
Study of the theory of phase transformations in metallic systems. Analysis of rate controlling processes for nucleation and growth controlled phase changes and for order-disorder reactions. Prereq: MET 463 or permission of instructor.

662 *Advanced Physical Metallurgy II.* (3)
Solidification theory and mechanisms. Diffusion in solids. Prereq: MET 661 or permission of instructor.

663 *Theoretical Structural Metallurgy.* (3)
Interatomic forces of crystal bonding; free electron; zone theory; equilibrium and rate of approach thereto; thermal behavior, structure and free energy of alloy phases; equilibrium diagrams; diffusion; order-disorder change; nucleation and phase growth. Prereq: MET 461.

666 *Diffraction Methods in Metallurgy.* (4)
Application of thin foil electron transmission methods to the study of the defect structure of metals, theory of electron diffraction contrast phenomena, sample preparation, X-ray theory and methods applied to the study of deformation characteristics of metals, order-disorder transformations, and crystal structure analysis. Prereq: MET 566.

768 *Residence Credit for the Master's Degree.* (0)
(1-6 credits equivalence.) May be repeated once.

769 *Residence Credit for the Doctor's Degree.* (0)
(1-12 credits equivalence.) May be repeated indefinitely.

771 *Seminar.* (0)
Review of current literature in the field of metallurgical engineering and presentation of papers thereon. Presentation of talks on departmental research. Group and panel discussions. Required of all graduate students every semester.

781 *Special Problems, Literature and Laboratory.* (1-3)
Literature research and planning of research programs; shop problems and technical writing, including a term paper, are required. Consultation and lecture by appointment. May be repeated for a total of nine credits.

782 *Special Problems, Literature and Laboratory.* (3)
A continuation of MET 781. Laboratory, six hours; consultation and lecture by appointment. May be repeated twice for a maximum of nine credits.

Home Economics

Coordinator of Graduate Education—Marjorie Stewart

Requirements for the Degree of Master of Science in Home Economics

Students who are graduates of fully accredited institutions of higher learning may obtain the degree of Master of Science in Home Economics by satisfying the following requirements:

1. The completion of 24 semester hours of graduate work with an average standing of 3.0 or better, and a thesis, or at the option of the major professor, the completion of 36 semester hours of graduate work with a standing of 3.0 or better, and no thesis requirement. At least one-half of the hours must be on the 600 level or above.
2. Under either plan no grade below C may be counted.
3. One-half of the work must be in one section or department, the remainder in any other department or departments approved by the major professor.
4. There is no language requirement for this professional degree.

A final oral examination is given the candidate not later than eight days before the close of the semester in which the degree is to be secured. The candidate is expected to show a comprehensive knowledge of the subject matter related to the field of his major work and in case a thesis has been prepared to defend it.

The program of graduate study developed for each graduate student is based on his career objectives and previous academic background. Those without sufficient background or training will be expected to make up deficiencies indicated by the section or department. Except for courses in research methods and statistics, students selecting Family Life, Management and Family Economics, or Textiles and Design as an area of specialization are required to select one of the departments in the social and economic sciences for work to fulfill degree requirements.

HOUSING AND INTERIOR DESIGN

520 *Textiles II.* (3)
Consideration of recent textile developments with emphasis on man-made fibers, new construction techniques and finishes. Opportunity for individual investigation. Lecture, one hour; laboratory, four hours. Prereq: TC 120, CHE 104, or CHE 112. (Same as TC 520.)

530 *Advanced Interior Design.* (2)
The art of interior decoration throughout the past and today. Interiors are planned to meet today's needs. Lecture, one hour; laboratory, two hours. Prereq: HID 330.

532 *Retail Job Analysis.* (5)
Supervised experience in apparel merchandising procedures through a cooperative program with a retail establishment. (One half semester of eight hour a day week.) Prereq: TC 523, 422, BA 330. (Same as TC 532.)

534 *Decorative Textiles.* (2)
Survey of techniques used in applying color and design to fabrics. Individual problems, demonstrating techniques, developed. Lecture, one hour; laboratory, two hours. Prereq: TC 120. (Same as TC 534.)

536 *Interior Decoration Projects.* (3)
Selected projects in furnishing the home, including furniture refinishing, upholstering, and slip-cover making. Costs in terms of time and money are considered. Laboratory, four hours; lecture, one hour. Prereq: HID 330 or approval of instructor.

537 *History of Furniture.* (4)
Study of historic styles of furnishings, textiles, and decorative accessories through contemporary design. Supplementary information through slides and field trips. Application of information through research project on selected topics. Prereq: HIS 104 and 105.

538 *Materials and Methods in Interiors.* (3)
Emphasis on lighting, built-in equipment, measurement, and cost specifications. Individual study of specific problems encountered in home design. One class hour per week; lecture and laboratory, four hours per week. Prereq: HID 332.

593 *Special Problems in Housing and Interior Design.* (1-3)
Intensive work on specific phases of the field. Senior or graduate standing. May be repeated for a total of six credits. Prereq: Consent of instructor.

597 *Special Problems in Textiles.* (1-3)
Intensive work on specific phases of the field. Senior or graduate standing. May be repeated for a total of six credits. Prereq: Consent of instructor. (Same as TC 597.)

772 *Seminar in Textiles, Clothing, Costume Design, and Interior Design.* (2)
Investigation of special textile, clothing, and costume design or interior design problems; lecture, two hours. May be repeated twice for a total of six credits. (Same as TC 772.)

783 *Special Problems in Interior Design.* (1-3)
Independent advanced work on a specific problem. Graduate standing. May be repeated for a total of six credits.

787 *Special Problems in Textiles.* (1-3)
Independent advanced work on a specific problem. May be repeated for a total of six credits. (Same as TC 787.)

HUMAN DEVELOPMENT AND FAMILY RELATIONS

Director of Graduate Study—David C. Payne

541 *Supervised Teaching in the Early Childhood Laboratory I.* (3)
Supervised teaching experience with preschool groups in a laboratory

school. Laboratory, seven hours. Prereq: HF 350, 540, or equivalent or concurrent or consent of instructor.

542 *Supervised Teaching in the Early Childhood Laboratory II.* (3)
Supervised teaching experiences with preschool groups in a laboratory school. Laboratory, seven hours. Prereq: HF 350, 540, or equivalent or concurrent or consent of instructor.

551 *Woman in Contemporary Society.* (3)
An examination of the status of women in terms of historical, psychological and social developments and the effects of participation in modern roles on family life. Prereq: Six hours of Social Sciences or consent of instructor.

552 *Organization and Administration of Early Childhood Education Programs.* (3)
Organization and administration, including housing, equipment, program, records, parent cooperation. Field trips. Prereq: HF 350 or consent of instructor.

553 *The Child in His Family.* (3)
Preparation and presentation of research reports of studies of family influences on the personality and development of children. Prereq: HF 153, and six credits in sociology and/or psychology.

555 *Creative Experiences and Concept Development: Preschool Years.* (3)
Techniques, methods and materials necessary for creative experiences in play, music, graphic and plastic arts, literature, language, and science, and concept development in time, space and numbers for the preschool child. Lecture, two hours; laboratory, two hours. Prereq: HF 350 or concur. or consent of instructor.

557 *Infant Development.* (2)
Study of development, care and guidance of the child during prenatal, natal, and infant periods. Prereq: PGY 206.

558 *Adolescence.* (3)
The psycho-social development of adolescents in contemporary U.S. culture. Particular emphasis is given to the impact of familial, institutional, and peer socialization systems on the individual in addition to the problems characteristic of this period of development. Prereq: Six credits in Social or Behavioral Sciences.

595 *Special Problems in Child Development and Family Relationships.* (1-3)
Intensive work on specific problems. May be repeated for a total of six credits. Prereq: Consent of instructor.

604 *The Disadvantaged Child in Early Childhood Programs.* (3)
A study of the psycho-social characteristics of disadvantaged children and families including language and cognitive development. Survey of early childhood education programs and related services for the disadvantaged. A review of methods of child guidance in the family and early childhood programs for the disadvantaged, parent involvement, and the role of para-professionals. Three lecture hours; one laboratory hour per week. Prereq: HF 555 or equivalent or permission of instructor.

775 *Seminar in Child Development.* (3)
Preparation and presentation of reports of current investigations in child development. May be repeated once for a total of six credits. Prereq: Consent of instructor.

785 *Special Problems in Child Development and Family Living.* (1-3)
Independent advanced work. May be repeated for a total of six credits. Prereq: Consent of instructor.

MANAGEMENT AND FAMILY ECONOMICS

Acting Director of Graduate Study—Carolyn McKinney

462 *Personal and Family Finance.* (3)
A study of individual and family financing as related to planning the use of credit, savings, investments, insurance, taxes, home ownership and estates. Prereq: 260.

596 *Special Problems in Home Management.* (1-3)
Intensive work on specific phases of home management. Senior or graduate standing. May be repeated for a total of six credits. Prereq: Consent of instructor.

602 *Consumer Economics.* (3)
A study of consumer economics with emphasis upon application of the theories and principles toward solution of problems of the individual and family unit as a part of the total economy. Prereq: ECO 260 or its equivalent; MFE 362, 462, or consent of instructor.

662 *Advanced Home Management and Family Relationships.* (3)
A course affording opportunity for special study of social and economic problems affecting family life. Prereq: MFE 463.

786 *Special Problems in Home Management.* (1-3)
Independent advanced work. May be repeated for a total of six credits. Graduate standing.

NUTRITION AND FOOD SCIENCE

Director of Graduate Study—Leonard Packett

Work leading to the master's degree must conform to general rules and regulations of the Graduate School and the College of Home Economics.

Bachelor of Science degree with a major in Foods, Nutrition, Life Science and/or Home Economics option with a background in biological and physical sciences will be required for admission. Those without sufficient background or training will be required to make up deficiencies indicated by the department. Emphases in Science, Education or Institutional Management are possible.

Programs are designed for individual interest and needs. The non-thesis option provides nutrition education emphasis useful to majors in public health nutrition, vocational education, dietitions, college teachers and extension specialists. Requirements for the Master of Science degree in Home Economics are: completion of 24 semester hours of graduate courses and a thesis or, at the option of the major professor and student, the completion of 36 semester hours of graduate work without a thesis.

Inquiries concerning the details of graduate programs (including work beyond the master's) as well as possible financial support of graduate students should be addressed to the Chairman of the Department of Nutrition and Food Science.

503 *Community Nutrition.* (3)
Study of nutrition education programs on a community level. Experience is provided for presenting nutrition in health clinics, schools, and state institutions. Lecture, two hours; laboratory, two hours. Prereq or concur: NFS 302. May be repeated for a total of six credits.

505 *Experimental Foods.* (3)
Study of factors that affect results obtained in cooking and food preparation processes. Experimental work under controlled conditions. Lecture, one hour; laboratory four hours. Prereq: NFS 204, 311.

507 *Workshop in Applied Nutrition.* (2)
The application of scientific knowledge of nutrition to the promotion of positive health. Emphasis is given to communications techniques and their use in field work.

508 *Seminar in Nutrition.* (1)
Investigations of recent research in nutrition. Prereq: Senior or graduate standing. May be repeated twice for a total of three credits.

512 *Normal and Therapeutic Nutrition.* (5)
Application of elementary biochemistry to understanding the utilization and function of nutrients in the body. Correlating metabolic changes due to disease with diet therapy. Lecture, four hours; laboratory, two hours. Prereq: NFS 311, CHE 236.

514 *Food Preservation.* (3)
Principles of home food preservation. Canning, dehydration, and freezing of fruits, vegetables and meats; pickling of fruits and vegetables; making of jams, jellies and preserves; brining. Lecture, two hours; laboratory, two hours. Prereq: MB 200, NFS 204.

516 *Food for Children.* (3)
Experience in selection, preparation and serving of food to young children. Emphasis is placed on the pre-school age and the factors important to establishing good food habits. Prereq: NFS 206, 311, HF 255.

517 *Food for Special Occasions.* (3)
Advanced work in culinary arts and skills. Preparation of attractive and appetizing dishes to help the homemaker in planning buffet suppers, receptions, picnics, wedding parties, formal meals. Laboratory, six hours. Prereq: NFS 204, 206.

540 *The School Lunch.* (3)
Designed for teachers who manage the lunch room. Consideration is given to equipment, menus, purchase, storage, preparation and service of food. Lecture, two hours; laboratory, two hours. Prereq: NFS 204, ECO 260.

542 *Institution Equipment.* (3)
Selection, arrangement, cost and care of equipment; problems of lighting, heating, ventilation and refrigeration. Two field trips are taken to neighboring cities to see equipment in use in institutions. Prereq: NFS 342.

546 *Institution Organization and Management.* (3)
Principles of institution organization, types of institution service, personnel and financial management. Legal aspects of institution management. Personal and professional qualifications of an institution manager. Prereq: NFS 340, 342.

548 *Institution Administration.* (3)
Application of scientific principles are developed in various aspects of food service management. Prereq: Approval of instructor. May be repeated twice for a total of nine credits.

590 *Field Work in Nutrition.* (1)
Nutrition problems at different age levels, correlated with surveys and experimental studies to show the relation between diet selection and its physical and mental effects. Lecture and laboratory. May be repeated three times for a maximum of four credits. Prereq: NFS 503, or approval of instructor.

591 *Special Problems in Foods and Nutrition.* (1-3)
Intensive work on a specific phase of the field. Senior or graduate standing. May be repeated for a maximum of six credits. Prereq: Consent of instructor.

594 *Special Problems in Institution Management.* (1-3)
Intensive work on specific problems. Senior or graduate standing. May be repeated for a total of six credits. Prereq: Consent of instructor.

603 *Advanced Community Nutrition.* (3)
Study of nutrition surveys and of bases for judging community nutrition. Emphasis is placed upon economic, geographic, social and educational causes of malnutrition. Experience is given in development of nutrition programs. Prereq: NFS 503. May be repeated once for a total of six credits.

610 *Human Nutrition I.* (4)
The application of biochemical, analytical and preparative analysis of blood, urine and tissues to the analysis of nutrient metabolism and human health status. Lecture, two hours; laboratory, six hours. Prereq: NFS 311, CHE 236, NFS 512.

771 *Seminar in Nutrition.* (2)
May be repeated twice for a total of six credits.

781 *Special Problems in Foods and Nutrition.* (1-3)
Independent advanced work on a specific problem. May be repeated for a total of six credits.

784 *Special Problems in Institution Management.* (1-3)
Independent advanced work. May be repeated for a total of six credits.

TEXTILES, CLOTHING AND MERCHANDISING

420 *Tailoring.* (3)
Analysis of tailoring techniques in the shop and in the home. Tailored garments are planned and construced. Lecture, one hour; laboratory, four hours. Prereq: TC 227 or consent of instructor.

422 *Economics of Clothing.* (3)
The clothing industry, its influence and economy. Field trips, class projects, and individual semester reports. Projects involve merchandising display and fashion show. Lecture, two hours; laboratory, two hours. Prereq: Consent of instructor.

520 *Textiles II.* (3)
Consideration of recent textile developments with emphasis on man-made fibers, new construction techniques and finishes. Opportunity for individual investigation. Lecture, one hour; laboratory, four hours. Prereq: TC 120, CHE 104 or CHE 112. (Same as HID 520).

523 *Socio-Psychological and Economic Aspects of Apparel.* (3)
A study of the social, cultural, psychological and economic factors which influence apparel and apparel use with particular emphasis on present day apparel in America. Prereq: SOC 101 or ANT 121 and ECO 260.

524 *History of Costume.* (3)
Development of costume from ancient to modern times with consideration of historic, social, and economic setting. Lecture, two hours; laboratory, two hours. Prereq: A-S 180, TC 120, 227 or consent of instructor.

529 *The Child and His Clothing.* (3)
A detailed study of the selection, cost and care of the pre-school child's clothing in relation to his needs. Lectures and occasional field trips. Prereq: HF 255.

532 *Retail Job Analysis.* (5)
Supervised experience in apparel merchandising procedures through a cooperative program with a retail establishment. (One half semester of eight hour a day week.) Prereq: TC 523, 422, BA 330. (Same as HID 532.)

534 *Decorative Textiles.* (2)
Survey of techniques used in applying color and design to fabrics. Individual problems, demonstrating techniques, developed. Lecture, one hour; laboratory, two hours. Prereq: TC 120. (Same as HID 534.)

535 *Textiles and Design Study Tour.* (1-3)
A domestic or foreign study tour to include investigation of interests related to Textiles and Design. Professional visits are planned according to the particular itineraries. Prereq: Six hours of Textiles and Design or consent of instructor. May be repeated for a total of six credits.

592 *Special Problems in Clothing and Costume Design.* (1-3)
Intensive work on specific phases of the field. Senior or graduate standing. May be repeated for a total of six credits. Prereq: Consent of instructor.

597 *Special Problems in Textiles.* (1-3)
Intensive work on specific phases of the field. Senior or graduate standing. May be repeated for a total of six credits. Prereq: Consent of instructor. (Same as HID 597.)

772 *Seminar in Textiles, Clothing, Costume Design, and Interior Design.* (2)
Investigation of special textile, clothing and costume design or interior design problems. Lecture, two hours. May be repeated twice for a total of six credits. (Same as HID 772.)

782 *Special Problems in Clothing and Costume Design.* (1-3)
Independent advanced work on a specific problem. May be repeated for a total of six credits.

787 *Special Problems in Textiles.* (1-3)
Independent advanced work on a specific problem. May be repeated for a total of six credits. (Same as HID 787.)

GENERAL HOME ECONOMICS

575 *Community Analysis.* (3)
A study of communal structure and processes with special emphasis on strategies of field investigation of particular communities. Prereq: SOC 101 or equivalent or consent of instructor. (Same as SOC 413 in Colleges of Arts and Sciences and Agriculture.)

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

Library Science

Director of Graduate Study—Lawrence Allen

The College of Library Science offers three degrees, M.A., Plan A; M.A., Plan B; and MSLS. The degree requirements for these degrees are as follows:

I. M.A., Plan A Requirements
  A. Course Requirements
    1. 36 total credit hours, 30 of which must be graduate credit hours
    2. 9 hours—Required Introductory Courses (LS 500, 501, 502)
       21 hours elective
       6 hours thesis credit
    3. 15 hours must be on the 600-700 level
  B. Thesis
  C. Modern Foreign Language—reading profiency in French, German, or Russian (one required). Another language may be substituted by petition. This requirement may be satisfied by one of three methods:
    1. by examination at beginning of each semester.
    2. by successful completion of special, non-credit, one semester course in a foreign language.
    3. by having completed the undergraduate language requirement at the University of Kentucky with a B average.
  D. Oral examination in defense of thesis

II. M.A., Plan B Requirements
  A. Course Requirements
    1. 36 credit hours, 30 of which must be graduate credit hours
    2. 9 hours—Required Introductory (LS 500, 501, 502)
       6 hours—advanced bibliography or technical processing courses
       6 hours—cognate courses on 500 level or above
       15 hours—elective
    3. 15 hours must be on the 600-700 level
  B. No thesis required
  C. Modern Foreign Language—as in M.A., Plan A
  D. Exit Interview

III. MSLS Requirements
  A. Course Requirements
    1. 36 total credit hours, 30 of which must be graduate credit hours
    2. 9 hours—Required Introductory Courses
       27 hours—elective
    3. 15 hours must be on the 600-700 level
  B. No thesis required
  C. No modern foreign language competency required
  D. Exit Interview

The minimum College standards for admission to graduate work in Library Science include a bachelor's degree from an accredited institution, an undergraduate GPA of 2.75 and a combined score of 900 on the verbal and quantitative aptitude tests of the Graduate Record Examination. A separate application to the College of Library Science is also required. For additional information, catalog, and appropriate forms, contact Assistant Dean, College of Library Science.

PROFESSIONAL COURSES

500 *Library Services and Administration.* (3)
An introduction to the field of Library Science with emphasis upon various types of services performed by libraries, the growth and development of library services as well as the profession and basic concepts of administration applied to libraries including such areas as organization, personnel, planning and financing.

501 *Library Operations.* (3)
Introduction to the principles, concepts, methods and problems in organizing library collections for effective use, with special emphasis in the areas of acquisitions, circulation systems, cataloging, and classification of books and non-book materials as practiced in small libraries.

502 *Reference and Information Services.* (3)
An introduction to reference services, activities, and functions. Emphasis will also be placed upon essential reference materials, including encyclopedias, dictionaries, atlases, yearbooks, indexes, and other guides to sources of information.

509 *Instructional Materials Centers.* (3)
Leadership responsibility of the librarian in an age of changing media of communication, the philosophy of the modern school and the librarian's role in implementing it, acquiring, organizing and assisting faculty in learning to use all available media. Relation of the individual school to the district materials center, type of personnel, equipment and collections needed in each.

510 *Children's Literature and Related Materials.* (3)
A survey of children's literature, traditional and modern. Reading and evaluation of books with emphasis on the relationship of the materials to the needs and interests of children. Covers various types of materials for use by and with children of grades 1-6.

511 *Literature and Related Materials for Young People.* (3)
Covers types of materials for use by and with readers of grades 7-12. Emphasis upon materials for curricular and recreational reading. Attention is given to some types of adult materials suitable for more mature students. Practice in the use of standard book selection aids.

512 *School Library Practice.* (3)
Observation and supervised work in a school library, fulfilling a state requirement for certification. Applications for placement must be submitted early in the semester preceding which placement is desired. Prereq: LS 500, 501, 502, 510, 511.

525 *Professional Field Experience.* (3)
Supervised work in an actual library to provide the student with operational library experience under the direction of a practicing librarian available to a limited number and only to those without previous library experience. Laboratory, 10 hours per week. Prereq: Nine hours of Library Science and consent of instructor.

586 *Utilization of Educational Media.* (3)
Surveys the broad area of educational media with an emphasis on utilization and the advantages and disadvantages of the various media. Provides experience in relating educational technology to productive learning activity. (Same as EDC 544.)

600 *Administrative Behavior in Library Management.* (3)
An emphasis upon human behavior in library administration including an understanding of group process, interpersonal relationships, communications, motivation, leadership, and developing an awareness of self in the administrative process. Prereq: LS 500.

601 *Technical Processing I.* (3)
The organization and operation of acquisitions work and the theory and application of the principles of cataloging and classification. Emphasis on descriptive cataloging, subject cataloging, and classification. Provides practice in the use of the *Anglo-American Cataloging Rules*, the *Library of Congress Subject Headings*, and the unabridged Dewey Decimal Classification scheme. Prereq: LS 501.

602 *Bibliography of Social Sciences.* (3)
Survey and evaluation of library materials in the social sciences with emphasis on reference and bibliographical sources in the following areas: Anthropology, Business, Economics, Education, Geography, History, Law, Political Science, Psychology, Sociology, and other closely related subjects. Prereq: LS 502 or equivalent.

603 *Bibliography of the Humanities.* (3)
Survey and evaluation of library materials in the humanities, with emphasis on reference and bibliographical sources in the following areas: the Arts, Language, Literature, Music, Philosophy, Religion and other closely related subjects. Prereq: LS 502.

604 *Bibliography of Science.* (3)
A survey and evaluation of library materials in the sciences with emphasis on reference and bibliographical sources in the following areas: Agriculture, Astronomy, Biology, Chemistry, Mathematics, Natural Resources, Zoology, and other closely related material. Prereq: LS 502.

605 *Introduction to Information Sciences.* (3)
Introduction to major areas of information science and technology. Consideration is given to the nature of information science and technology as a field of study, the analysis and design of information systems, basic computer systems, and specific components of information storage and retrieval systems. (Same as CMO 605.)

606 *Automation and the Library.* (3)
Introduction to the theory and practice of automation and its implication and application to libraries. A survey and evaluation of electronic and other automated systems for document processing in libraries. Prereq: LS 605, or consent of instructor.

608 *Methods of Research in Librarianship.* (3)
Basic tools, techniques and methods of library research. Consideration to the role and purpose of research in librarianship and relationship to research in other fields. Critical evaluation of current research reports in library literature and the development of a research proposal.

609 *Public Libraries.* (3)
An analysis of public library objectives and of the services provided and techniques employed to achieve them. Some attention is given to special problems of public library management and to trends in public library development. Prereq: LS 500.

610 *Academic Libraries.* (3)
History, aims and functions of university and college libraries including organization, collection building and evaluation, finance and personnel. Recent trends in national and regional cooperation. Undergraduate libraries, community colleges and the "library college" will also be reviewed.

611 *Special Libraries I.* (3)
Organization, administration and services of the library serving a selective clientele with consideration of the role of the library as a part of the larger institution with well-defined functions. Prereq: LS 500.

613 *Library Systems Analysis.* (3)
Role of systems analysis in libraries with emphasis on the analysis, design, and implementation of library systems. The application of tools and techniques used in systems analysis, such as flow charting, data gathering techniques. An introduction to electronic data processing and statistical evaluation methods. Prereq: LS 605,

614 *Information Storage and Retrieval Systems.* (3)
Investigates the flow of information through information storage and retrieval systems; abstracting, indexing, file organization, storage, search strategy, dissemination of information and its utilization. Consideration will also be given to special problems of vocabulary control, semantic and syntactic controls, determination of user requirements and the evaluation of in system performance. Prereq: LS 605, or consent of instructor. (Same as CMO 614.)

617 *History of Books and Printing to 1800.* (3)
The making of books from earliest times to the end of the eighteenth century, including the manuscript book, the invention and spread of printing, type design, methods and styles of illustration. Technological, economic and political aspects will also be emphasized.

618 *Books for Adults.* (3)
Selection, use and individual evaluation of books for the typical community library. Distinctions between the notable, the popular and the significant in books which meet the needs of adult library patrons.

620 *Rare Books Bibliography.* (3)
Introduction to descriptive bibliography and to a wide range of bibliographic reference works necessary for a modern special collections or rare book librarian. Topics include incunabula research, paper and watermarks, the canons of description, and recent trends in institutional collections. Prereq: LS 617.

621 *Special Collections.* (3)
The acquiring, processing and servicing of rare books, manuscripts and other special materials. Attention is given to the criteria for building a collection and for its interpretation through descriptive guides and catalogs, and to the relation of the special collection department to the research worker and the library as a whole.

622 *Special Libraries II (by type).* (3)
Development, present status and intensive study of a single type of special library such as theological, business, hospital, and institutional libraries and librarianship, etc. May be repeated to a maximum of six credits.

623 *Subject Bibliography.* (3)
Survey and evaluation of library materials in a special subject area, with emphasis on reference and bibliographical sources. Subject areas vary, e.g., theology, law, engineering, and other topics. Prereq: LS 502.

May be repeated for credit when topics vary to maximum of nine hours.

624 *Technical Processing II.* (3)
Advanced study of the organization and operation of technical processing, including special problems in acquisitions work and the cataloging of special types of library material, such as serials, incunabula, and non-book materials. Special emphasis on the Library of Congress Classification. Prereq: LS 601.

625 *History of Books and Printing 1800 to the Present.* (3)

The history of printing technology, publishing and bookselling since the French Revolution, focusing on the rise of a mass reading public in the 19th century. Book design and illustration will be considered as reflections of changing artistic fashion under such headings as—Victorian Medievalism; Art Nouveau, Dada, and "Concrete Poetry."

626 *Government Publications.* (3)

Study of the nature and scope of government documents, including problems and methods of acquisition, organization, and reference use of federal, state, local and international publications. Prereq: LS 502 or equivalent.

627 *History of Libraries.* (3)

Development of libraries from earliest times to the present with special reference to the relationship of the library to the contemporary social, economic, cultural and political trends.

628 *Library Buildings.* (3)

Relationship between physical structure and library function; problems in planning and building procedures, library equipment, acoustics, illumination, and materials of construction. Prereq: LS 500.

629 *Public Library Systems.* (3)

Survey of the changing nature of public library government, larger units of service financed by federal and state assistance, influence on the role of the small public library in new methods of evaluation and stimulation of long range planning.

639 *Organization and Administration of Youth Services in Public Libraries.* (3)

Study of the historical development and changes in patterns of library service to young adults. Definition of the respective roles of the school and public library, cooperation with other community agencies, critical evaluation of current procedures. Prereq: LS 511 and LS 609.

640 *Medical Librarianship.* (3)

Emphasis is on introducing the student both to the basic bibliographic tools—indexes, abstracts, basic texts, etc.—used in the health sciences as well as to those administrative and technical problems peculiar to a health sciences library environment. A practical approach to such problems is emphasized in class lectures and seminars.

641 *Law Librarianship.* (3)

A study of the materials of legal research and reference work. Emphasis is placed on the methods of effective research and the actual use of legal materials in the solution of practical reference problems. The selection, cataloging, classification, and storage of materials in a law collection are considered. The specialized requirements of law librarianship and law library administration are treated.

687 *Multi-Media Materials.* (3)

The function, evaluation, selection, acquisition, preparation for use, and preservation of multi-media materials in a library program. Prereq: LS 501, 502, or equivalent.

700 *Seminar: Library Organization and Management.* (3)

Major problems and newer developments in the field of management and administration and casting them in the library environment. Current research in library management. For the advanced student. Prereq: LS 500 and 600 or equivalent.

701 *Seminar: Library Materials and Services for Children and Young People.* (3)

Intensive study of special problems in the development of collections for young people, controversial aspects of book selection, studies of reading interests, relation of types of libraries: school, public, extension through bookmobile, and institutional services, regional and state plans. Prereq: LS 504, 505.

702 *Seminar in Printing and Publishing History.* (3)

Bibliographical and technical background for original research in various fields of bookmaking, printing, publishing and the dissemination of literature. Survey of current trends in research. For the advanced student. Prereq: LS 617 and 625.

703 *Seminar: Technical Services.* (3)

Survey and analysis of technical services in libraries, with special attention both to historical and recent developments, controversial issues, current trends, and literature of the field. Prereq: LS 501 and 601 and 503 or permission of instructor.

704 *Seminar: Education for Librarianship.* (3)

Attention is given to the development of library education with an emphasis on current trends and problems. Explanation of curriculum development and instructional techniques in library schools.

705 *Seminar: Information Sciences.* (3)

An investigation of the parameters of the information sciences from an interdisciplinary approach. Investigation and analysis of the literature of communications, management science, cybernetics, information theory to identify the similarities and differences. From this investigation, both qualitative and quantitative concepts of the directions of information science will be derived. Prereq: LS 605 or consent of instructor. (Same as CMO 705.)

710 *Independent Study in Library Science.* (3)

Opportunity for directed study in subject or problems of interest to a student. Observation and research is required, and a written report describing the work accomplished is required. May be repeated to a maximum of six hours.

711 *Workshops in Librarianship.* (1-4)

Intensive study of one aspect of librarianship under the leadership of an authority in that field. Duration is normally shorter than a regular University term, and the student is expected to devote his full-time to the course. May be repeated for credit when topics vary.

768 *Residence Credit for the Master's Degree.* (0)

May be repeated once. (1-6 credits equivalence.)

Medicine

ANATOMY

Director of Graduate Study—Harold F. Parks

The program of graduate studies in Anatomy is intended to provide educational opportunities for people with several different objectives. Some students will pursue graduate work in Anatomy with the intention of teaching in departments of anatomy; some will have already obtained a professional degree, such as an M.D. or D.M.D., and may be interested in obtaining specific training in some region or system of the body to complement their professional education. Others may study in Anatomy as a minor or simply for specific credit.

Preparation for graduate work in anatomy should include some course work in biological science along with other grounding in the sciences to the minimal extent of course work in quantitative analysis and organic chemistry, a term of calculus, and a year of college physics. Students with deficiencies in any of these areas may be admitted, but will be expected to complete their background early in the course of their graduate studies.

The Department is prepared to offer the M.S. and Ph.D. degrees with major training in gross human anatomy, microscopic human anatomy, embroyology, endocrinology, genetics, and neuroanatomy. Also, a major interest can center in tissues, organs, regions or systems of the body, in which, for example, professional graduates such as dentists or orthopedic surgeons might wish to take specific training. Certain students with special needs will, with permission of the Director of Graduate Studies, be permitted to work toward the M.S. degree on Plan B, however, in most cases students will follow Plan A.

Potential applicants for graduate work in Anatomy are requisted to write directly to the Chairman of the Department of Anatomy.

503 *Independent Work in Anatomy.* (3)
Reading and laboratory work in a defined area of anatomy are carried out under the direct supervision of one staff member. Hours of discussion and laboratory work by individual arrangement. May be repeated three times for a maximum of 12 credits. Prereq: An introductory course in biology, zoology, or botany and permission of the chairman.

511 *Introduction to Anatomy.* (4)
The principles of organization of the human body are presented. Several methods of studying anatomy are utilized. Gross anatomy lectures follow a systemic development. Other methods include radiology, palpation of living structures, *in vivo* microscopy, the demonstration of prosected fresh and fixed materials and dissection. Prereq: Some background in biology, including one or more such courses as biology, zoology, botany, comparative anatomy or embryology, and consent of the instructor.

512 *Microscopy and Ultrastructure.* (3)
The organization of cells, tissues and organs are presented through lectures and in the laboratory, through the microscopic study of *in vivo* materials, histological sections and illustrations. Prereq: Some background in biology, including one or more such courses as biology, zoology, botany, histological techniques, comparative anatomy or embryology, and consent of the instructor.

513 *Developmental Anatomy.* (2)
The development of the human body is presented through lecture, visual aids including motion pictures, histological sections and laboratory demonstrations and exercises. A majority of the time is spent on intra-uterine development; however, post-natal growth and common morphological changes associated with aging are also taken up. Prereq: Some background in biology, including one or more such courses as biology, zoology, botany, comparative anatomy or embryology, and consent of instructor.

516 *Anatomy of the Nervous System.* (3)
The gross and microscopic structure of the central and peripheral nervous systems and their blood supply will be studied. The course will include the functional interpretation of anatomical structures. Prereq: ANA 511, 512, 513; PGY 511; consent of instructor.

529 *Concepts of Morphology.* (2)
The objective of this course is to present concepts of morphology as they concern cells, tissues, or organs, systems and/or regions of the human body. Necessarily, the history of the development of ideas about the selected topic will be surveyed. Inherent also in the presentation of concepts of structure will be the presentation of controversies which have resulted from differing methods and interpretations. Four class hours per week. May be repeated once for a total of 4 hours. Prereq: Advanced work in biology, preferably a major or minor in a biological science, and consent of the staff.

531 *Combined Gross and Neuroanatomy.* (6)
The course includes a presentation of principles and generalizations about the morphology of the human body and several techniques for studying gross and neuroanatomy of the head, neck, and thorax. Neuro and gross anatomy will be given to three hours of laboratory work. Dissection guide, texts, atlases and original articles will be assigned. Prereq: Entrance requirements of College of Dentistry. Some background in biology and consent of instructor.

532 *Combined Histology, Embryology, and Special Oral Microanatomy.* (6)
The course consists of an analysis of the histological organization and embryological development of the human body and includes an especially detailed treatment of the tissues and organs related to the oral cavity. Prereq: Admission to the College of Dentistry or some background in biology and consent of instructor. (If a student has taken ANA 532, he cannot take ANA 533.)

533 *Oral Histology.* (2)
A detailed study of the microscopic organization and ultrastructure of the several gross structures of the oral cavity and tooth development. Texts and original articles are assigned. Discussion will be carried out within the laboratory periods. ANA 533 may not be taken by students who have completed ANA 532. Prereq: ANA 512, 513, and 531 or their equivalent, and consent of instructor.

611 *Regional Gross Anatomy.* (8)
The course will include: (1) a detailed dissection of the human body (2) study of specific relations of the systems within major regions (3) a familiarization with reference sources in the field of gross human anatomy. Prereq: Courses in Comparative Anatomy and Embryology and ANA 511 or the equivalent and consent of instructor. Available as elective course for senior medical students.

629 *Techniques of Anatomical Research.* (2)
The objective of this course is the familiarization of students with research techniques in anatomy. The relationship will be tutorial. Students will work under the direction of given staff members for determined periods of time, usually on a problem. The exact length of time will depend upon the student's purposes, progress and the techniques. The problem may be new research or a repetition of previous work. Prereq: Previous senior college or graduate level work in biology and consent of chairman.

631 *Advanced Gross Anatomy.* (3-5)
The objective of this course is to meet individual student needs for increased knowledge in particular areas of gross human morphology. Investigations of problems involving gross morphology will be carried out. One or several defined areas of the body will be studied in considerable detail by dissection, by intensive use of the pertinent literature, by the use of visual aids, prosected materials and other appropriate learning aids. May be repeated at the discretion of the student's committee. Prereq: A background in gross human anatomy equivalent to a medical school course in regional anatomy and consent of instructor.

633 *Advanced Developmental Anatomy.* (2-5)
The objectives of the course include a detailed study of the intrauterine development of the human fetus as well as of fetal physiology and comparative aspects of gestation. Prereq: Comparative Anatomy, Embryology, consent of instructor.

634 *Advanced Endocrinology.* (2-5)
The objectives of this course include interrelating the microscopic and ultrastructural morphology of endocrine glands with the functions of these glands. Emphasis will be placed on functional aspects, chemistry and mode of action of specific hormones. All endocrine organs will be studied and given equal importance. The relationship between the central nervous system and the endocrine system will be covered in detail. Prereq: Fundamental background in biology including some previous work in endocrinology; consent of instructor.

636 *Advanced Neuroanatomy.* (3-5)
The objectives include specific and detailed correlation of anatomical materials with clinical data particularly in the areas of the subspecialties of Neurology, Psychiatry, Ophthalmology, Otolaryngology, Internal Medicine, and Neurosurgery. Clinical data from these subspecialties will be related to the location of nuclei, the precise patterns of fiber tracts, and to blood supply. The detailed content and emphasis will depend upon both the background and the purposes of the students. Prereq: ANA 511, 512, 513, 516, or their equivalent and consent of instructor.

638 *The Genetic Basis of Human Morphology.* (2-5)
The course will provide an historical survey of human genetics as background for current concepts. The genetics of man will be studied together with the problems of data gathering which are unique and are inherent in this field. The interrelations of known errors of human metabolism to alterations of cell and system morphology will be presented. Prereq: Elementary Genetics and consent of instructor.

651 *Special Projects in Anatomy of Head and Neck Correlated with Neuroanatomy.* (3-5)
The objective of the course is to provide the opportunity for the learning of detailed information about gross anatomical relations in the head and neck. Prereq: A course in regional gross anatomy and neuroanatomy and consent of the instructors.

662 *Ultrastructural Anatomy.* (2-5)
The objectives of this course are to advance the student's knowledge of the mammalian tissues and the human body. Those students registering for more than two hours of credit will do advanced laboratory work in electron microscopy and micro-radiographic technics. Correlation of intra and extra cellular morphology and function will be stressed. Prereq: Previous work in microscopy including histology or cytology and previous technique work with microbiology; consent of instructor.

768 *Residence Credit for Master's Degree.* (0)
(1-6 credits equivalence.)

769 *Residence Credit for Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

BEHAVIORAL SCIENCE

A program of concentration or a minor in medical behavioral science is offered for doctoral candidates in sociology, anthropology, psychology or other behavioral science disciplines through the Department of Behavioral Science in the Medical Center. The concentration has three objectives:

1. An orientation to the several behavioral sciences; to their areas of overlap and interrelation as well as to their discrete contents, theories and methods.

2. An orientation to medical settings, including an enculturation to the social structure, attitudes, beliefs, values and objectives of health personnel and organizations, and the nature of behavioral science research in these areas.

3. Research training, designed to afford each student an opportunity to learn the basic skills and approaches to research design, data acquisition, and data analysis, through personalized, supervised participation in one or more research projects. Such training is arranged to include experimental, survey, and case-study methods, to insure the integration of research training with a student's program of courses and to culminate in a health-related topic for the doctoral dissertation. As far as possible, students in the concentration are provided office space in the Medical Center so that they may have ready access to resources and events.

Students may elect to minor in medical behavioral science by taking a group of approved courses with the sponsorship and guidance of a designated faculty member.

The concentration is partially supported by a training grant from the National Institute of Mental Health for Research Training in the Social Sciences, under which selected students are provided with traineeship stipends.

527 *Society and Health.* (3)
The study of human behavior in illness and of medicine as a complex form of social organization in perspective of historical, cross-cultural and contemporary analysis. This course is designed primarily for students preparing for careers in an allied health science and profession. Prereq: SOC 101. (Same as SOC 527.)

529 *Survey of Medical Anthropology.* (3)
A cross-cultural survey of behavioral factors in the recognition, prevention and treatment of disease in primitive, folk, and modern cultures with an emphasis on the solution of world-health problems. Topics to be covered include non-western medical systems, health behavior as a projective system, transcultural medicine and psychiatry and health behavior and culture change. Prereq: ANT 120, 121. (Same as ANT 529.)

546 *Social Factors in Mental Health.* (3)
The significance of social and cultural factors in the recognition, course, and management of mental health problems; social organization of the mental hospital and cultural alternatives of hospitalization. Prereq: Consent of instructor; SOC 101. (Same as SOC 546.)

670 *Seminar on Role Theory.* (3)
An exploration of differences and similarities in the utilization of the

concept of role in sociology, anthropology and psychology. Emphasis is placed on the potentiality of role as a unifying concept in the behavioral sciences. Prereq: Consent of instructor; SOC 101. (Same as SOC 670.) (Same as ANT 670.)

738 *Seminar: Drug Use as Deviant Behavior.* (3)
A seminar for advanced students. Data on drug abuse and its control used to exemplify and test sociological theories of deviant behavior. Covers characteristics of users, treatment approaches, relations to control measures, changes over time and drug policies. Prereq: SOC 636. (Same as SOC 738.)

761 *Interpersonal Processes in Critical Situations.* (3)
A review of the processes underlying the manner in which people react to situations involving potentially serious consequences for themselves and others. The evidence to be reviewed will come from studies of: reactions in disaster situations; laboratory studies of stress; patterned responses to victims of physical and social pathology. Prereq: PSY 544 and Introductory Statistics.

764 *Topical Seminar in Psychological Anthropology.* (3)
Advanced study of topics of current interest in psychological anthropology; e.g., language and cognition, psychological concomitants of rapid culture change; and transcultural psychiatry. Prereq: ANT 526 or PSY 544, or permission of instructor. (Same as ANT 764.)

765 *Research Problems in Medical Anthropology.* (3)
(1) History and theory of medical anthropology; (2) research design, field work, analysis of data, and report writing. Two class hours, three lab hours per week. Prereq: Graduate status in ANT, SOC, or PSY, and a Concentration or Minor in Medical Behavioral Science. (Same as ANT 765.)

766 *Concepts in Medical Sociology.* (3)
A systematic review of sociological concepts and methods which have been applied to the study of health and medicine; the contributions of medical sociology to general sociological theory; the roles of sociology in education for the health professions and in research on health related problems of society. Two class hours and four laboratory hours per week. Prereq: Predoctoral status in one of the Social or Behavioral Sciences with a Concentration or Minor in Medical Behavioral Science; SOC 101. (Same as SOC 766.)

767 *Research Problems in Medical Social Psychology.* (3)
Advanced training in research strategies, designs, and techniques applicable to problems in medical social psychology, such as patient compliance, adaptive and maladaptive responses to pathology, status relations as a variable in the effectiveness of health teams, socialization of the medical student. Prereq: Introductory Statistics, permission of instructor.

772 *Topical Seminar in Medical Behavioral Science.* (1-3)
Advanced study of topics of current importance in medical behavioral science such as alcoholism, social psychological processes related to health, social structure of mental hospitals, social epidemiology of disease, institutional dependency, computer-aided medical diagnosis. May be repeated to a maximum of six credits. Prereq: Consent of instructor.

790 *Research in Medical Behavioral Science.* (1-6)
Individually directed research and reading in particular aspects of medical behavioral science under the supervision of one or more members of the faculty. By appointment. Prereq: For students taking a Concentration or a Minor in Medical Behavioral Science as part of their doctoral programs or as elective for graduate, medical or dental students.

BIOCHEMISTRY

Director of Graduate Study—Fred J. Bollum

The program of graduate studies in biochemistry is designed primarily for doctoral candidates who plan to pursue a research career in this field. Creative research in biochemistry requires broader training and more extensive laboratory experience than can be achieved at the master's level. Therefore, candidates for the master's degree will be accepted only under unusual circumstances.

As preparation for graduate work in biochemistry, students should have completed courses in chemistry through physical chemistry, in mathematics through the calculus and must have had one year of work in physics and in one of the biological sciences. A reading knowledge of two modern foreign languages, of which one should be German and the other French or Russian, should be acquired as an undergraduate. Although students who have deficiencies in their preparation may be admitted to graduate study in the Department of Biochemistry, the time necessary for completion of their work will necessarily be lengthened. Although programs of study will be fitted to the preparation and interests of individual students, it is anticipated that most students will take advanced courses in chemistry and in physiology, cell biology, microbiology, zoology or botany.

Inquiries concerning availability of financial support for graduate students should be addressed to the chairman of the department.

401 *Fundamentals of Biochemistry.* (3)
Descriptive chemistry of amino acids and proteins, carbohydrates, lipids and nucleic acids and discussion of major metabolic pathways and of methods of energy production in cells. Lecture, three hours; one optional conference. Prereq: CHE 104 or 112, CHE 236 and BIO 202 or equivalent.

511 *Biochemistry.* (6)
A selective summary of available information on cellular activities at the molecular level. Particular emphasis will be given to the processes by which metabolites are converted into compounds essential to the maintenance or growth of the cell or are oxidized to yield energy in a form which is useful to the cell. Discussions of respiration, nutrition and of the processes by which a constant extracellular environment is maintained are also included. Lecture, five hours; laboratory, one hour. Prereq: CHE 104, 112, 232; CHE 442 is also highly desirable; permission of chairman.

514 *General Biochemistry.* (3)
An introductory but intensive course in the broader aspects of biochemistry. Topics stressed include the chemistry of naturally occurring materials, nature of enzyme action, intermediary metabolism and chemical aspects of the specialized behavior of animals, plants and microorganisms. Prereq: CHE 112, 222, 232. One year of a biological science; CHE 442 and 443 are highly desirable for students majoring in Biochemistry. These courses, however, may be taken concurrently.

515 *General Biochemistry.* (3)
A continuation of BCH 514.

517 *Experimental Methods in Biochemistry.* (4)
A laboratory course dealing with the instrumentation and procedures of biochemical research. Because many of the materials used are labile, the course is given in a block during a four-week period at the end of the spring semester. Five days per week during four-week intersession, or summer session. Prereq: BCH 401, 502 or 811 and permission of instructor.

610 *Intermediary Metabolism.* (3)
A lecture and seminar course devoted to a study of the detailed mechanisms of carbohydrate, lipid and nitrogen metabolism. Prereq: BCH 511 or 514, 515.

611 *Intermediary Metabolism.* (3)
A lecture and seminar course devoted to a study of the detailed mechanisms of carbohydrate, lipid and nitrogen metabolism. A continuation of 610. Prereq: BCH 511 or 514, 515.

614 *Biochemistry of Proteins, Nucleic Acids and Enzymes.* (3)
A lecture and seminar course devoted to the chemical, physical and biological properties of proteins and nucleic acids and to the broad area of physical biochemistry, including kinetic and thermodynamic aspects of enzyme-catalyzed reactions. Prereq: BCH 511 or 514, 515; CHE 442.

615 *Biochemistry of Proteins, Nucleic Acids and Enzymes.* (3)
A continuation of BCH 614. Prereq: BCH 511 or 514, 515; CHE 442.

618 *Seminar in Biochemistry.* (1)
A weekly seminar, required of all students majoring in biochemistry devoted to discussions of areas not covered in other courses and to recent developments in the field.

619 *Seminar in Biochemistry* (1)
A weekly seminar, required of all students majoring in biochemistry, devoted to discussions of areas not covered in other courses and to recent developments in the field.

640 *Research in Biochemistry.* (1-15)
Prereq: Permission of instructor.

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

CELL BIOLOGY

710 *Special Topics in Cell Biology.* (2)
A variety of topics relating to modern molecular and cell biology. Prereq: Permission of instructor.

PATHOLOGY

While there is as yet no graduate program in pathology the department offers two courses which are open to qualified graduate students. The permission of the department chairman is required prior to enrollment.

421 *Fundamental Human Pathology.* (4)
This course will provide a general survey of the various types of reactions to injury; regeneration, repair, the granulomata and the fundamentals of neoplasia. The emphasis will be upon the pathogenesis, mechanisms, and natural history of disease processes with particular stress on the interrelationships of structural and metabolic abnormalities. For non-medical students. Prereq: For graduate students: ANA 511, 512, 513, PGY 511, BCH 511 or equivalents and permission of departmental chairman.

422 *Systemic Human Pathology.* (7)
The study of disease of each organ system. For non-medical students. Prereq: For graduate students: ANA 511, 512, 513, PGY 511, BCH 511 or equivalent; permission of department chairman.

PHARMACOLOGY

Director of Graduate Study—Tihamer Z. Csaky

The Department of Pharmacology offers M.S. (according to Plan A)* and Ph.D. degrees in Pharmacology.

Pharmacology is the study of the actions of drugs upon living matter. Pharmacologists in modern society find careers as teachers in academic professions, as scientists engaged in research of problems related to pharmacology, and in developing new drugs along with evaluating drugs for their potential efficacy, toxicity, side effects, etc.

Graduates from accredited colleges with bachelor degrees in the biological sciences, in chemistry, physics or pharmacy or with professional degrees in medicine, dentistry, veterinary medicine or pharmacy are eligible for candidacy for graduate degrees in pharmacology. It is advisable that the candidates obtain a good basic training in mathematics, physics, chemistry and biological sciences. The Ph.D. program involves extensive research work under the supervision of appropriate staff scientists. At the present, special training can be obtained in fundamental pharmacodynamics, in neuropharmacology, psychopharmacology, and in gnotobiotic biology.

There is also a combined M.D./M.S. (in pharmacology) program available.

Only one modern foreign language is required for the Ph.D. degree in Pharmacology.

Inquiries concerning the details of the program as well as possible financial support for graduate students should be addressed to the Chairman of the Department of Pharmacology.

There is available a joint program in Pharmacology between the University of Kentucky and the University of Louisville. Inquiries relative to this program should be directed to the Department of Pharmacology.

* Under exceptional circumstances an M.S. degree may be awarded according to Plan B. Candidates who wish to receive the degree according to Plan B have to submit a written application to the Director of Graduate Studies.

Candidates in the combined M.D./M.S. (in pharmacology) program obtain their M.S. degree exclusively according to Plan A.

521 *General Pharmacodynamics.* (2)
A fundamental discussion of the response of the living organism to drugs analyzed primarily on the cellular and subcellular levels. Factors which affect the absorption, distribution and the disposal of drugs in the body will be discussed. The quantitative aspects of dose-response relationships to drugs will be analyzed including an introduction to the problems of biological assay. Prereq: Consent of instructor.

522 *Pharmacology in Medicine.* (3)
This course is aimed to give a fundamental understanding of the pharmacodynamic action of drugs most commonly used in medical practice. Prereq: PHA 521; consent of instructor.

541 *Biological Assay.* (4)
Review of selected specialized methods in study of the effects of drugs including the study of the estimation of potencies of treatments against some standardized scale. Two hours lecture, five hours laboratory. Prereq: Consent of the Department Chairman.

555 *Gnotobiotic Methodology.* (2)
A practical course for students who wish to learn how to conduct gnotobiotic experiments. In this type of work animals are maintained either in absence or in association with known microbial contaminants. Prereq: MB 200, consent of instructor.

610 *Seminar in Pharmacology.* (1)
May be repeated indefinitely.

612 *Quantitative Pharmacodynamics. Pharmacokinetics.* (2)
Quantitative treatment of dynamics of drug absorption, distribution, metabolism and excretion, including development of mathematical models for these processes and application of techniques such as analog simulation. Prereq: PHA 521 and consent of instructor. (Same as PHR 612.)

621 *Advanced Pharmacodynamics.* (2)
Continuation of Pharmacology 521 with particular emphasis on recent developments in the field. Prereq: PHA 521, consent of department chairman.

631 *Principles of Pharmacology, Lectures.** (5)
Discussion of the pharmacodynamic principles by which the main classes of drugs exert their action on living organisms. Prereq: Consent of instructor

632 *Principles of Pharmacology, Laboratory.** (2)
Experimental study of drug action, emphasis being placed on whole animals and isolated organ effects. Prereq: Consent of instructor.

633 *Advanced Pharmacology.** (4)
Work conducted outside the thesis area and with a preceptor, other than the thesis director, by special arrangement. Prereq: Consent of one of the instructors. Lecture, two hours; laboratory, four hours per week.

634 *Pharmacology of Cardiovascular Drug Therapy.** (3)
A discussion of the mechanism of action, dosing theory, toxicity and metabolism of drugs used as therapeutic agents in the treatment of cardiovascular disease. Prereq: Consent of instructor.

641 *Bioassay with Human Subjects.* (2)
Discussion and illustration of statistical principles and techniques which form the basis of bioassay. Special emphasis is placed on analysis of variance techniques for experimental designs useful in parallel line quantitative assays. Prereq: STA 670, PHA 541, PHA 521, or equivalent. Consent of instructor.

645 *Physiology and Pharmacology of Biological Membranes and Transport.* (1)
Advanced study of the structure, functions and permeability of biological membranes and the effect of change of chemical environment upon them. Prereq: BCH 514/515 or PCH 400 or CHE 552 or equivalent, PGY 502/503 or 511 or equivalent, PHA 521, consent of instructor.

650 *Host-Contaminant Relationships.* (2)
The course deals with the effects of microbial associates on various systems of the animal host with special reference to gastrointestinal, cardiovascular, defensive functions and aging. Materials will be presented as a comparative study between gnotobiotic and conventional animals. Prereq: BSC 421/422, CHE 220, 230, 444, ZOO 200, MB 200, 550 or equivalent, consent of instructor.

658 *Advanced Neuropharmacology.* (4)
A study of the general theories of the mode of action of drugs upon nervous tissue and a review of the effects of analgesics, sedatives, hypnotics, anesthetics, tranquillizers, psychotomimetics, analeptics, antidepressants, anticonvulsants and drugs affecting motor dyskinesias upon neurones, synapses and functional components of the central nervous system. Prereq: PGY 416 or equivalent, PHA 521, 522, consent of instructor.

660 *Pharmacology of Steroids.* (4)
Lectures and laboratory work dealing with the chemistry, metabolism and pharmacology of steroids. Emphasis will be placed on methods of research which will be illustrated in laboratory exercises. Prereq: CHE 232, BCH 514/515 or PCH 400 or CHE 522 or equivalent, PHA 521. Consent of instructor.

664 *Advanced Molecular Pharmacology.* (2)
An advanced discussion of actions of drugs at the molecular level. The mechanism by which drugs alter the biochemical machinery which operates in the maintenance in the cellular integrity will be emphasized. Chemical events which occur when drug molecules interact with macromolecules with cell constituents which modulate the activities of cell will be discussed. Prereq: PHA 521 and consent of instructor.

665 *Drug Receptor Interrelationship.* (1)
A seminar course in which the nature and topography of the reactive groups constituting the receptors of various drugs is discussed. Prereq: CHE 550/552 or BCH 514/515 or equivalent, PHA 521, 522; consent of instructor.

666 *Human Pharmacology.* (3)
Discussion of pharmacodynamics and practical therapeutic applications of drugs particularly as related to humans. Prereq: PHA 521, 522, 541, 641. Consent of instructor. Two class hours per week; laboratory, two hours.

670 *Clinical Psychopharmacology.* (2)
Purposes, indications and contraindications, methods of administration and effects of psychotropic drugs on human behavior. Prereq: PHA 521, 522, PSY 210, 330 and 336 or equivalent and consent of the Director of Graduate Studies in PHA.

671 *Integrative Psychopharmacology.* (2)
Mechanisms of action of psychotropic drugs. Prereq: Same as for PHA 670, PSY 505 and 507 or 509, PGY 516, ANA 516, and PHA 670 are strongly recommended.

680 *Applied Toxicology.* (5)
The course will acquaint students with the various toxicological principles as they apply to problems arising from the complexities of modern society. Lectures, demonstrations and informal discussions. Prereq: Consent of the Director of Graduate Studies in Toxicology. (Offered as a Conjoint course.)

750 *Research in Pharmacology.* (1-5)
May be repeated to a maximum of 15 credits.

768 *Residence Credit for Master's Degree.* (0)
(1-6 credits equivalence.) May be repeated.

769 *Residence Credit for Doctor's Degree.* (0)
(1-12 credits equivalence.) May be repeated indefinitely.

770 *Seminar in Toxicology.* (1)
Prereq: Consent of Director of Graduate Studies in Toxicology.

790 *Research in Toxicology.* (1-5)

PHYSIOLOGY AND BIOPHYSICS

Director of Graduate Study—
Fred W. Zechman, Jr.

Physiology is the biological field concerned with function. It is, in fact, dynamic biology. The increase in knowledge in the field of physiology as well as the change in the nature and complexity of instrumentation necessary for experimentation and analysis of experimental data have lengthened doctoral programs in physiology or necessitated a restriction in the scope of the program.

The graduate program meets these problems in three stages:

1. Requirement of adequate physical, chemical and biological background before admission to the program or a reasonable plan to make up deficiencies that exist. In general, one year of physics, three years of chemistry, one year of

biological science and mathematics through calculus are required. A reading knowledge of one modern foreign language is required of candidates for the Ph.D. degree.

2. A basic program covering one to two years to allow instruction in basic mammalian and cellular physiology and the correlated instrumentation including project type laboratory work.

3. Special training and research including a thesis in the areas of physiology in which the department has competence. These include neurophysiology, cardiovascular physiology, respiratory physiology, temperature regulation, developmental physiology, cellular physiology, physiological correlates of behavior. Special programs may be developed in biophysics, space physiology, and biomedical engineering.

Graduates of accredited colleges with a bachelor's degree in biology, zoology chemistry, physics, psychology, mathematics, or engineering may become candidates for a graduate degree in physiology.

Inquiries concerning availability of financial support should be addressed to the chairman of the department.

502 *Principles of Physiology Lectures.* (3)
A comprehensive discussion of physiology using advanced texts and library reading; includes function as related to major body systems. Prereq: One year Physics and Organic Chemistry. (Same as ZOO 502.)

503 *Principles of Physiology.* (5)
A comprehensive discussion of physiology using advanced texts and library reading; includes function as related to major body systems and laboratory experience with major experimental techniques. Prereq: One year Physics and Organic Chemistry. (Same as ZOO 503.)

504 *Independent Work in Physiology.* (2-4)
A study of some advanced problems in physiology under the direct supervision of the instructor. Discussion period, one hour; laboratory, four hours. May be repeated to a maximum of eight credits. Prereq: Consent of instructor.

507 *Introduction to Endocrinology.* (3)
Introductory study of the development, structure, and fundamental functions of endocrine glands. Prereq: General chemistry; consent of instructor.

510 *Medical Physiology Lectures.* (4)
Provides advanced work in mammalian physiology approached from a biophysical point of view. Lectures and small group discussions will include consideration of cellular function, excitable tissues, volume conductors, contractile tissues, circulation, respiration, gastrointestinal tract, energy exchange, kidney and mid-brain control systems.

511 *Medical Physiology.* (7)
The instruction in physiology will provide advanced work in mammalian physiology approached from a biophysical point of view. Lectures and small group discussions will include consideration of cellular function, excitable tissues, volume conductors, contractile tissues, circulation, respiration, gastrointestinal tract, energy exchange, kidney and mid-brain control systems. Laboratory experience will also include electrophysiological techniques and mammalian surgical techniques with emphasis on experimental design and biometrics. Prereq: Admission to medical school or permission.

512 *Cellular Physiology.* (4)
An intensive study of general physiological principles with emphasis on the chemistry and physics of the cell. Lecture, two hours; laboratory, two hours. Prereq: Physics and general chemistry.

520 *Theoretical Biophysics.* (3)
A multidisciplinary approach to the study of biological systems as viewed from the fundamental laws of the physical sciences. Magnitudes: space, time, forces, particles, allometric relationships. *The Fundamental Biological Unit*: Information, ordering processes, evolution, biological necessity and religious freedom. *The Organism*: Cell as a machine, man as a machine, physics of death. *The Ecosystem*: Systems and analysis, energy flow, species level, ecological crisis. Prereq: MA 113, PGY 502 or 512 or BOT 501 or permission of instructor.

522 *Mathematical Biophysics.* (3)
Mathematical approaches to biophysical problems in biology. Emphasis on the abstract representation of physiological systems and processes. Prereq: MA 114 or equivalent.

602 *Physiological Instrumentation I.* (3)
Electronic circuits in physiological measuring systems. One lecture, two lab hours per week. Prereq: MA 113; knowledge of integration and differentiation of simple functions or permission of instructor.

603 *Physiological Instrumentation II.* (3)
Physical basis of physiological measurement and analogs of physiological systems. Three lectures per week. Home assignments will emphasize problem solving and will include a term problem to be selected by the student in consultation with the instructor. Topics to be covered in this course include: non-linear electronic circuits; transducers; synthesis of instrumentation systems; and analogs of biological and mechanical systems. Prereq: MA 113, PGY 511, PGY 602, or consent of instructor.

606 *Advanced Neurophysiology.* (3)
Electrical analysis of nerve fibres and synapse; nerve impulse theories, reflexes, metabolism and central nervous function are considered from the cybernetic viewpoint. Lecture, two hours; laboratory, two hours. Prereq: PGY 512, 513; consent of instructor.

627 *Proseminar in Physiological Psychology.* (2)
An intensive examination of theories, methods of investigation, and current developments in the field of physiological psychology. Prereq: Graduate student or permission of instructor. (Same as PSY 627.)

630 *Advanced Topics in Physiology and Biophysics.* (2)
Contemporary topics in physiology and biophysics. Course designed to utilize the special research interests of resident and visiting faculty. May be repeated to a maximum of six credits. Prereq: PGY 503 or 511 or consent of instructor.

660 *Systems Physiology.* (3)
The analysis of physiological systems. This includes application of mathematical and engineering techniques. Development and discussion of modeling physiological systems. Prereq: PGY 522 or consent of instructor.

767 *Seminar in Physiological Psychology.* (3)
A study of selected topics in Physiological Psychology with emphasis on recent research and theory. May be repeated to a maximum of nine credit hours. This course may be elected to fulfill requirements in the Psychology and Physiology graduate programs. Prereq: Consent of instructor. (Same as PSY 767.)

768 *Residence Credit for the Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

774 *Graduate Seminar in Physiology.* (1)

791 *Research in Physiology.* (2-5)
May be repeated to a maximum of 15 credits.

RADIATION MEDICINE

540 *General Radiation Biology.* (4)
A basic course devoted to a study of radiation techniques and research and their application in the various fields of biology. Lectures devoted to basic background and health hazard aspects followed by more comprehensive treatment of biological aspects. Laboratory devoted to

use of radioisotopes and techniques of their measurement using various radiation detectors and counters. Lectures, two hours per week; laboratory, four hours. Prereq: Two years of biological sciences, one year of Chemistry, and consent of insructor. (Same as ZOO 540.)

545 *Radiation Hazards and Protection.* (2)
An analysis of common radiation hazards encountered in medicine and research, regulations for safe usage of radiation, and procedure fo rsafe use of radiation. One class hour per week, two laboratory hours. Prereq: College physics; one year biology.

546 *General Medical Radiological Physics.* (2)
Following a mathematics and physics review, the nature, origin, uses and dosimetric aspects of radiation will be discussed. Application in the fields of diagnostic radiology, therapeutic radiology and nuclear medicine will be emphasized. Prereq: PHY 260 or consent of instructor. (Same as PHY 546.)

547 *Medical Radiation Imaging—I, Physical Aspects of Diagnostic Radiology.* (2)
Medical radiation and the generation of information; X-ray circuits and operation of the X-ray apparatus; the radiological image and the retrieval of information; X-ray image intensification; image intensifiers; fluoroscopy; cinefluorography; special procedures and patient dosimetry. Prereq: PHY 260, or RM 546 or consent of instructor. (Same as PHY 547.)

548 *The Physics of Radiation Therapy.* (2)
The terminology and advanced methods of treating various diseases using beam devices such as X-rays, Co-60, and linear accelerators as well as brachytherapy (interstitial and intracavitary implantation of radioactive sources). Emphasis will be placed upon "treatment planning" including dose calculation and methods of optimizing tumor to healthy tissue dosage by both hand and computer methods. Prereq: PHY 260 or RM 546 or consent of instructor. (Same as PHY 548.)

640 *Biological Effects of Radiation.* (3)
A consideration of the action of ionizing radiation and ultraviolet light at progressively higher levels of organization. Recent experiments and current theoretical concepts will be emphasized. Prereq: ZOO 540, 541, or two years of Chemistry, Physics and Biological Sciences and consent of instructor. (Same as ZOO 640.)

HRS 710 *Seminar in Bioradiation Sciences.* (1)
Topics of current interest relating to radiation and its biomedical significance will be discussed. Prereq: Graduate standing in radiation-related science.

TOXICOLOGY

Director of Graduate Study—Tihamer Z. Csaky

The Graduate Program in Toxicology is interdepartmental with members of the various faculties of the Medical Center, the College of Arts and Sciences, and the College of Agriculture participating. Both the M.S. (Plan A) and Ph.D. degrees are offered.

Toxicology, the science of poisons, is concerned with the interaction of chemical agents or changes in the physico-chemical environment with living systems. The Graduate Program in Toxicology is designed to train individuals to utilize the biological, physical, and mathematical sciences in the study of the causes, mechanisms, and evaluation of poisoning as well as the sources, identification and quantitation of poisons.

Graduates of accredited colleges with baccalaureate degrees in the biological sciences, chemistry, or physics or professional degrees in medicine, dentistry, pharmacy, or veterinary medicine may apply for graduate study in the toxicology program. It is advisable that candidates have a good background in chemistry, physics, biological sciences, and mathematics. Students with other advanced degrees may be considered for admission. However, the number of credits and courses transferable will be considered on the merits of each individual case.

Since each candidate may be expected to have specific interests, the actual curriculum will be tailored to meet individual needs. Only one modern foreign language is required for the Ph.D. degree in Toxicology.

Inquiries concerning the details of the program as well as possible financial support for graduate students should be addressed to the Chairman of the Department of Pharmacology.

Nursing

Director of Graduate Study—Loretta M. Denman

The College of Nursing offers a master's program in nursing under Plan B. The program is one calendar year in length and requires a minimum of 30 credits. There is no language requirement for this professional degree program.

The general Graduate School admission requirements apply; however, applicants are asked to submit Graduate Record Examination scores at the time of application for admission. The transcripts of all applicants not graduated from NLN accredited baccalaureate programs in nursing will be evaluated individually and additional course work prescribed for deficiencies. Nurse licensure is required and personal interviews will be arranged when feasible.

Eighteen credits in nursing plus Behavioral Science 772 are required of all students. The remaining credits may be selected from several designated areas with the consent of the adviser.

The Master of Science in Nursing degree is awarded upon completion of the program requirements with a grade-point average of 3.0 or better.

610 *Concepts and Theories in Nursing.* (6)
Study and analysis of concepts and theories from nursing and cognate areas. The focus is on nursing in any setting, viewed through the spectrum of human needs, health-illness continuum and the age span. Students explore the commonalities of nursing, teaching and administration and the process of systematic inquiry. Lecture, seminar and laboratory. Four class hours per week; laboratory arranged. Prereq: Admission to Graduate Program.

620 *Clinical Nursing I.* (6)
Review and expansion on the process of collaborative efforts for health care; students continue the exploration of nursing care problems and increase their knowledge of systematic inquiry, nursing care and the transmission of knowledge. The focus expands to include greater opportunity for the pursuit of special interests. Four class hours per week; laboratory arranged. Prereq: NUR 610.

630 *Clinical Nursing II.* (6)
A continuation of NUR 620. Focus is on the consolidation of learnings from nursing and cognate courses into a framework for advanced nursing practice with opportunity to test and evaluate results. Four class hours per week; laboratory arranged. Prereq: NUR 620.

768 *Residence Credit for Master's Degree.* (0)
May be repeated once. (1-6 credits equivalence.)

781 *Independent Study in Nursing.* (1-3)
An elective course which gives the student an opportunity to explore independently a topic of special interest. May be repeated to a maximum of four credits. Prereq: Consent of adviser.

Pharmacy

PHARMACEUTICAL SCIENCES

Director of Graduate Study—H. B. Kostenbauder

The College of Pharmacy offers M.S. and Ph.D. programs in Pharmaceutical Sciences, with areas of concentration in either Pharmaceutics (Physical Pharmacy or Biopharmaceutics) or Pharmaceutical Chemistry (Medicinal Chemistry and Pharmaceutical Analysis).

The M.S. degree is offered under a modification of Plan A which permits a student to take approximately one-half of his course in work areas outside the major area. Plan B may be employed only in exceptional cases.

The language requirement for both the M.S. and Ph.D. degrees is a reading knowledge of one foreign language chosen from French, German, or Russian.

Subject to some substitution at the recommendation of the candidate's committee, courses considered basic to the Ph.D. program are CHE 440, 442, 522, 532, 548, 633, 635, MA 481, STA 670, PHA 521, BCH 514, 515. Superimposed upon this base it is expected that the student will take graduate level courses within his major area of interest from the courses listed in the departments of Pharmacy and Pharmaceutical Chemistry.

For regular admission to graduate study in Pharmaceutical Sciences a student should have a sound background in pharmacy, chemistry, and biology, with a mastery of mathematics through calculus. Applicants lacking basic requirements in these areas will be required to make up such deficiencies by taking undergraduate courses for non-graduate credit.

540 *Industrial Pharmaceutical Technology.* (4)
The course is designed to give the student a basic understanding of the technology used in the preparation of the principal type of dosage forms by the pharmaceutical industry. Two class hours and four laboratory hours per week. Prereq: PHR 825 or equivalent.

612 *Quantitative Pharmacodynamics. Pharmacokinetics.* (2)
Quantitative treatment of dynamics of drug absorption, distribution, metabolism and excretion, including development of mathematical models for these processes and application of techniques such as analog simulation. Prereq: PHA 521 and consent of instructor. (Same as PHA 612.)

622 *Advanced Biopharmaceutics.* (2)
An advanced treatment of the factors affecting drug availability from dosage forms and the influence of the route of administration and the dosage regimen on drug availability. Prereq: PHR 612.

630 *Pharmaceutical Rate Processes.* (3)
Kinetics of reactions of pharmaceutical interest; mechanisms of drug decomposition and theoretical approaches to stabilization and preservation; accelerated stability analysis. Prereq: Physical Chemistry and Chemical Kinetics.

631 *Equilibrium Phenomena in Pharmaceutical Systems.* (3)
An advanced study in special topics of a physical chemical nature which are applicable to pharmacy, with special emphasis on physical properties and molecular structure, solubility, complexation and equilibria in solution. Prereq: Physical Chemistry.

632 *Pharmaceutical Disperse Systems.* (3)
The theoretical considerations basic to the technology of pharmaceutical disperse systems. Topics include colloidal dispersions, suspensions, emulsions, and rheology. Prereq: Physical Chemistry.

760 *Topics in Pharmaceutics.* (2)
This course deals with emerging basic concepts of pharmaceutical interest that are being covered in other courses.

768 *Residence Credit for the Master's Degree.* (0)
May be repeated indefinitely. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

776 *Seminar in Pharmaceutics I.* (1)
Reports and discussion of pertinent research and literature in pharmaceutics. Prereq: Graduate standing.

778 *Seminar in Pharmaceutics II.* (1)
Reports and discussion of pertinent research and literature in pharmaceutics. Prereq: Graduate standing.

780 *Special Problems in Pharmaceutics.* (1-6)
Special problems of a laboratory or literature nature in which a student pursues a topic of interest to him. Prereq: Consent of the instructor.

790 *Research in Pharmaceutics.* (1-12)
Research work to be conducted in various areas of pharmaceutics. Prereq: Approval of student's Graduate Committee and consent of instructor.

PHARMACEUTICAL CHEMISTRY

400 *Biochemistry.* (4)
A fundamental course in the chemistry and interrelationships of carbohydrates, lipids, and proteins, as well as the role of enzymes, vitamins, and hormones in physiological processes. Prereq: CHE 232, 233, or equivalent.

402 *Pharmaceutical Analysis and Control.* (4)
A course which deals with the application of analytical methods in the determination of the strength, purity and quality of drugs and pharmaceuticals; and includes the means by which quality can be assured in a fabricated pharmaceutical product. Laboratory exercises include analysis of raw materials and dosage forms. Lecture, three hours; laboratory, three hours. Prereq: CHE 226.

404 *Chemistry of Medicinal Products.* (3)
A study of the official and more important non-official medicinal agents with respect to their physical and chemical properties, relationships of chemical structure to physiological activity, as well as their potential incompatabilities. Prereq: PCH 400 or equivalent.

406 *Chemistry of Medicinal Products.* (3)
Continuation of PCH 404 including considerations of such topics as alkaloids, glycosides, steroids, and other chemotherapeutic agents. Prereq: PCH 404.

510 *Modern Methods in Pharmaceutical Analysis.* (5)
A course which deals with the application of modern analytical methods, primarily instrumental methods, in the determination of the strength, purity, and quality of drugs and pharmaceuticals. Laboratory exercises include analysis of raw materials and finished dosage forms. Three class hours and four laboratory hours per week. Prereq: CHE 226.

620 *Natural Products Chemistry.* (3)
Chemistry of natural products. A course designed to establish a bridge between organic chemistry, biochemistry and biology in terms of such areas as biogenisis, biotransformations, isolation, degradation, structure elucidation and synthesis of natural products of interest as medicinal agents. Prereq: PCH 400 or equivalent and consent of instructor.

640 *Advanced Pharmaceutical Chemistry I.* (3)
Chemistry of chemotherapeutic agents. A course bridging synthetic organic chemistry and biological activity and considering those organic compounds used as therapeutic agents in infectious diseases emphasizing the synthesis, relationship between chemical structure, biological activity, molecular modification and metabolism. Prereq: Advanced Organic Chemistry and consent of instructor.

642 *Advanced Pharmaceutical Chemistry II.* (3)
Chemistry of pharmacodynamic agents. A course similar to PCH 640, but considering those agents altering physiological activity such as antihistaminics, anesthetics, antispasmodics, hypnotics, etc. Prereq: Advanced Organic Chemistry and consent of instructor.

760 *Topics in Pharmaceutical Chemistry.* (Topic and credit to be listed when offered) (2-4)
A study of selected areas of pharmaceutical chemistry such as drug-protein binding, synthetic methods in drug development, heterocyclic compounds, alkaloids, steroids, flavones, etc. May be repeated for a maximum of 10 hours. Prereq: Consent of instructor.

768 *Residence Credit for Master's Degree.* (0)
May be repeated. (1-6 credits equivalence.)

769 *Residence Credit for the Doctor's Degree.* (0)
May be repeated indefinitely. (1-12 credits equivalence.)

776 *Seminar in Pharmaceutical Chemistry I.* (1)
Reports and discussion on pertinent research and literature developments in pharmaceutical chemistry. Required of all graduate students. Prereq: Graduate standing.

778 *Seminar in Pharmaceutical Chemistry II.* (1)
Reports and discussion on pertinent research and literature developments in pharmaceutical chemistry. Required of all graduate students. Prereq: Graduate standing.

780 *Special Problems in Pharmaceutical Chemistry.* (1-6)
Selected problems of laboratory or library nature in which a student pursues a topic of interest to him under the supervision of a faculty member particularly qualified in that area. May be repeated once. Prereq: Consent of instructor.

790 *Research in Pharmaceutical Chemistry.* (1-12)
Research work to be conducted in the various areas of pharmaceutical chemistry such as synthesis of medicinal agents, analytical methods for drugs, structure action relationships, and related topics. Prereq: Approval of student's Graduate Committee and consent of instructor.

MATERIA MEDICA

450 *Pharmacology and Toxicology.* (5)
A presentation of the pharmacodynamic actions, modes of administration, toxic manifestations of drugs, and the relationship of pharmacodynamic action to therapeutic use. Lecture, four hours; laboratory, two hours. Prereq: MM 334, 346, PCH 400.

462 *Pharmacology and Toxicology.* (5)
A continuation of MM 450. Lecture, four hours; laboratory, two hours. Prereq: MM 450 or equivalent.

470 *Drug Literature Evaluation.* (3)
This course apprises the student of the pharmacological and toxicological principles and techniques employed in the clinical evaluation of drugs and enables the student to use more effectively clinical literature. It is designed as a natural continuation of MM 462. Prereq: MM 462.

474 *Independent Problems in Toxicology.* (1-3)
Selected problems requiring literature and laboratory research are designed to meet specific needs of graduate minors in toxicology and satisfy professional elective requirements for pharmacy students. Prereq: Permission of the instructor. May be repeated for a total of six credits.

475 *Independent Problems in Pharmacognosy.* (1-3)
Selected problems requiring literature and laboratory research are designed to meet specific needs of graduate minors in pharmacognosy and satisfy professional elective requirements for pharmacy students. Prereq: Permission of the instructor. May be repeated for a total of six credits.

476 *Independent Problems in Pharmacology.* (1-3)
Selected problems requiring literature and laboratory research are designed to meet specific needs of graduate minors in pharmacology and satisfy professional elective requirements for pharmacy students. Prereq: Permission of the instructor. May be repeated for a total of six credits.

620 *Biotoxicology.* (3 or 5)
An advanced course in toxicology and toxicodynamics concerned with the sources, isolation, purification identification as well as the physiologic effects on man, animals, and plants of the various toxic substances encountered in the occupations, home, as well as rural and urban environments. Special attention will be given to type compounds as well as structure-activity relationships. Lecture, three hours; laboratory, four hours. Prereq: BCH 514, 515, CHE 532, PHA 521, and PGY 503 or MM 334 and 346; or consent of instructor.

630 *Biotoxicology.* (3 or 5)
A continuation of MM 620. Prereq: MM 620 or permission of the instructor.

640 *Environmental Toxicology and Occupational Hygiene.* (3)
An advanced course concerned with the recognition, analysis, evaluation, and control of the physical, physiologic, and toxicologic factors arising from occupational and natural environments; their effects on the well-being of the worker and the community; and current practices in their recognition, elimination and/or mitigation. The occupational environment will be considered as a special case of the ambient environment. Special attention will be given to the development of design data for practical problems. Prereq: MM 620, 630 or permission of the instructor.

Social Professions

Director of Graduate Study—Ernest F. Witte

The College of Social Professions offers a graduate curriculum of four semesters' duration, leading to the Master of Social Work degree in accordance with Plan B. The M.S.W. degree program is designed to prepare students for careers in the social professions. The college also offers a series of courses in its undergraduate Social Work Major Program which may be taken for graduate credit.

Requirements for the Degree of Master of Social Work:

1. Earn 54 units of credit with a grade average of B or above. Forty of these units must be the required social work courses. Four units will be chosen from additional courses offered within the graduate social work curriculum of the College of Social Professions. The remaining 10 units may be elected from relevant courses offered throughout the University or by the College of Social Professions.
2. Earn all 54 units within a seven-year period.
3. Earn not less than 28 of the 54 required credit units at the University of Kentucky. All social work transfer credits accepted for the degree must have been earned in a school accredited by the Council on Social Work Education.
4. Be advanced to candidacy by the end of the first year of graduate study.
5. Successfully complete the final comprehensive examination.
6. Complete at least 18 hours of the minimum graduate degree requirements while in residence on the Lexington campus of the University of Kentucky.

The M.S.W. degree program is being developed in cooperation with the Council on Social Work Education. The application for Admission to Candidacy made by the college in December 1969 was approved by the Accreditation Commission of the Council on Social Work Education in January 1970. Final action on the application will be taken in June 1972 under the regulations prescribed by the Accreditation Commission of the Council on Social Work Education governing all accreditation applications.

Full-time students are admitted to the M.S.W. degree program only in the fall semester. Applications must be filed not later than April 15, prior to entrance in the fall. Application forms and instructions may be obtained upon request from the Dean, School of Social Professions, Office Tower Building, University of Kentucky, Lexington, Kentucky 40506.

Applicants must meet the general requirements prescribed by the University for all graduate students.

SOCIAL WORK

444 *Field Instruction.* (6)
Supervised field instruction in a wide variety of problem settings. Laboratory, 18 hours per week. Prereq: Major and SW 520 or consent of Dean.

445 *Field Instruction.* (6)
Intensive field experience in the specialized setting of the student's choice. Laboratory, 18 hours per week. Prereq: Major and SW 444 or consent of Dean.

500 *Public Welfare Administration.* (3)
Philosophy, background, and methods of tax-supported social work. Interrelationship of federal, state and local services; standards and supervision as influenced by federal welfare legislation.

505 *Child Welfare Services.* (2-3)
A study of community and national programs for child care and protection, including aid to dependent children and other social security services.

510 *Mental Health and Behavioral Knowledge For Social Workers.* (2)
An analysis of personality development and behavior patterns with special reference to psychiatric interpretations and their implications for social work. Prereq: Permission of Dean.

516 *Social Work Research and Statistics.* (3)
A consideration of statistical and other types of research in social work problems with illustrations drawn from current studies of government and private welfare agencies.

520 *Interventive Methods in Social Work.* (3)
First semester of a two-semester course to study the integrated Social Work method and problem-solving skills. Consideration will be given specifically to theories underlying social work practice. Selected readings, practice records and actual problems brought by the student from the field will be discussed and analyzed. Prereq: Junior standing, SW 225 or equivalent or consent of the Dean.

521 *Interventive Methods in Social Work.* (3)
The second semester of a two-semester course to study the integrated Social Work method and problem-solving skills. Application of practice theory and examination of particular strategies used in working with a variety of client systems and consideration of problems and social issues of particular importance to the Social Work Profession. Prereq: SW 520.

541 *Administration and Supervision of Group Work Agency Programs.* (3)
The group work process as applied to agency administration, supervision of staff and volunteers, statistical and process recording, evaluation of program, personnel and committee relationships. Prereq: Permission of Dean.

551 *Public Assistance Programs.* (3)
The current function of public assistance upon the federal, state, and local level with emphasis on the public assistance provisions of the Social Security Act, general relief, and work relief policies.

601 *Social Work Practice.* (4)
This course lays the basic foundations for the educational practicum and all advanced practice courses. It deals with the variety of strategies for intervention in problem solving and helping processes in social work practice. Prereq: Concurrently enrolled in SW 620, 630, 690 or consent of the Dean.

602 *Social Work Practice with Adults.* (2)
Study and analyses of problems in social functioning during the adult years with emphasis upon prevention, amelioration and restoration. Prereq: SW 601 or consent of the Dean.

603 *Social Work Practice with Children and Youth.* (2)
Study and analysis of developmental crises and problems of children and youth. Emphasis upon social work strategies of intervention for prevention, amelioration or resolution. Prereq: SW 601 or consent of the Dean.

604 *Social Work Practice with the Aging.* (2)
This course will develop the framework of knowledge and skills necessary for effective social work practice in a variety of primary and host settings which deal with problems and issues confronting the aging citizen in contemporary society. Prereq: SW 601 or consent of Dean. SW 620, 630, 690 recommended.

605 *Social Work Practice in Health Services.* (2)
Examination and analysis of the role of social work in health care delivery systems. Prereq: SW 601 or consent of the Dean. SW 620, 630, 690 recommended.

606 *Social Work Practice in Correctional Services.* (2)
This course will familiarize the student with the interplay of social, cultural and psychological factors in the selection of individuals for apprehension, adjudication, confinement and rehabilitation efforts and the theories which propose to explain, predict, control and modify behavior which result in the imposition of legal sanctions. Emphasis will be placed on the role, contributions and limitations of the social worker within the correctional process. Prereq: SW 601 or consent of Dean. SW 620, 630 and 690 recommended.

607 *Social Work Practice with Families.* (2)
The presentation and critical examination of theory as it relates to the study of contemporary marriage and family life and professional social work practice skills intended to strengthen family life. Seminar, two hours per week. Prereq: SW 601 or consent of the Dean. SW 620, 630, 690 recommended.

608 *Social Work Practice for Social Reform.* (2)
The need for analysis and planning as the basis for action by social workers in their professional roles as agents of social change. Prereq: SW 630 or consent of the Dean.

620 *Human Growth and the Social Environment.* (4)
This course lays the necessary foundation for advanced courses in the biological, social, cultural, environmental, and psychological factors that influence human behavior. Prereq: Concurrent enrollment in SW 601, 630, 690.

621 *Perspectives on Deviance for Social Workers.* (2)
An intensive analysis and study of deviant personality and behavior patterns as they are applicable to the practice of social work. The theoretical basis will be reviewed. Prereq: SW 620 or consent of the Dean.

622 *Group Theory for Social Workers.* (2)
Intensive study of theoretical perspectives of group process and leadership and the application of these to the practice of social work. Prereq: SW 620 or consent of the Dean. SW 601, 630, 690 recommended.

623 *Ethnicity in Social Work Practice and Education.* (2)
The course is designed to provide the knowledge needed in understanding the dynamics of the urban dilemma. Race and race related matters facing the social work practitioner and educator. Prereq: SW 620 or consent of the Dean.

625 *Social Insurance.* (2)
A study of social insurance in Europe and the United States. Emphasis will be given to the problems in administration, financing, and coverage.

630 *Social Welfare Policies and Services.* (4)
This course lays the basic foundation for sequential courses in this content area. Emphasis is on the study and understanding of the decision-making process involved in the development, formulation, implementation and impact of social welfare policies and services. Prereq: Concurrent enrollment in SW 601, 620 and 690 or consent of the Dean.

632 *Social Work and the History of Social Reform.* (2)
The study of the history of social reform and social work with emphasis on the development of contemporary social institutions. Theories and historical analysis will be demonstrated on pressing current problems. Prereq: SW 630 or consent of the Dean.

633 *Social Welfare and the Political Processes.* (2)
An examination of social welfare programs and services in the context of local, state, and federal political processes and structure. Focus will be on both an examination of the historical issues as well as on current policies, programs and proposals as outputs of the political and governmental processes. Prereq: SW 630 or consent of Dean.

640 *Educational Practicum I.* (10)
Social work practice experience under faculty direction in a Learning Teaching Center comprised of a complex of social agencies and institutions. Application of the problem-solving method to intervention with individuals, families, groups and communities towards social change. Knowledge and concepts from classroom learnings will be applied and tested in the practice situation. Thirty-two laboratory hours per week. Prereq: SW 601, 620, 630, and 690.

650 *Problem-Solving Seminar I.* (2)
Selected major social problems and their causes are analyzed intensively. Emphasis is placed on social work interventions which are evaluated for their effectiveness in reduction and/or elimination of causes and harmful effects on people. Two class hours per week; laboratory hours as needed. Prereq: SW 601, 620, 630, 690 and concurrently enrolled in SW 640 or consent of the Dean.

680 *Special Problems in Social Work Practice.* (2-4)
Current issues that have special significance for social work practice. Selected problems in accordance with the needs and interests of the students registered for the course. Prereq: Consent of Dean.

690 *Research in Social Work.* (2)
Analysis and study of research and scientific process through critical evaluation of examples of social work and social research; identification of areas in which social work research is needed. Prereq: Concurrent enrollment in SW 601, 620, 630 or consent of the Dean.

701 *Advanced Practice Theory.* (2)
Study and analysis of problem-solving processes with emphasis upon strategies of intervention relevant to particular target populations or service delivery systems. Two class hours, four laboratory hours per week. Prereq: SW 640, concur with SW 740.

706 *Social Work Practice in Correctional Services.* (2)
This course is a continuation of SW 606 and is intended to provide the student with an understanding of the functions, responsibilities and complex role performance required of the social worker in identifying and capitalizing on points of entry for change efforts will be studied in detail. Prereq: SW 630 and 731, or approval of the Dean.

710 *Leadership Roles in Social Work I.* (2)
Study and analysis of leadership roles in social work practice. Introduction to theories of adult learning. Focus upon roles in supervision and consultation. Prereq: SW 601, 640 or consent of the Dean.

711 *Leadership Roles in Social Work II.* (2)
Continued study and analysis of social work leadership roles. Review of theories of adult learning. Focus on roles in teaching, staff development and administration. Prereq: SW 710 or consent of Dean.

712 *Principles and Methods of Field Instruction in Social Work I.* (2)

Designed for the agency social work personnel who will be assisting in the educational direction of social work students in agencies within the Learning Teaching Centers. Theories of adult learning, and curriculum design as it relates to the education of social workers in the field, will be stressed. Prereq: Master's Degree in Social Work and/or consent of the Dean.

713 *Principles and Methods of Field Instruction in Social Work II.* (2)

Continued study of curriculum design for field learning in social work. Learning opportunities to support integrated practice theory. Attention to evaluation of learning experiences and their outcome. Prereq: SW 712 or consent of the Dean.

720 *Organizational and Administrative Theory for Social Workers.* (2-4)

Emphasis on organizational and administrative theories which aid social workers in understanding factors impinging on the optimum delivery of social services and in implementing planned change. Prereq: Second year standing and consent of Dean.

730 *Public Social Policy and the Delivery of Social Services.* (2)

Critical study and analysis of social welfare policy needs, policy development and policy impact as related to citizen functioning and socialization. Prereq: SW 630 or consent of the Dean.

731 *Social Work and Community Planning.* (2)

Study and analysis of the social work process through the critical evaluation of social welfare needs in urban renewal, housing, health services, citizen participation in planning and other areas related to the humanization of community life. Prereq: SW 630 and second year standing or consent of the Dean.

732 *Social Planning and Development.* (2)

A survey of the theories, concepts and components of social planning and development. The social welfare component of social planning will be studied in detail. Prereq: SW 630 and 731, or the approval of the Dean.

740 *Educational Practicum II.* (8)

Further field experience in a Learning Teaching Center under educational direction. Continued application of classroom learnings in advanced methods of intervention. Emphasis will be upon leadership roles as in supervision, consultation, teaching and administration. Experiences in decision-making and social policy formulation planned. Laboratory hours, 26 per week. Prereq: SW 601, 620, 630, 640, 690.

745 *Advanced Specialized Educational Practicum.* (2-4)

Advanced field placement for second year graduate students in a specialized area of social work practice in which students will carry major responsibility for independent practice or leadership. Laboratory, 8-16 hours per week. Prereq: SW 640, 740 or equivalent with consent of the Dean.

750 *Problem-Solving Seminar II.* (2)

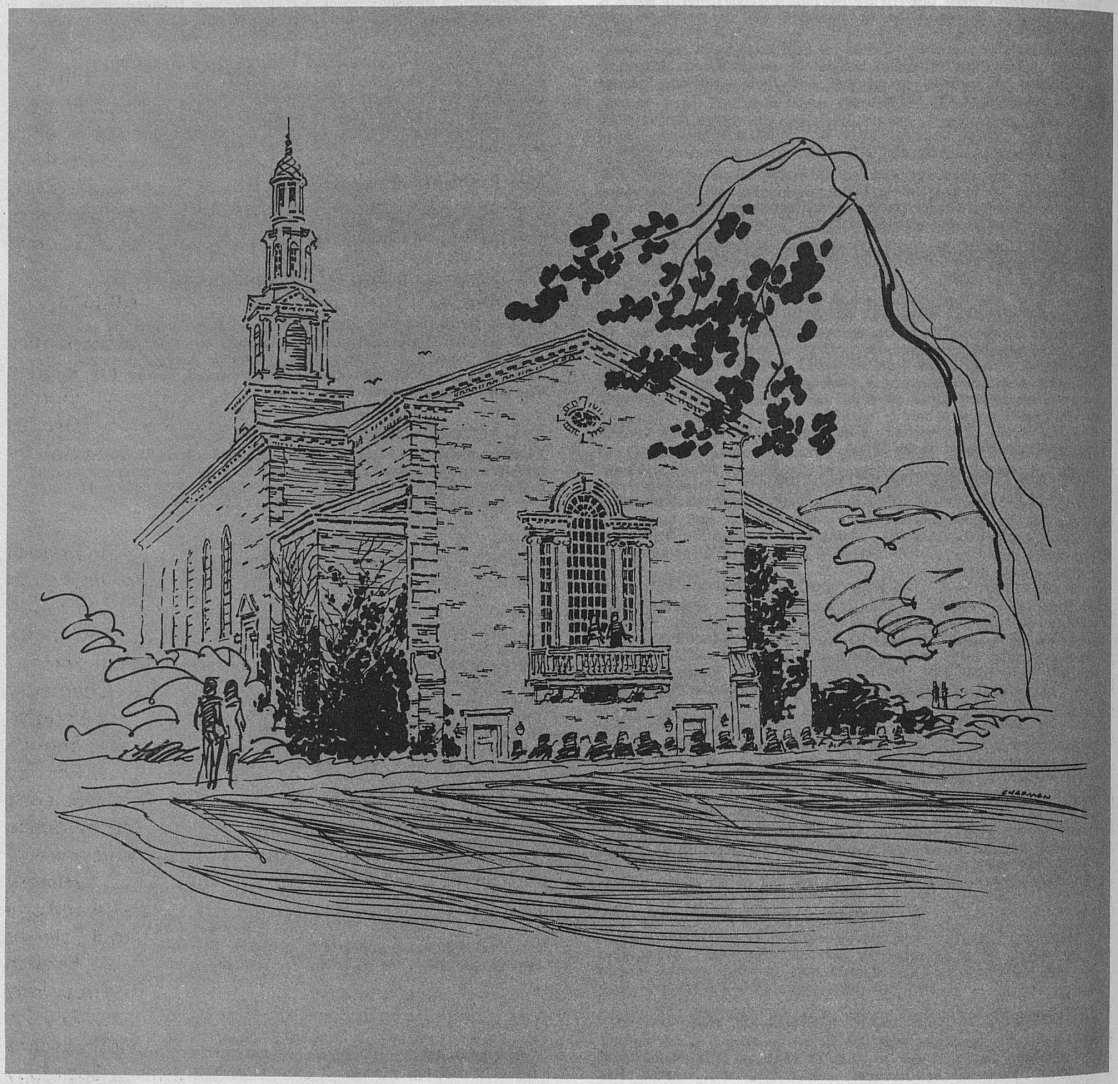
Continuation of SW 650 on more advanced level of analysis. Two class hours per week; laboratory hours as needed. Prereq: SW 650 or equivalent with consent of the Dean.

770 *Seminar on Social Issues and Social Work Practice.* (2)

Seminar for second year students on social issues which are currently vital to legislation, public concern and social action for the purpose of effecting changes in institutions and service delivery systems. Two class hours per week; laboratory hours as needed. Prereq: SW 750 or equivalent or by consent of the Dean.

790 *Methods in Social Work Research.* (2-6)

An intensified study of the research process with emphasis on design, sampling process, data collection, and analysis. For students seeking beginning skill in social work research. Prereq: SW 690 and second year standing, or consent of the Dean.



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Eugene McCane ..... History
Simon Rusmin ..... Botany
C. N. Vancil ..... Statistics

Haggin Fellows

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C. M. Boysen ..... Psychology
William Brown ..... Education
Jerry Clark ..... Anthropology
Robert Clement ..... Education
J. D. Cook ..... Physiology
P. S. Grossman ..... Psychology
Chris Hayman ..... Art
Dorie Hucal ..... Library Science
L. A. Hwang ..... Civil Engineering
Steven Kirby ..... Spanish
S. G. Lindle ..... Statistics
M. Ma ..... Chemistry
Patricia McAuley ..... English
Michael Miller ..... English
Debbie Ogletree ..... Music
Mary Osterholt ..... French
C. D. Rawn ..... Plant Pathology
Barbara Reinhardt ..... Music
W. A. Samsonoff ..... Microbiology
Nimi Sharma ..... French
E. S. Shapiro ..... Psychology
S. H. Strange ..... Zoology
S. E. Trail ..... Zoology
L. D. Wilson ..... Mechanical Engineering
Margaret Wolfe ..... History
A. C. Yin ..... Metallurgical Engineering

Paul I. Murrill Fellow

George Pendygraft ..... Chemistry

Jeffrey Fellows

Travis Tomes ..... Biology
John Yager ..... Plant Pathology
Richard Zartman ..... Soil Sciences

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Mark Rowe Elliot ..... History
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Bonnie Louise Hammel ..... Psychology
Richard James Lockett ..... Political Science
David J. Lynch ..... Economics
David William Sweatt ..... Political Science

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Jesse G. Mayes ..... Engineering Mechanics
J. P. McGovern ..... Pharmaceutical Sciences
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Dennis Callan ..... Political Science
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Joyce Hancock ..... English
Thomas Harms ..... Physics
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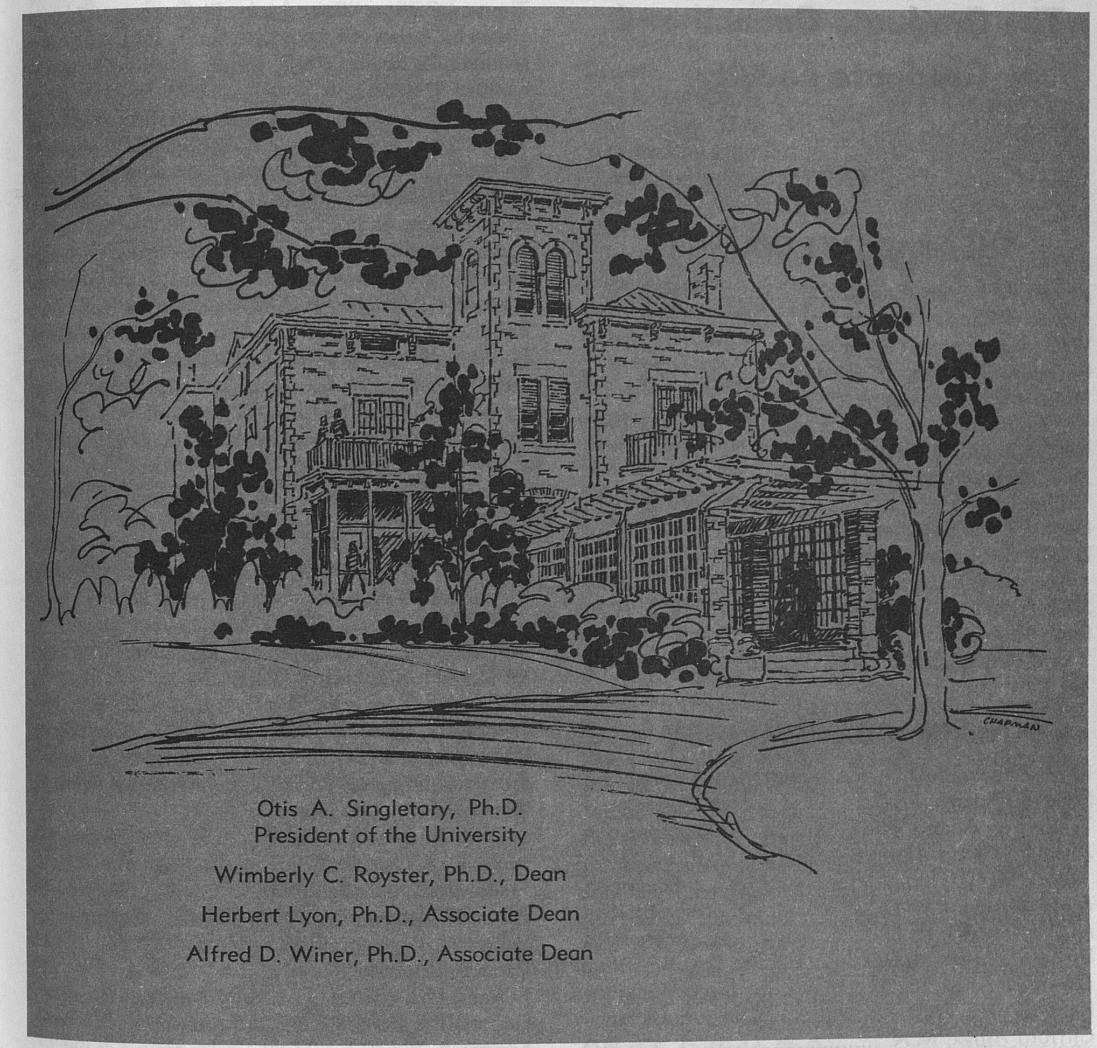

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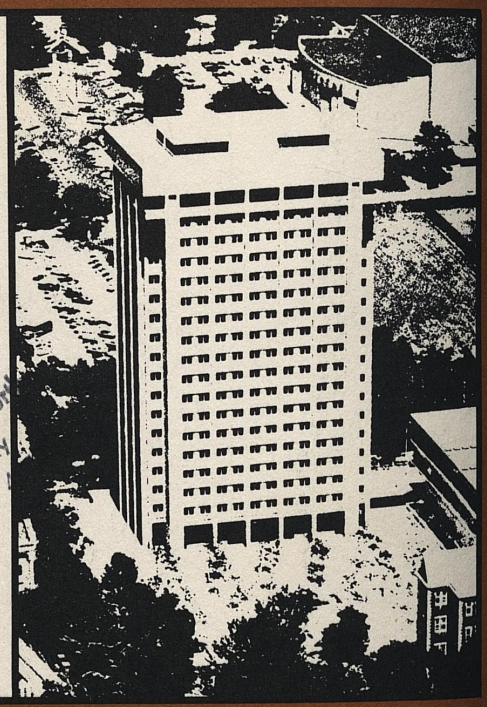

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