

THE
UNIVERSITY of MARYLAND
BULLETIN

Graduate School Announcements



1962-64

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Graduate School Announcements

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UNIVERSITY CALENDAR

FALL SEMESTER 1961

SEPTEMBER

- 18-22 Monday to Friday—Fall Semester Registration
- 25 Monday—Instruction Begins

NOVEMBER

- 22 Wednesday—Thanksgiving Recess Begins After Last Class
- 27 Monday—Thanksgiving Recess Ends 8 a.m.

DECEMBER

- 20 Wednesday—Christmas Recess Begins After Last Class

JANUARY 1962

- 3 Wednesday—Christmas Recess Ends 8 a.m.
- 24 Wednesday—Pre-Examination Study Day
- 25-31 Thursday to Wednesday, inclusive—Fall Semester Examinations

SPRING SEMESTER 1962

FEBRUARY

- 5-9 Monday to Friday—Spring Semester Registration
- 12 Monday—Instruction Begins
- 22 Thursday—Washington's Birthday, Holiday

MARCH

- 25 Sunday—Maryland Day

APRIL

- 19 Thursday—Easter Recess Begins After Last Class
- 24 Tuesday—Easter Recess Ends 8 a.m.

MAY

- 16 Wednesday—AFROTC Day
- 30 Wednesday—Memorial Day, Holiday

JUNE

- 1 Friday—Pre-Examination Study Day
- 2-8 Saturday to Friday, inclusive—Spring Semester Examinations
- 3 Sunday—Baccalaureate Exercises
- 9 Saturday—Commencement Exercises

SUMMER SESSION 1962

JUNE 1962

- 25 Monday—Summer Session Registration
- 26 Tuesday—Summer Session Begins
- 30 Saturday—Classes as Usual

JULY

- 4 Wednesday—Independence Day, Holiday

AUGUST

- 3 Friday—Summer Session Ends

SHORT COURSES 1962

JUNE 1962

- 18-23 Monday to Saturday—Rural Women's Short Course

AUGUST

- 6-11 Monday to Saturday—4-H Club Week.

SEPTEMBER

- 4-7 Tuesday to Friday—Firemen's Short Course

FALL SEMESTER 1962

SEPTEMBER

- 17-21 Monday to Friday—Fall Semester Registration
- 24 Monday—Instruction Begins

NOVEMBER

- 21 Wednesday—Thanksgiving Recess Begins After Last Class
- 26 Monday—Thanksgiving Recess Ends 8 a.m.

DECEMBER

- 21 Friday—Christmas Recess Begins After Last Class

JANUARY 1963

- 3 Thursday—Christmas Recess Ends 8 a.m.
- 23 Wednesday—Pre-Examination Study Day
- 24-30 Thursday to Wednesday—Fall Semester Examinations

SPRING SEMESTER 1963

FEBRUARY

- 4-8 Monday to Friday—Registration
- 11 Monday—Instruction Begins
- 22 Friday—Washington's Birthday, Holiday

MARCH

- 25 Monday—Maryland Day (Not a Holiday)

APRIL

- 11 Thursday—Easter Recess Begins After Last Class
- 16 Tuesday—Easter Recess Ends 8 a.m.

MAY

- 15 Wednesday—AFROTC Day
- 30 Thursday—Memorial Day, Holiday
- 31 Friday—Pre-Examination Study Day

JUNE

- 1-7 Saturday to Friday—Spring Semester Examinations
- 2 Sunday—Baccalaureate Exercises
- 8 Saturday—Commencement Exercises

SUMMER SESSION 1963

JUNE 1963

- 24 Monday—Summer Session Registration
- 25 Tuesday—Instruction Begins
- 29 Saturday—Classes as Usual

JULY

- 4 Thursday—Independence Day, Holiday

AUGUST

- 2 Friday—Summer Session Ends

SHORT COURSES 1963

JUNE

- 17-22 Monday to Saturday—Rural Women's Short Course

AUGUST

- 5-10 Monday to Saturday—4-H Club Week

SEPTEMBER

- 3-6 Tuesday to Friday—Firemen's Short Course

The pamphlet "Important Dates" providing information about dates when application for admission to candidacy, for diploma, for Language Examination etc., must be filed, are available in the Office of the Graduate School. It will be issued annually.

BOARD OF REGENTS
and
MARYLAND STATE BOARD OF AGRICULTURE

	<i>Term Expires</i>
CHARLES P. McCORMICK <i>Chairman</i>	1966
McCormick and Company, 414 Light Street, Baltimore 2	
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Denton	
LOUIS L. KAPLAN <i>Assistant Secretary</i>	1964
5800 Park Heights Avenue, Baltimore 15	
C. E. TUTTLE <i>Assistant Treasurer</i>	1962
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Commercial Credit Building, Baltimore	
THOMAS W. PANGBORN	1965
The Pangborn Corporation, Pangborn Blvd., Hagerstown	
THOMAS B. SYMONS	1963
Suburban Trust Company, 6950 Carroll Avenue, Takoma Park	
WILLIAM C. WALSH	1968
Liberty Trust Building, Cumberland	
MRS. JOHN L. WHITEHURST	1967
4101 Greenway, Baltimore 18	

Members of the Board are appointed by the Governor of the State for terms of seven years each, beginning the first Monday in June. Members may serve only two consecutive terms.

The President of the University of Maryland is, by law, Executive Officer of the Board.

The State law provides that the Board of Regents of the University of Maryland shall constitute the Maryland State Board of Agriculture.

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B.A., University of Texas, 1932; M.A., 1932; B.LITT., Oxford University, 1936; D. PHIL., 1936.

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B.S., University of Maryland, 1938; M.S., 1939; PH.D., 1948.

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B.S., California State College, Pa., 1934; M.A., Ohio State University, 1936; PH.D., 1942.

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B.A., Illinois College, 1933; LL.B., Cornell University, 1936.

FRANK L. BENTZ, JR., *Assistant, President's Office*

B.S., University of Maryland, 1942; PH.D., 1952.

Emeriti

HARRY C. BYRD, *President Emeritus*

B.S., University of Maryland, 1908; LL.D., Washington College, 1936; LL.D., Dickinson College, 1938; D.S.C., Western Maryland College, 1938.

J. FREEMAN PYLE, *Dean of the College of Business and Public Administration Emeritus*

PH.B., University of Chicago, 1917; M.A., 1918; PH.D., 1925.

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B.A., Tulane University, 1921; M.A., University of Maryland, 1924.

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D.D.S., University of Maryland, 1922.

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B.S., University of Minnesota, 1930; M.A., 1936; PH.D., University of Colorado, 1942.

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B.S., University of Connecticut, 1924; M.S., University of Vermont, 1926; PH.D., Columbia University, 1931.

GORDON M. CAIRNS, *Dean of Agriculture*

B.S., Cornell University, 1936; M.S., 1938; PH.D., 1940.

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B.A., Wabash College, 1929; M.A., Butler University, 1930; PH.D., Syracuse University, 1937.

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PH.C., South Dakota State College, 1929; B.S., 1929; M.S., University of Maryland, 1932; PH.D., 1933.

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B.A., Randolph-Macon College, 1928; M.A., 1937; PH.D., Peabody College, 1939.

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B.S., Catholic University of America, 1937; M.S., University of Pennsylvania, 1940; ED.D., University of Maryland, 1952.

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R.N., Mills School of Nursing, Bellevue Hospital, New York, 1938; B.S., University of Denver, 1942; M.B.A., in Hospital Administration, University of Chicago, 1943.

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B.S., University of Idaho, 1928; M.S., State College of Washington, 1930; PH.D., University of Maryland, 1933.

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B.A., Johns Hopkins University, 1914; PH.D., 1917; LL.B., University of Maryland, 1917.

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A.B., Huron College, 1933; M.A., University of Chicago, 1939; D.S.W., Western Reserve University, 1954.

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B.S., Arkansas State Teachers College, 1938; M.S., University of Tennessee, 1945; PH.D., Pennsylvania State University, 1953.

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B.S., University of Illinois, 1922; M.S., 1926; C.E., 1932; PH.D., 1935.

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B.S., University of California, 1928; M.S., University of Maryland, 1931; M.P.A., Harvard University, 1948; D.P.A., 1951.

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B.S., University of Iowa, 1923; M.A., American University, 1933.

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B.A., Emory University, 1919; M.A., University of Chicago, 1928; PH.D., 1930; Diplome de l'Institut de Touraine, 1932.

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B.S., University of Idaho, 1924; M.S., 1925; M.D., University of Louisville, 1929; PH.D., (HON.), University of Louisville, 1946.

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B.A., University of Maryland, 1930; M.S., 1931.

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B.S., Northwestern University, 1921; M.A., 1923; PH.D., Cornell University, 1929.
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B.S., University of Maryland, 1923; M.S., 1924; PH.D., 1926.

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The Graduate School

THE GRADUATE SCHOOL WAS ESTABLISHED IN ITS PRESENT form in 1918 under the jurisdiction of the Graduate Council with the Dean of the Graduate School serving as Chairman. It was created for the purpose of administering and developing programs of advanced study and research for graduate students in all branches of the University. Prior to the present organization some advanced degrees were awarded but they were under the jurisdiction of the individual departments subject to the supervision of the general faculty. Despite the large expansion of graduate programs into new areas as the University has grown, the spirit of each program is essentially that of individual study under competent supervision. The Graduate School is not an extension of the undergraduate program but was created rather for the preparation of those who in the future will carry on the spirit of individual inquiry. Thus it promotes and provides an atmosphere of research and scholarship for both the students and the faculty; in particular, it stimulates that harmonious relationship between the two which results in the advancement of learning. At the present time over fifty departments are authorized to offer graduate programs to one or more of the advanced degrees awarded by the University.

General Information

The Graduate Council consists of ex-officio, elected and appointed members of the Graduate Faculty and is charged with the formulation of the overall policies of the Graduate School. It meets regularly in March, June and November to consider all matters relating to graduate work brought to its attention by the University Administration, the Graduate Faculty and the Dean of the Graduate School. It may also be called for special meetings throughout the year if urgent business must be transacted.

The Graduate Faculty consists of regular and associate members chosen in accordance with the Plan of Organization of the Graduate Faculty and is listed in the back of this catalog. The direction of individual programs and theses is primarily assigned to the regular members of the Graduate Faculty.

The Graduate Faculty Assembly consists of the regular members of the Graduate Faculty and meets once each year. Special meetings may be called by the Dean of the Graduate School if necessary. In accordance with the University Faculty Organization Plan, it has authority over the educational policy of the Graduate School, may review actions taken by the Graduate Council and serves as a referendum body on questions referred to it by the Graduate Council.

The Dean of the Graduate School serves as chairman and executive officer of both the Graduate Council and the Graduate Faculty Assembly.

The following standing committees are appointed by the Dean of the Graduate School: The Committee on Publications, Committee on Language Requirements, Committee on Graduate Programs and Standards for Graduate Work, Committee on Fellowships and Student Welfare, Committee on Research, Committee on Procedures, Committee on the Graduate Faculty, and the Committee on Elections. They report annually to the Graduate Council and reports may be requested by the Dean of the Graduate School or by the Graduate Faculty Assembly.

LOCATION

The office of the Graduate School is located in the Business and Public Administration Building, Rooms 112-115, on the College Park campus. This campus is located in Prince Georges County on a large tract of rolling wooded land less than eight miles from Washington, D. C. and approximately thirty-two miles from Baltimore and is served by excellent transportation.

The Baltimore campus of the University is located at the corner of Lombard and Greene Streets, and on this campus the various departments in the Schools of Medicine, Dentistry, Pharmacy and Nursing offer their graduate programs.

LIBRARIES

The libraries of the University are located on both the College Park and Baltimore campuses. They consist of the general University Library and the many college and departmental libraries which house special collections. Because of the location of the University the large libraries of Baltimore

and Washington are a valuable asset to graduate work. Arrangements can be made for personal work in the Enoch Pratt Library of Baltimore, the Library of Congress, the United States Department of Agriculture Library and the many fine collections of other government agencies in Washington.

GENERAL INFORMATION

Detailed information concerning the American Civilization Program, fees and expenses, scholarships and awards, student life, and other material of a general nature, may be found in the University publication titled *An Adventure in Learning*. This publication may be obtained on request from the Office of University Relations, North Administration Building, University of Maryland at College Park. A detailed explanation of the regulations of student and academic life may be found in the University publication titled, *University General and Academic Regulations*. This is mailed in September and February of each year to all new undergraduate students.

Requests for course catalogs for the individual schools and colleges should be directed to the deans of these respective units, addressed to:

COLLEGES LOCATED AT COLLEGE PARK:

Dean
(College in which you are interested)
The University of Maryland
College Park, Maryland

PROFESSIONAL SCHOOLS LOCATED AT BALTIMORE:

Dean
(School in which you are interested)
The University of Maryland
Lombard and Greene Streets
Baltimore 1, Maryland

Academic Information

ADMISSION

An applicant for admission to the Graduate School must hold a bachelor's or a master's degree from a college or university of recognized standing. The applicant shall furnish an official transcript of his collegiate

Academic Information

record which for unconditional admission must show creditable completion of an adequate amount of undergraduate preparation of high quality for graduate work in his chosen field. Application for admission to the Graduate School should be made not later than September 1 for the fall term and not later than January 1 for the spring term on blanks obtained from the office of the Dean. Admission to the summer session is governed by the date listed in the Summer School Catalog, which is generally soon after June 1.

After approval of the application a matriculation card, signed by the Dean, is issued to the student. This card permits him to register in the Graduate School. It is his certificate of membership in the Graduate School and should be retained by the student to present at each succeeding registration.

If the student admitted is not enrolled upon the passing of the third registration, the matriculation card becomes invalid and a new application will have to be filed if the student wishes to pursue a graduate program.

At the time of the first registration, an Identification Card will be issued to all full-time graduate students.

Admission to the Graduate School does not necessarily imply admission to candidacy for an advanced degree.

REGISTRATION

All students pursuing graduate work in the University, even though they are not candidates for higher degrees, are required to register in the Graduate School at the beginning of each session. *Graduate credit will not be given unless the student matriculates and registers in the Graduate School.* This applies especially to those students who register through University College at locations away from the campus.

The program of work for each session is arranged by the student with the major department and entered upon two course cards which are signed first by the professor in charge of the student's major subject and then by the Dean of the Graduate School. One card is retained by the Dean. The student takes the other card, and his matriculation card, to the Registrar's Office, where the registration is completed. Students will not be admitted to graduate courses until the Registrar has certified to the instructor that registration has been completed. Registration forms are obtained at the Registrar's Office.

A time schedule, supplementing this catalog, is issued shortly before the beginning of each semester, showing the hours and location of class meetings. This schedule is available at the Office of the Registrar.

GRADUATE COURSES

Graduate students must elect for credit in partial fulfillment of the requirements for higher degrees only courses designated *For Graduates* or *For Graduates and Advanced Undergraduates*. Students who are inadequately

prepared for graduate work in their chosen fields or who lack prerequisites for minor courses may elect a limited number of courses numbered from 1 to 99 in the general catalog, but graduate credit will not be allowed for these courses. Courses that are audited are registered for in the same way as other courses, and the fees are the same.

PROGRAM OF WORK

The professor who is selected to direct a student's thesis work is the student's adviser in the formulation of a graduate program, including suitable minor work, which is arranged in cooperation with the instructors. To encourage thoroughness in scholarship through intensive application, graduate students in the regular sessions are limited to a program of fifteen credit hours per semester. If a student is preparing a thesis during the minimum residence for the master's degree, the registration in graduate courses should not exceed twelve hours for the semester since registration in research is required.

SUMMER SESSION

The University conducts a six-week summer session at College Park, with a comprehensive undergraduate and graduate program. The University publishes a separate bulletin giving full information on this summer session. This bulletin is available upon application to the Director of the Summer School, University of Maryland, College Park.

GRADUATE WORK IN PROFESSIONAL SCHOOLS AT BALTIMORE

Graduate courses and opportunities for research are offered in the professional schools at Baltimore. Students pursuing graduate work in the professional schools must register in the Graduate School and meet the same requirements and proceed in the same way as do other graduate students in the other departments of the University.

OAK RIDGE INSTITUTE

The University is one of the sponsoring institutions of the Oak Ridge Institute of Nuclear Studies located at Oak Ridge, Tennessee. One of the features of this affiliation is the opportunity, in the appropriate fields, for graduate students to do their research problems and prepare their theses under a cooperative arrangement. Such opportunity is limited to those who have completed their course work on the campus, are working in a field where facilities are available, and generally are candidates for the doctoral degree. Successful applicants will receive Oak Ridge Graduate Fellowships with varying stipends depending upon their marital status and dependents. Detailed information can be obtained from the Graduate School office or from Dr. Ronald Bamford, Dean of the Graduate School, Councilor for the University.

FOREIGN STUDENTS

Graduate students from foreign countries where English is not the native tongue should be adequately prepared to read and write in this language. Admission to graduate study implies that the student is aware of this requirement and is prepared to fully participate in the course of study and research work that is assigned. A foreign student adviser is available to all graduate students from other countries to discuss matters of immigration.

Since the admission and stay of foreign students are in part dependent on regulations issued by the United States Immigration and Naturalization Service, it is advisable for all graduate students who have been admitted to the Graduate School to consult the foreign student adviser in regard to their immigration status. Students wishing to come to the United States with a student visa must secure an Immigration I-20 Form from the Foreign Student Adviser in order to secure the proper visa from the American consul. Students with student visas already studying in the United States who wish to transfer to the University of Maryland must also secure an I-20 Form from the Foreign Student Adviser in order to request the Immigration and Naturalization Service to grant permission for the transfer.

Every foreign student is expected to see the foreign student adviser as soon as possible after arriving at the University. The adviser will be able to assist not only with various problems regarding immigration, housing, fees, etc., but also with more general problems of orientation to life in the University and the community.

GRADUATE WORK BY SENIORS IN THIS UNIVERSITY

A senior of this University who has nearly completed the requirements for the undergraduate degree may, with the approval of his undergraduate dean, the head of the department concerned, and the Dean of the Graduate School, register in the undergraduate college for graduate courses, which may later be transferred for graduate credit toward an advanced degree at this University, but the student must be within seven credit hours of completing his undergraduate work and the total of undergraduate and graduate courses must not exceed fifteen credits for the semester. Excess credits in the senior year cannot later be used for graduate credit unless such prearrangement is made. Seniors who wish to register for graduate credit should apply to the Dean of the Graduate School for information about procedure.

ADMISSION TO CANDIDACY FOR ADVANCED DEGREES

Application for admission to candidacy for the master's and for the doctor's degree is made on application blanks which are obtained at the office of the Dean of the Graduate School. These are filled out in duplicate by the student and submitted to his major department for further action and transmission to the Dean of the Graduate School. All applications for admission to candidacy must be approved by the Graduate Council.

Admission to candidacy in no case assures the student of a degree, but merely signifies he has met all the formal requirements and is considered by his instructors sufficiently prepared and able to pursue such graduate study and research as are demanded by the requirements of the degree sought. The candidate must show superior scholarship in graduate work already completed.

Application for admission to candidacy is made at the time stated in the sections dealing with the requirements for the degree sought.

REQUIREMENTS FOR THE DEGREES OF MASTER OF ARTS AND MASTER OF SCIENCE

ADVANCEMENT TO CANDIDACY. Each prospective candidate for the master's degree is required to make application for admission to candidacy not later than the date on the calendar for the semester in which the degree is sought. (See Graduate School Supplement to the General Calendar in the front of this Catalog.) He must have completed at least twelve semester hours of graduate work at the University of Maryland. An average grade of "B" in all major and minor subjects is the minimum requirement. Courses completed with a "D" or "F" in the major and minor must be repeated.

MINIMUM RESIDENCE. A residence of at least two semesters, or equivalent, at this institution, is required.

COURSE REQUIREMENTS. A minimum of twenty-four semester hours, exclusive of thesis and registration for research, with a minimum average grade of "B" in courses approved for graduate credit, is required for the degrees of Master of Arts and Master of Science. The student is also required to register for six semester hours for research and thesis work. The total number of credit hours required for the degree is thirty. If the student is inadequately prepared for the required graduate courses, either in the major or minor subjects, additional courses may be required to supplement the undergraduate work. Of the twenty-four hours required in graduate courses, not less than twelve and not more than sixteen semester hours must be earned in the major subject. The remaining credits must be outside the major subject and must comprise a group of coherent courses intended to supplement and support the major work. Not less than one-half of the total required course credits for the degree, or a minimum of twelve, must be selected from courses numbered 200 or above. No credit for the degree of Master of Arts or Master of Science may be obtained for correspondence courses or those taken by examination. The entire course of study must constitute a unified program approved by the student's major adviser and by the Dean of the Graduate School. All requirements for the degree must be completed within an eight-year period.

TRANSFER OF CREDIT. Credit not to exceed six semester hours for course work at other recognized institutions may be applied towards the master's degree only when such course work has been taken after the student has been admitted to the University of Maryland Graduate School. Before taking

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course work for transfer, the student must have the approval of his adviser and the head of the department in his major field. Normally, approval may be given only for courses which are not offered by the University of Maryland during the period of the student's attendance. The request for transfer of credit shall be submitted to the Graduate Council for approval when the student applies for admission to candidacy. The candidate is subject to final examination by this institution in all work offered for the degree.

If a graduate student working for an advanced degree at another institution wishes to take courses at the University of Maryland, his application for admission must be accompanied by a letter from the graduate dean of his institution stating that credit for such courses is acceptable toward his degree.

THESIS. In addition to the twenty-four semester hours in graduate courses, a satisfactory thesis is required of all candidates for the degrees of Master of Arts and Master of Science. (Exceptions may be made in the cases of candidates for the degree of Master of Arts in American civilization. See pages 9-10). The thesis must demonstrate the student's ability to do independent work and it must be acceptable in literary style and composition. With the approval of the student's major professor and the Dean of the Graduate School, the thesis in certain cases may be prepared *in absentia* under direction and supervision of a member of the faculty of this institution.

The original copy of the thesis must be deposited in the office of the Graduate School not later than the date specified in the calendar in the front of this catalog. The date published is the deadline for the acceptance of theses but they may be deposited earlier. The thesis should not be bound by the student, as the University later binds all theses uniformly. An abstract of the contents of the thesis, not to exceed 250 words in length, must accompany it. A manual giving full directions for the physical make-up of the thesis should be consulted by the student before the typing of the manuscript is begun. Students may obtain copies of this manual from the Students' Supply Store at nominal cost.

FINAL EXAMINATION. The final oral examination is conducted by a committee appointed by the Dean of the Graduate School. The student's adviser acts as the chairman of the committee. The other members of the committee are persons under whom the student has taken most of his major and minor courses. The chairman and the candidate are notified of the personnel of the examining committee at least one week prior to the period set for oral examinations unless an emergency arises. The chairman of the committee selects the exact time and place for the examination and notifies the other members of the committee and the candidate. The examination is normally conducted at the end of the semester, but upon recommendation of the student's adviser, an examining committee may be appointed by the Dean of the Graduate School at any time when all other requirements for the degree have been completed. A report of the committee is sent to the Dean as soon as possible after the examination. A special form for this purpose is supplied to the chairman of the committee and the approval must be unanimous.

Such report is the basis upon which recommendation is made to the faculty that the candidate be granted the degree sought. The period for the oral examination is usually about one hour, but the time should be long enough to insure an adequate examination.

The examining committee also approves the thesis, and it is the candidate's obligation to see that each member of the committee has ample opportunity to examine a copy of the thesis prior to the date of the examination.

A student will not be admitted to final examination until all other requirements for the degree have been met. In addition to the oral examination a comprehensive written examination may be required at the option of the major department.

REQUIREMENTS FOR THE DEGREES IN AMERICAN CIVILIZATION

Studies in the American Civilization Program are intended to prepare the candidate for teaching and research in American culture. The program is particularly designed for the teacher or student whose intellectual interest is not limited to a single academic department. For instance, the historian who likes literature, the literary critic who wishes to study the social background of literature, the political scientist who wishes to know more about the history of this country, and the sociologist who wants to study the roots of sociology in America, all may find the American Civilization Program the proper one for them. The four cooperating departments of English, History, Government and Politics, and Sociology offer the basic work in the program, and the student will stress the work of one of those departments when he determines his course of graduate studies. All students, however, will be expected to understand the development of American institutions and to show some proficiency in the literary, social, economic, and political history of the United States.

The study of American civilization brings in many different fields, so a student has an unusually wide opportunity to plan a program suited to his individual need. To help him do this, a committee representing the departments whose American fields he intends to study is set up shortly after he registers. The chairman of the committee is from the department of the student's greatest interest and acts as his adviser. The committee also prepares and reads the student's comprehensive examination and reads the thesis if one is submitted.

The candidate for a degree must pass a final written examination testing his understanding of American civilization in terms of his individual program of studies.

MASTER OF ARTS. With the approval of his advisers and committee, a candidate for the Master of Arts degree with a major in American civilization may elect in lieu of the thesis six additional hours of course work, to include at least two substantial seminar papers. The total number of credit hours required for the degree would then be thirty semester hours.

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Each candidate must present credits for at least *fifteen semester hours* of work in *two of the four cooperating departments*, and credits for at least fifteen semester hours in supporting courses (nine hours if a thesis is elected). Supporting courses will normally be in such fields as European or Latin-American history. English literature, comparative literature, philosophy, art, education, sociology, economics, and government and politics.

Each candidate must demonstrate in a written examination that he possesses a reading knowledge of one foreign language.

All other requirements are the same as for the degrees of Master of Arts and Master of Science in other fields.

DOCTOR OF PHILOSOPHY. The American Civilization Program cuts across several fields; therefore, a faculty committee representing the departments in which the student plans to study will be appointed shortly after the student registers. The chairman of the committee is from the department of the student's major interest and acts as his adviser. The committee is responsible for helping the student to integrate his program. Working through the student's adviser the committee aids in planning the student's over-all program, prepares and grades any comprehensive examinations, and reads the dissertation.

The general requirements for the degree of Doctor of Philosophy in American civilization are the same as those for the doctoral degree in other fields.

REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

The Master of Education degree is designed to increase competency in applied areas within the general field of education. Thirty semester hours of course work are required. Of the thirty hours, one-half must be in courses numbered 200 and above, and one-half must be in education. Subject to the foregoing limitations, courses in departments other than education may be selected by the student and his adviser.

In connection with course work there are required two semester papers, the nature and form of which are prescribed in a Statement of Policy issued by the Department of Education.

The procedure for advancement to candidacy and the transfer of credits is the same as for the degrees of Master of Arts and Master of Science. The nature of the comprehensive examination, and other matters pertaining to degree requirements, are described elsewhere in these announcements and in the Statement of Policy referred to above.

REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION

The Master of Business Administration program is designed primarily to train students for positions of responsibility in business and government.

The aim is to develop technical competence plus a thorough knowledge and appreciation of the art of management. The study of administrative policies and practices encourages interest and realistic thinking in management problems and responsibilities.

The program leading to the degree of Master of Business Administration includes advanced study of business organization and administration in the fields of accounting and statistics, finance, general business, industrial management, insurance and real estate, marketing, personnel relations, public utilities and transportation.

Those students whose major undergraduate work has been in arts, agriculture, science, education, or engineering subjects are required to complete certain basic core course requirements in business and economics before undertaking specialized graduate work for the degree of Master of Business Administration. The core course requirements are listed below.

Principles of Economics . . .6 hours	Marketing Management3 hours
Principles of Accounting 6 or 8 hours	Personnel Management3 hours
Statistics3 hours	Money and Banking 3 hours
Business Law3 or 4 hours	

The other requirements for the degree are the same as for the degrees of Master of Arts and Master of Science.

REQUIREMENTS FOR THE DEGREE OF MASTER OF MUSIC

Three areas of specialization are provided in the Master of Music program to allow the student to pursue advanced work in the area for which his experience and interest have best prepared him. (1) Specialization in the history and literature of music leads to a study of musical styles and literatures and of the methods and materials of systematic musicology. Each candidate must demonstrate that he possesses a reading knowledge of one foreign language. A thesis is required in which mastery of musicological method must be shown. (2) Specialization in theory and composition leads to advanced work in analysis and the use of musical materials. A thesis of an analytical nature will normally be required. Students with the necessary creative ability may be allowed to present a thesis which consists of an original composition of major proportions. (3) Specialization in performance leads to advanced work in the history, literature, and theory of music, and will combine seminars in the literature of a particular instrument with advanced instruction in that literature. In this approach the final project will consist of a seminar paper of an analytical nature and a graduate-level recital containing the works covered in the paper.

At least nine semester hours of the thirty required for the degree will normally be in a field of music outside the area of specialization (music theory in the case of the history-literature concentration, for example), and will constitute the minor area. In exceptional cases a student may take minor courses (no more than nine hours) in a field outside music. History, Philosophy, Music Education, American or English Literature, and Foreign Languages are among the recommended minor fields.

All other requirements are the same as for the degree of Master of Arts.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SOCIAL WORK

The School of Social Work offers work leading to the degree of Master of Social Work with a concentration in social casework. Concurrent field instruction is provided in cooperative arrangement with affiliated social agencies throughout Maryland.

Two academic years of full-time study are required for completion of the School's requirements, except that a limited number of part-time students are permitted to enroll for designated courses.

A comprehensive examination is given late in the semester in which the student completes requirements for the degree.

Additional details may be obtained by addressing a request to: The School of Social Work, University of Maryland, 721 West Redwood Street, Baltimore 1, Maryland.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

ADVANCEMENT TO CANDIDACY. Candidates for the doctor's degree must be admitted to candidacy at least one academic year prior to the conferring of degrees. Applications for admission to candidacy for the doctor's degree are made in duplicate by the student and submitted to his major department for further action and transmission to the Dean of the Graduate School. Blanks may be obtained at the office of the Graduate School.

Before admission to candidacy the applicant must have demonstrated to the Head of the Foreign Language Department that he possesses a reading knowledge of at least two foreign languages from the list approved by his major department and the Graduate Council, one of which must be either French or German. Preliminary examinations or such other substantial tests as the departments may elect are also required for admission to candidacy.

The student must complete all of his program for the degree, including the theses and final examination, during a four-year period after admission to candidacy. Failure to do so requires another application for admission to candidacy with the usual preliminary examination unless the Graduate Council rules otherwise.

RESIDENCE. The equivalent of three years of full-time graduate study and research is the minimum required. Of the three years the equivalent of at least one year must be spent in residence at the University. On a part-time basis the time needed will be correspondingly increased. All work at other institutions offered in partial fulfillment of the requirements for the Doctor of Philosophy degree is submitted to the Graduate Council for approval, upon recommendation of the department concerned, when the student applies for admission to candidacy for the degree.

The doctor's degree is not given merely as a certificate of residence and work, but is granted only upon sufficient evidence of high attainments in

scholarship, and ability to carry on independent research in the special field in which the major work is done.

MAJOR AND MINOR SUBJECTS. The candidate must select a major and one or two closely related minor subjects. At least twenty-four semester hours of course work, exclusive of research, are required in the minor. Of the twenty-four semester hours at least eight hours must be at the 200-level unless special permission is granted beforehand. If two areas are chosen for the minor requirement not less than nine semester credit hours may be presented in either area. The remainder of the required residence is devoted to intensive study and research in the major field. The amount of required course work in the major subject will vary with the department and the individual candidate. The candidate must register for a minimum of twelve semester hours of research.

THESIS. The ability to do independent research must be shown by a dissertation on some topic connected with the major subject. An original type-written copy and one clear, plain carbon copy of the thesis, together with an abstract of the contents, not to exceed 600 words in length, must be deposited in the office of the Dean not later than the date specified in the calendar in the front of this catalog. The date published is the deadline for the acceptance of theses but they may be deposited earlier. It is the responsibility of the student also to provide copies of the thesis for the use of the members of the examining committee prior to the date of the final examination.

The original copy should not be bound by the student, as the University later binds uniformly all theses for the general University Library. The carbon copies are bound by the student in cardboard covers which may be obtained at the Students' Supply Store. The abstracts are published by University Microfilms.

A manual giving full directions for the physical make-up of the thesis should be consulted by the student before typing of the thesis is begun. Students may obtain copies of this manual at the Students' Supply Store.

FINAL EXAMINATION. The final oral examination is held before a committee appointed by the Dean. One member of this committee is a representative of the graduate faculty who is not directly concerned with the student's graduate work. One or more members of the committee may be persons from other institutions who are distinguished scholars in the student's major field.

The duration of the examination is approximately three hours, and covers the research work of the candidate as embodied in his thesis, and his attainments in the fields of his major and minor subjects. The other detailed procedures are the same as those stated for the master's examination.

RULES GOVERNING LANGUAGE EXAMINATIONS FOR CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

1. A candidate for the doctor's degree must show in a written examination that he possesses a reading knowledge of at least two foreign languages

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from the list approved by his major department and the Graduate Council, one of which must be either French or German. *The passages to be translated will be taken from books and journals approved by the student's major department. The Foreign Language Department will select material amounting to approximately 500 words from the literature submitted and present to the students in each field a common examination in mimeographed form.* The examination aims to test ability to use the foreign language so that the student may be able to read some of the original basic literature in the field. It is presumed that the candidate will know sufficient grammar to distinguish inflectional forms and that he will be able to translate in two hours 500 words with the aid of a dictionary.

2. *Students planning to take the examination must register personally in the office of the Department of Foreign Languages at least three weeks in advance of the test.*

3. Examinations are held in the office of the Department of Foreign Languages in October, February and June. The specific days when these examinations are found in "Important Dates" published annually and available in the Office of the Graduate School.

4. There is no limitation on the number of times the examination may be taken, but a \$5.00 fee will be charged for the second and subsequent examinations.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF EDUCATION

The Doctor of Education degree is offered for students who hold or expect to hold teaching or administrative positions in education and who desire to develop exceptional competence in special areas. The ability to explore and solve practical educational problems is emphasized. The requirements are the same as for the degree of Doctor of Philosophy except as specified below.

FOREIGN LANGUAGES. When the program of study and research does not involve the use of foreign languages the requirement may be waived by the Department of Education.

MAJOR AND MINOR SUBJECTS. The candidate must select one major area and one minor area in which he expects to develop exceptional competence. The minor may be a single area or may consist of a group of related areas selected to broaden the candidate's understanding of education. In addition to the major and minor, other areas if desired may be included in the program also. The amount of course work required in the major, minor, and related areas will vary according to the needs of each individual candidate.

PROJECT. Instead of completing a thesis as required for a candidate for the degree of Doctor of Philosophy, a candidate for this degree must demonstrate exceptional competence to work through field problems by completing a project in the major area. A Committee on Doctoral Research is appointed for each candidate. The committee is composed of three members

at least two of whom are from the faculty of the College of Education. The committee passes upon the student's plans for research. The specialist in the student's major area serves as sponsor and provides detailed guidance for the project.

The regulations governing submission and form of copies of the project are the same as for theses submitted for the degree of Doctor of Philosophy.

WRITTEN EXAMINATIONS. Written examinations for the degree of Doctor of Education parallel those for the degree of Doctor of Philosophy in education.

FINAL ORAL EXAMINATION. The final examination covers the project and its relationship to the general field in which it lies and the candidate's attainments in related areas.

GRADUATE FEES

The fees paid by graduate students are as follows:

Matriculation fee of \$10.00. This is paid once only, upon first registration in the Graduate School.

Graduation fee for master's degree. \$10.00.

Graduation fee for doctor's degree including a hood, microfilming and binding of thesis, \$50.00.

Tuition fee. A fixed charge, each semester, of \$12.00 per semester credit hour for students carrying ten hours or less; for students carrying more than ten hours, \$120.00 for the semester.

Foreign Language Examination (first examination without charge), \$5.00.

Testing fee for education majors, \$5.00.

Laboratory fees, where charged, range from \$1.00 to \$20.00 per course per semester.

Infirmary fee, \$5.00 (College Park only). All full-time students are charged the fee of \$5.00 for the academic year at the time of registration for the fall semester. Heads of departments will designate status of graduate students.

There is a \$3.00 fine for violation of the University parking regulations. All graduate students are expected to abide by these regulations, regardless of full-time or part-time attendance. The failure to register for a parking permit entails a \$5.00 fee.

LIVING EXPENSES AND SELF-HELP. The University in no way assumes responsibility for the housing of graduate students.

Board and lodging are available in many private homes in College Park and Baltimore. The cost of board and room varies from about \$105.00 to \$140.00 a month, depending upon the desires of the individual. For College

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Park only, a list of accommodations is maintained by the housing bureau in the Office of the Dean of Men.

Application for student employment, aside from fellowships and assistantships, may be made through the Offices of the Dean of Men and the Dean of Women, or to department heads.

FELLOWSHIPS AND ASSISTANTSHIPS

FELLOWSHIPS. A number of fellowships have been established by the University. The stipend for the University fellows is \$800.00 for nine months and the remission of all graduate fees except the graduation fee. Several industrial and special fellowships, with varying stipends, are also available in certain departments.

University Fellows are permitted to carry a full graduate program, and they may satisfy the residence requirement for higher degrees in the normal time.

Applications for fellowships are made on blanks which may be obtained from the office of the Graduate School. The application, with the necessary credentials, is sent by the applicant directly to the Dean of the Graduate School.

Applications are forwarded by the Dean to the Departments for their consideration and recommendation. The awards of University fellowship are on a competitive basis.

GRADUATE ASSISTANTSHIPS. A number of teaching and research assistantships are available in several departments. The compensation is at a rate of \$180.00 per month unless otherwise specified and varies with the nature and amount of service required and with the terms of appointment. The amount of credit allowed toward a degree is normally a maximum of ten credit hours in a regular semester. The research assistants usually participate in research that meets the requirements for a master's or a doctor's degree.

Applications for graduate assistantships are made directly to the departments concerned and appointments are made through the regular channels for staff appointments. Further information regarding these assistantships may be obtained from the departments concerned.

RESIDENCE COUNSELING GRADUATE ASSISTANTSHIPS A limited number of assistantships are available to graduate men students to act as supervisors in undergraduate residence halls. To qualify, persons must receive full status in the Graduate School, must have outstanding leadership qualities and must be single. Remuneration for all residence assistantships is \$2,000 per academic year, and remission of Graduate School fees. Further information about these assistantships may be obtained from the office of the Director of Housing.

Similar residence assistantships are available for graduate women students contingent upon acceptance to the Graduate School. They should offer evidence of leadership ability and interest in working with people. Graduate assistants live in the residence halls with students and serve as counselors and group advisors under the supervision of the director of residence and

the student personnel staff. Remuneration for the assistantship is \$2,000 per academic year and remission of Graduate School fees. Board and room must be paid by the student. A limited number of graduate workshops are available in the women's residence halls for graduates who are interested in personnel work but do not wish a full-time assistantship. Holders of workshops assist the house director at the reception desk a total of 140 hours a semester for which they receive \$120.00 a semester toward a single room (the full rate for Maryland residents). For further information about these assistantships and workshops women applicants should write to the Office of the Dean of Women.

GRADUATE PRIZE OF THE COLLEGE PARK BRANCH OF AAUW

A Graduate Prize of \$100.00 will be awarded annually by the College Park Branch of the American Association of University Women to an outstanding woman student, admitted to candidacy for an advanced degree at the University of Maryland. The selection will be made by the Scholarship Committee of the Branch from candidates recommended by departments and the Graduate School.

STUDENT LOAN FUNDS

National Defense Education Act Loan Funds are available to graduate students of the University of Maryland up to \$1000 per year. Such applications should be directed to Mr. H. Palmer Hopkins, Director, Office of Student Aid, North Administration Building, University of Maryland at College Park, Maryland.

A Student Loan Fund is maintained by the College Park Branch of the American Association of University Women. It is administered through the Office of the Dean of Women, and is available to deserving women who are junior, senior or graduate students at the University of Maryland.

Likewise the Sigma Chapter of Phi Delta Gamma Fraternity for Graduate Women provides loans to graduate women of the University of Maryland.

For further information contact the office of the Graduate School.

COMMENCEMENT

Attendance is required at the June commencement if the degree is conferred at that time.

Application for diploma must be filed in the Office of the Registrar eight weeks before the date at which the candidate expects to obtain a degree except during the summer session.

Academic costume is required of all candidates at the June commencement. Those who so desire may purchase or rent caps and gowns at the Students' Supply Store. Orders must be filed eight weeks before the date of convocation but may be cancelled later if the student finds himself unable to complete his work for the degree.

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METHOD OF NUMBERING COURSES AND COUNTING CREDIT HOURS

Courses for Advanced Undergraduates and Graduates are numbered 100 to 199; courses for Graduates only are numbered 200 and upward.

A course with a single number extends through one semester.

A course with a double number extends through two semesters.

The number of semester hour credits is shown by the arabic numerals in parentheses after the title of the course. Examples:

Course 101. Title (3).

First semester.

If a laboratory course:

Course 101. Title (3).

One lecture and two laboratory periods a week, first semester.

(This is a semester course: offered once a year.)

Course 101. Title (3).

First and second semester.

(This is a semester course, repeated each semester, and except for research, seminar, and certain problem courses, must be taken only one semester.)

Course 103, 104. Title (3, 3).

Three hours a week, first and second semesters.

If a laboratory course:

Course 103, 104. Title (3, 3).

One lecture and two laboratory periods a week, first and second semesters.

(This is a course extending through two semesters and carrying three semester credits each semester.)

Course 103, 104. Title (3, 3).

Three hours a week, second and first semesters.

(This is a course extending through two semesters, but it begins with the second semester.)

Course 105, f, s. Title (3, 3).

Three hours a week, first and second semesters.

(This is alternate way of listing a two-semester course.)

GRADES

The following symbols are used for grades: "A", "B", "C" and "S"—Passing; "D" and "F"—Failure; "I"—Incomplete. Since graduate students must maintain an overall "B" average, every credit hour of "C" in course work must be balanced by a credit hour of "A." A grade of "A" in thesis research will not balance a grade of "C" in a course. All incomplete grades must be removed before the degree is conferred.

Curricula and Courses

AERONAUTICAL ENGINEERING

Professors: SHERWOOD, CORNING, AND WESKE.

Associate Professor: RIVELLO.

Lecturers: KURZWEG, LOBB, NICOLAIDES, PAI, SEIGEL AND WILSON.

The Department of Aeronautical Engineering offers courses and opportunities for research leading to the degree of Master of Science and Doctor of Philosophy in aeronautical engineering.

Facilities for graduate research include two subsonic and two supersonic wind tunnels, a shock tube, a ballistic range and complete structural loading and measuring equipment for both static and dynamic conditions.

Aeronautical Engineering

For Graduates and Advanced Undergraduates

Aero. E. 101. Aerodynamics I. (3)

Second semester. Three lectures a week. Prerequisites, Phys. 21 and Math. 21. Basic fluid mechanics and aerodynamic theory. (Sherwood.)

Aero. E. 102. Aerodynamics II. (2)

First semester. Two lectures a week. Prerequisite, Aero. E. 101. Elements of hydrodynamics and application to engineering problems. (Sherwood.)

Aero. E. 107, 108. Airplane Design. (4, 4)

First and second semesters. Two lectures and two supervised calculation periods per week. Prerequisites, Aero. E. 101, Aero E. 104, and M.E. 22, 23. Aero. E. 102 and Aero. E. 113 to be taken concurrently. Theory and method of airplane design, airplane stability and control, airloads, and structural design. Each student designs a jet transport, high speed private airplane or other suitable airplane of student's choice, based upon set specifications. Charts and formulas used in industry are derived and used as basis of design. Optimum airplane is obtained by variation of fundamental parameters. (Corning.)

Aero. E. 109, 110. Aircraft Power Plants. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisite, M.E. 100. Study of basic operating principles of reciprocating, turbojet, turboprop, ramjet, and rocket engines. Specific topics of study include thermodynamic processes, combustion, fuels, carburetion, supercharging, lubrication, and engine performance. Various engine tests are run in the laboratory. (Weske.)

Aero. E. 111, 112. Aeronautical Laboratory. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, Aero. E. 101. To be taken concurrently with Aero. E. 102 and Aero. E. 113. Wind tunnel tests. Structure tests. Ballistics tests. Fluid flow analogies. Report writing, original research project. (Staff.)

Aero. E. 113, 114. Mechanics of Aircraft Structures. (4, 3)

First and second semesters. First semester, 3 lectures and one calculation period a week. Second semester, 3 lectures a week. Prerequisites, M.E. 22, 23 and Math. 64. Principles and problems of airplane stress analysis and structural design. (Rivello.)

Aero. E. 115. Aerodynamics III. (3)

Second semester. Prerequisite, Aero. E. 102. Elementary theory of the flow of a compressible gas at subsonic and supersonic speeds. (Sherwood.)

Aero. E. 117. Aircraft Vibrations. (3)

First semester. Three lectures a week. Prerequisite, Math. 64. Vibration and other dynamic problems occurring in airplane structures. Specific topics of study include the single degree of freedom system, damping, forced vibrations, critical frequency, multiple degrees of freedom, and vibration isolation and absorption. (Corning.)

Aero. E. 118. Dynamics of Aero-Space Vehicles. (3)

Prerequisites, M.E. 24, Aero. E. 101. Design principles of orbiting and hypersonic non-orbiting vehicles. (Corning.)

For Graduates

A. BASIC AERODYNAMICS

Aero. E. 220, 221. Aerodynamics of Incompressible Fluids. (3, 3)

Prerequisites, Aero. E. 101, Aero. E. 102, Math. 64. Fundamental equations in fluid mechanics. Irrotational motion. Circulation theory of lift. Thin airfoil theory. Lifting line theory. Wind tunnel corrections. Propeller theories. Linearized equations in compressible flow. (Ludford.)

Aero. E. 222, 223. Aerodynamics of Viscous Fluids. (3, 3)

Prerequisites, Aero. E. 101, Aero. E. 102, Math. 64. Fundamental concepts. Navier-Stokes' equations. Simple exact solutions. Laminar boundary layer theory. Pohlhausen method. Turbulent boundary layer; mixing length and similarity theories. Boundary layer in compressible flow. (Shen.)

Aero. E. 224, 225. Aerodynamics of Compressible Fluids. (3, 3)

Prerequisites, Aero. E. 115, Math. 64. One dimensional flow of a perfect compressible fluid. Shock waves. Two-dimensional linearized theory of compressible flow. Two-dimensional transonic and hypersonic flows. Exact solutions of two dimensional isotropic flow. Linearized theory of three-dimensional potential flow. Exact solution of axially symmetrical potential flow. One-dimensional viscous compressible flow. Laminar boundary layer of compressible fluids. (Pai)

B. APPLIED AERODYNAMICS

Aero. E. 230, 231. The Aerodynamics of High Altitude Vehicles. (3, 3)

Prerequisite, permission of instructor. Aerothermodynamic study of several types of high altitude, hypersonic vehicles including ballistic, boost-glide and satellite vehicles. Examination of problems in stability, control, boundary-layer growth, shockwave interactions and convective and radiative heating. (Wilson.)

Aero. E. 232, 233. Wave Propagation in Gases and Solids. (3, 3)

Prerequisite, permission of instructor. Application of method of characteristics to unsteady compressible flow. Study of isentropic and non-isentropic flows of both ideal and non-ideal gases. The Lagrange ballistic problem, detonation, the shock tube and spherical waves. Impact loading on elastic-plastic materials, the stopping shock, interactions and reflections in solids. Stress and strain produced in solids with varying cross-sectional area. (Seigel.)

Aero. E. 234, 235. Aerospace Facilities and Techniques. (3, 3)

Prerequisite, permission of instructor. Problems in supersonic and hypersonic tunnel development such as the aerodynamic design of nozzles, diffusers, storage systems and arc heaters. Shock tubes and shock tube wind tunnels. Development of ballistic ranges and basic considerations in the design of high-speed launchers. Instrumentation and data reduction. (Lobb.)

Aero. E. 236, 237. Heat Transfer Problems Associated with High Velocity Flight. (3, 3)

Prerequisite, permission of instructor. Heat conduction in solids and thermal radiation of solids and gases. Analytic solutions to simple problems and numerical methods for solving complicated problems. Convective heating associated with laminar and turbulent boundary-layer flow. Heat transfer equations are derived for the flat plate case

Agriculture

and for selected body shapes such as cones and hemispheres. Real gas effects on convective heating are examined. (Wilson.)

C. STRUCTURES

Aero. E. 250, 251. Advanced Flight Structures. (3, 3)

Prerequisites, Math. 64 and Aero. E. 113, 114, or permission of the instructor. Introduction to two dimensional theory of elasticity, energy methods, plate theory, theory of elastic instability. Aerodynamic heating of structures, thermal stresses, creep, creep bending and buckling, visco-elastic theory. (Rivello)

D. PROPULSION

Aero. E. 260, 261. Advanced Propulsion. (3, 3)

Prerequisites, M. E. 100; Aero. E. 109, 110. Special problems of thermodynamics and dynamics of aircraft power plants; jet, rocket and ramjet engines; plasma, ion and nuclear propulsion for space vehicles. (Weske.)

E. DYNAMICS

Aero. E. 270, 271. Flight Dynamics. (3, 3)

Prerequisites, Math. 64 and Aero. E. 114. Dynamics of a rigid body and applications to airplane dynamics. Generalized coordinates and Lagrange's equations. Vibrations of simple systems. Dynamics of elastically connected masses. Influence coefficients. Mode shapes and principal oscillations. Transient stresses in an elastic structure. Wing divergence and aileron reversal. Theory of two dimensional oscillating airfoil. Flutter problems. Corrections for finite span. Compressibility effects. (Shen, Nicolaides)

F. GENERAL

Aero. E. 290. Seminar.

(Credit in accordance with work outlined by Aeronautical Engineering staff). First and second semesters.

Aero. E. 291, 292. Selected Topics in Aerospace Engineering. (3, 3)

Prerequisite, permission of instructor. Topics of current interest and recent advances in the field of aerodynamics.

Aero. E. 399. Research.

(Credit in accordance with work outlined by Aeronautical Engineering staff). First and second semesters. Prerequisite, graduate standing. (Staff.)

AGRICULTURE

For Graduates and Advanced Undergraduates

Agr. 100. Introductory Agricultural Biometrics. (3)

First semester. Two lectures and one laboratory period per week. Introduction to fundamental concepts underlying the applications of biometrical methods to agricultural

problems with emphasis on graphical presentation of data, descriptive statistics, chi-square and t-tests, and linear regression and correlation.

Agr. 200. Agricultural Biometrics. (3)

Second semester. Two lectures and one laboratory period per week. Prerequisite, Agr. 100 or equivalent. A continuation of Agr. 100 with emphasis on analysis of variance and co-variance, multiple and curvilinear regression, sampling, experimental design and miscellaneous statistical techniques as applied to agricultural problems.

Agr. 202, 203. Advanced Biological Statistics. (2, 2)

First and second semesters. Prerequisite, approval of instructor. An advanced course dealing with specialized experimental designs, sampling techniques and elaborations of standard statistical procedures as applied to the animal and plant sciences.

AGRICULTURAL ECONOMICS

Professors: BEAL, CURTIS, POFFENBERGER AND WALKER.

Visiting Professor: TAYLOR.

Associate Professors: HAMILTON, MURRAY AND SMITH.

Assistant Professors: ISHEE, SWOPE AND WYSONG.

The Department offers a course of study leading to the degree of Master of Science and Doctor of Philosophy. Although the major field is agricultural economics, thesis topics may be selected and courses concentrated in farm management, farm taxation, farm finance, marketing, land economics, agricultural policy and foreign agricultural trade.

Department requirements, supplementary to the Graduate School, have been formulated for the guidance of candidates for graduate degrees. Copies of these requirements may be obtained from the Department of Agricultural Economics.

For Graduates and Advanced Undergraduates

A.E. 101. Marketing of Agricultural Products. (3)

First semester. Prerequisites, Econ. 31, 32, or Econ. 37. The development of marketing, its scope, channels, and agencies of distribution, functions, costs, methods used and services rendered. (Swope.)

A.E. 103. Cooperation in Agriculture. (3)

First semester. (Offered 1963-64.) Historical and comparative development of farmers' cooperative organizations; reasons for failure and essentials to success; commodity developments; operative practices; banks for cooperatives; present trends. (Nuckols.)

A.E. 104. Agricultural Finance. (3)

Second semester. (Offered 1962-63.) A study of credit principles as applied to private and cooperative farm business and the agencies extending farm credit. The needs for and benefits of farm insurance, including fire, crop, livestock, and life insurance.

(Ishee.)

Agricultural Economics

A.E. 106. Prices of Agricultural Products. (3)

Second semester. A general course in prices, price relationships, and price analysis, with emphasis on prices of agricultural products. (Wysong.)

A.E. 107. Analysis of the Farm Business. (3)

First semester. A concise, practical course in the keeping, summarizing and analyzing of farm accounts. (Hamilton.)

A.E. 108. Farm Management. (3)

Second semester. A study of the organization and operation of farms from the standpoint of efficiency, selection of farms, size of farms, leasing systems, and factors affecting profits. Students will make an analysis of the actual farm business and practices of different types of farms, and make specific recommendations as to how these farms may be organized and operate as successful businesses. (Hamilton.)

A.E. 111. Land Economics. (3)

First semester. (Offered 1963-64.) A study of the principles, problems and policies in the utilization of land with special emphasis on agricultural land. (Ishee.)

A.E. 112. Economic Development of American Agriculture. (3)

First semester. (Offered 1962-63.) This course is designed to acquaint students with major economic development in American agriculture. It places particular emphasis upon the economic impact of major agricultural movements, such as, colonial agrarianism, the disposition of the public domain, farm organizations, recent governmental farm programs and the relationship of agriculture to public affairs. (Beal.)

A.E. 114. Foreign Trade in Farm Products. (3)

First semester. (Offered 1963-64.) Economic principles in historical setting, trade barriers, foreign exchange problems, measures to promote trade, past and prospective trends of American imports and exports of farm products. (Taylor.)

A.E. 115. Marketing of Dairy Products. (2)

First semester. (Offered 1962-63.) A study of principles and practices in the marketing of milk and manufactured dairy products, including the influence of significant geographical and institutional relationships on costs and methods of distribution. (Beal.)

A.E. 116. Marketing of Fruits and Vegetables. (2)

Second semester. (Offered 1962-63.) A study of principles and practices in the marketing of fresh and processed fruits and vegetables, including the influence of significant geographical and institutional relationships on costs and methods of distribution. (Swope.)

A.E. 117. Economics of Marketing Eggs and Poultry. (3)

Second semester. (Offered 1963-64.) This course embraces the economic phases of egg and poultry marketing. Supply and demand factors, including trends, will be discussed along with marketing methods, marketing costs and margins, market facilities, transportation, government grading, storage and efficiency in marketing. Consumer preference, acceptance and purchases will be related to consumer income, pricing of competitive products, and display methods. (Smith.)

A.E. 118. Foreign Agricultural Policies. (3)

First semester. This course deals with how the agricultural policies of the United States and foreign countries of major agricultural importance are formulated and

conducted. Specific policies are evaluated. The effect of various incentives and barriers to American exports and imports of agricultural products is appraised with the assistance of visiting discussion leaders working at the policy level in the United States and other major agricultural countries. (Taylor.)

A.E. 119. Foreign Agricultural Economics. (3)

Second semester. This course deals with differences between the agricultural economies of several countries and their significance to world-wide production, trade, and consumption of the agricultural products of major importance to the United States. Special emphasis is given to the roles of institutional and governmental arrangements. (Taylor.)

A.E. 198. Research Problem. (1-2) (2 Cr. Max.)

First and second semesters. With the permission of the instructor, students will work on any research problems in agricultural economics. There will be occasional class meetings for the purpose of making reports on progress of work. (Staff.)

A.E. 199A-B. Seminar. (1, 1)

First and second semesters. Students will prepare and present reports on economic literature and current agricultural economic problems. (Hamilton.)

Technology of Market Eggs and Poultry.

See Poultry Husbandry, P. H. 104.

Poultry Industrial and Economic Problems.

See Poultry Husbandry, P. H. 107.

Market Milk.

See Dairy, Dairy 109.

Livestock Markets and Marketing.

See Animal Husbandry, A. H. 150.

Meat and Meat Products.

See Animal Husbandry, A. H. 160.

Advertising.

See Business Administration, B. A. 151.

Retail Store Management.

See Business Administration, B. A. 154.

For Graduates

A.E. 208. Agricultural Policy. (3)

Second semester. The evolution of agricultural policy in the United States, emphasizing the origin and development of governmental programs, and their effects upon agricultural production, prices and income. (Beal.)

A.E. 210. Agricultural Taxation. (3)

First semester. (Offered 1962-63.) Principles, theory and practical problems of taxation applied to the field of agriculture; trends in farm taxes; farm tax burdens;

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equalizing and reducing farm tax burdens; taxation of farm cooperatives; forest lands and interstate agricultural commerce; application of income taxes and sales to farmers; taxation of agriculture in foreign countries. (Walker.)

A.E. 211. Functional Aspects of Farm Taxation. (3)

Second semester. (Offered 1963-64.) Two lectures and one laboratory period a week. Taxation policies and inter-governmental allocations and grants-in-aid as they affect public services for rural people, with special emphasis on public education, public highways, public welfare, social security, public dept; and governmental research, extension, and regulatory activities directly concerning agriculture. (Walker.)

A.E. 214. Advanced Agricultural Marketing. (3)

First semester. Advanced study of the complex theoretical, institutional and legal factors governing both domestic and foreign agricultural trade, with particular attention given to policies and practices affecting cost and price. (Beal.)

A.E. 216. Advanced Farm Management. (3)

Second semester. An advanced course in farm organization and management which applies the economic principles of farm production to the operation of farms of different sizes, types, operations, and geographical locations. Consideration is also given to adjustments which have taken place in farming specific areas and probable changes in the future. (Ishee.)

A.E. 218. Agricultural Economics Research Techniques. (3)

First semester. A study and an appraisal of agricultural economics research techniques. Experience is given in outlining and conducting research projects. A critical appraisal is made of methods of analysis and the presentation of results. (Beal.)

A.E. 219. Advanced Land Economics. (3)

Second semester. A critical analysis of the principles and problems in issuing and controlling land resources, including a review of land policies, is given, with special consideration being placed on the problems of submarginal lands, range lands, and water resources. Conservation of various land resources is appraised; problems of landed property are presented; and criteria essential to the development of a sound land policy are studied. (Ishee.)

A.E. 220. World Agricultural Production. (3)

First semester. A world-wide appraisal of the economic significance of the growth of population, changes in food and fiber requirements, development of land resources, development of crop and livestock productivity, substitute or supplementary products from factory and sea, the economic imbalance between developed and under-developed countries, financial and social limitations, and organized international agricultural development activities. (Taylor.)

A.E. 301. Special Problems in Agricultural Economics. (1-4) (4 Cr. Max.)

First and second semesters. An advanced course dealing extensively with some of the economic problems affecting the farmer, such as land values, taxation, credit, prices, production adjustments, transportation, marketing, and cooperation. (Staff.)

A.E. 302. Seminar. (1)

First and second semesters. M. S. Candidates can obtain 4 credits; Ph.D. Candidates can obtain 6 credits. Students will be assigned research in agricultural economics under the supervision of the instructor. The work will consist of original investigation in problems of agricultural economics. (Staff.)

A.E. 399. Research.

Credit according to work accomplished. This course will consist of special reports by students on current economic subjects, and a discussion and criticism of the same by the members of the class and instructional staff. (Staff.)

AGRICULTURAL AND EXTENSION EDUCATION

Professors: CARDOZIER AND WARNER.

Assistant Professor: SMITH.

The Department of Agricultural and Extension Education offers work leading to the degree of Master of Science. Students may choose either a program on agricultural education or extension education. Either program may be pursued on a part-time or full-time basis.

Students pursuing either curriculum will be expected to have completed at least one year of experience in the field in which they are studying. They will be expected to have completed at least 16 semester hours of education, except that one year of professional experience in their field of study may be substituted for eight semester hours of the prerequisites. Deficiencies in prerequisites may be made up after being admitted to the Graduate School.

Department requirements, supplemental to the Graduate School, are available for the guidance of graduate students.

For Graduates and Advanced Undergraduates

R. Ed. 114. Rural Life and Education. (3)

Second semester. An intensive study of the educational agencies at work in rural communities, stressing an analysis of school patronage areas, the possibilities of normal life in rural areas, early beginnings in rural education, and the conditioning effects of educational offerings. (Staff.)

R. Ed. 150. Extension Education. (2)

Second semester. The Agricultural Extension Service as an educational agency. The history, philosophy, objectives, policy, organization, legislation, and methods used in extension work. (Staff.)

R. Ed. 160. Agricultural Communications. (2)

First semester. A general introduction to communications and the application of communication principles and problems of teaching agricultural workers, person to person, with groups and through mass media. (Staff.)

R. Ed. 170 A-B. Workshop: Teaching Conservation of Natural Resources. (3-3)

Summer session only. Laboratory fee, \$25.00. This workshop is devoted to a study of the state's basic wealth, its natural resources, natural resource problems and practices pertinent to local, state, national and world welfare. (Staff.)

Agricultural and Extension Education

For Graduates

R. Ed. 201. Rural Life and Education. (3)

First semester. (Given in accordance with demand, but not more often than alternate years.) Prerequisite, R. Ed. 114 or equivalent. A sociological approach to rural education as a movement for a good life in rural communities. (Smith.)

R. Ed. 203. Farm Organizations and Rural Education. (3)

Second semester. (Given in accordance with demand, but not more often than alternate years.) Prerequisite, R. Ed. 114 or equivalent. The part played by farm organizations in formal and informal education in the rural community.

R. Ed. 207, 208. Problems in Vocational Agriculture. (2, 2)

First and second semesters. (Given in accordance with demand, but not more often than alternate years.) In this course special emphasis is placed upon the current problems facing teachers of vocational agriculture. It is designed especially for persons who have had several years of teaching experience in this field. (Cardozier.)

R. Ed. S207 A-B. Problems in Teaching Vocational Agriculture. (1, 1)

Summer session only. A critical analysis of current problems in the teaching of vocational agriculture with special emphasis upon recent developments in all-day programs. (Smith.)

R. Ed. S209 A-B. Adult Education in Agriculture. (1, 1)

Summer session only. Principles of adult education as applied to rural groups, especially young and adult farmers. Organizing classes, planning courses and instructional methods are stressed. (Staff.)

R. Ed. S210 A-B. The Land Grant College System. (1, 1)

Summer session only. Development of teaching, research and extension in land grant colleges and the role these colleges have played in improving rural conditions. (Staff.)

R. Ed. S213 A-B. Supervision and Administration of Vocational Agriculture. (1, 1)

Summer session only. Administrative and supervisory problems in vocational agriculture including scheduling, local administrative programs, supervision-teacher relationships and the responsibilities of superintendents and principals in the program. (Cardozier.)

R. Ed. 215. Supervision of Student Teaching. (1)

Arranged. (Given in accordance with demand, but not more often than alternate years.) The role of the supervising teacher in checking progress, supervising and grading student teachers. Particular emphasis will be given to the region-wide program in training teachers of vocational agriculture, including the evaluation of beginning teachers. (Cardozier.)

R. Ed. 240. Agricultural College Instruction. (1)

Second semester. (Given in accordance with demand, but not more often than alternate years.) Open to graduate students and members of the faculty in the College of Agriculture. A seminar type of course consisting of reports, discussions, and lectures dealing with the techniques and procedures adapted to teaching agricultural subjects at the college level. (Cardozier.)

R. Ed. S250 A-B. Critique in Rural Education. (1, 1)

Summer session only. Current problems of teaching agriculture are analyzed and discussed. Students are required to make investigations, prepare papers and make reports. (Smith.)

R. Ed. 301. Field Problems in Rural Education. (1-3)

First and second semesters and summer session. Prerequisite, six semester hours of graduate study. Problems accepted depend upon the character of the work of the student and the facilities available for study. Periodic conferences required. Final report must follow accepted pattern for field investigation. (Staff.)

R. Ed. 302. Seminar in Rural Education. (1, 1)

First and second semesters. Problems in the organization, administration, and supervision of the several agencies of rural education. Investigations, papers, and reports. (Cardozier.)

R. Ed. 399. Research.

First and second semesters and summer session. Credit hours according to work done. (Staff.)

AGRICULTURAL ENGINEERING

Professors: GREEN AND BURKHARDT.

Associate Professors: GIENGER AND WINN.

Assistant Professors: HARRIS AND MATTHEWS.

The Department of Agricultural Engineering offers a graduate course of study leading to the degree of Master of Science. The student may pursue major work in agricultural power and machinery, soil and water conservation engineering, agricultural structures or electric power and processing. A thesis

Agricultural Engineering

based upon original research work is required. An employee of a nearby institution may submit a thesis based on research work at the institution under the direction of and with prior approval by the Department.

Laboratory facilities are available for work in each area of specialization and, in cooperation with other departments, ample areas for field tests and studies are available.

For Graduates and Advanced Undergraduates

Agr. Engr. 101. Agricultural Machinery. (2)

First semester. Two lectures per week. Concurrent registration in Agr. Engr. 121 or 131 required. Materials and construction of agricultural machinery with particular reference to functions of unit assemblies and complete machines, and factors affecting their adaptation and management. (Matthews.)

Agr. Engr. 102. Agricultural Tractors and Power Units. (2)

Second semester. Two lectures per week. Concurrent registration in Agr. Engr. 122 or 132 required. Principles of internal combustion engines and fundamentals of power transmission and control mechanisms in self-propelled or stationary units. (Matthews.)

Agr. Engr. 105. Farm Structures. (2)

First semester. Two lectures per week. Concurrent registration in Agr. Engr. 135 required for students in agricultural engineering curriculum. Functional and environmental requirements of farm structures are stressed. Characteristics of materials and structural details of conventional types of construction are included. (Matthews.)

Agr. Engr. 107. Soil and Water Conservation Engineering. (1)

Second semester. One lecture per week. Concurrent registration in Agr. Engr. 127 or 137 required. Applications of engineering sciences in erosion control, drainage, irrigation, and watershed management. (Green.)

Agr. Engr. 109. Farm Applications of Electricity. (1)

Second semester. One lecture per week. Concurrent registration in Agr. Engr. 129 or 139 required. Applications of electricity for lighting, heating, cooling or power and characteristics of motors and equipment considered in design to meet requirements. (Matthews.)

Agr. Engr. 113. Special Problems in Agricultural Processing. (3-4)

Second semester. Three lectures and one laboratory a week. Laboratory optional. Prerequisite, Physics 1 or 10. A study of problems in power transmission, hydraulics, electricity, thermodynamics, refrigeration, instruments and controls, materials handling, and analysis of time and motion as related to the processing of agricultural commodities. (Staff.)

Agr. Engr. 121. Agricultural Machinery Laboratory. (1)

First semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 101 required. Studies of operating characteristics, adjustments and where applicable, calibration of current models of machinery. (Matthews.)

Agr. Engr. 122. Agricultural Tractors and Power Laboratory. (1)

Second semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 102 required. Studies of power unit components as related to overall engine and tractor performance. (Matthews.)

Agricultural Engineering

Agr. Engr. 127. Soil and Water Conservation Laboratory. (1)

Second semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 107 required. Simple surveying and use of level for erosion control, irrigation and drainage. (Green.)

Agr. Engr. 129. Farm Electrification Laboratory. (1)

Second semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 109 required. Layout and design of farmstead wiring plans together with essentials of wiring practices. (Staff.)

Agr. Engr. 131. Agricultural Machinery Design Laboratory. (1)

First semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 101 required. Prerequisite, C. E. 24 or M. E. 24. A study of design factors and force analysis including design of simple units. (Staff.)

Agr. Engr. 132. Farm Power Analysis Laboratory. (1)

Second semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 102 required. Prerequisite, M. E. 100. Determination of efficiency of internal combustion engines, forces and moments of tractor loading, and stability. Engineering aspects of hydraulic control systems and power transmission are included. (Staff.)

Agr. Engr. 135. Farm Structures Design Laboratory. (1)

First semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 105 required. Prerequisite, C. E. 160. Design of structures with emphasis on functional and environmental requirements for agriculture. (Staff.)

Agr. Engr. 137. Soil and Water Conservation Engineering Laboratory. (1)

Second semester. One three-hour laboratory per week. Prerequisites, C. E. 110 and C. E. 140 or M. E. 102. Hydraulic design of water conveyance systems for erosion control, drainage and irrigation. (Green.)

Agr. Engr. 139. Farm Electrification Engineering Laboratory. (1)

Second semester. One three-hour laboratory period per week. Concurrent registration in Agr. Engr. 109. Prerequisite, E. E. 52. Study of farmstead electrical loads and the design of distribution networks therefor. (Staff.)

Agr. Engr. 198. Special Problems in Farm Mechanics. (1-3)

First and second semesters. Prerequisite, approval of Department. Problems assigned in proportion to credit. (Gienger.)

For Graduates

Agr. Engr. 201. Special Topics in Agricultural Engineering. (3)

First and second semesters. Two lectures and one laboratory period per week. Timely topics in specialized areas of agricultural engineering will be selected. For example, Instrumentation for Agricultural Engineering Research. (Staff.)

Agr. Engr. 301. Special Problems in Agricultural Engineering. (1-6)

First and second semester and summer school. Work assigned in proportion to amount of credit. (Staff.)

Agronomy

Agr. Engr. 302. Seminar. (1)

First and second semesters. Prerequisite, permission of instructor. (Staff.)

Agr. Engr. 399. Research. Credit according to work accomplished. (1-6) (Staff.)

AGRONOMY—CROPS AND SOILS

Professors: ROTHGEB AND STREET.

Associate Professors: AXLEY, BOURBEAU, DECKER, LEFFEL AND STRICKLING.

Assistant Professors: CLARK, KRESGE, SANTELMANN.

The Department of Agronomy offers a graduate course of study leading to the degree of Master of Science and to the degree of Doctor of Philosophy. The student may pursue major work in the crops division or in the soils division of the Department. A thesis based on original research is required for each degree. Ample laboratory and greenhouse facilities for graduate work are available on the campus. The Plant Research Farm, the Forage Research Farm, and the Tobacco Experiment Farm offer adequate nearby field research facilities. Many projects of the Department are conducted in cooperation with the Agricultural Research Service of the United States Department of Agriculture with headquarters located three miles from the campus.

Departmental regulations have been assembled for the guidance of candidates for graduate degrees. Copies of these regulations are available from the Department of Agronomy.

For Graduates and Advanced Undergraduates

CROPS

Agron. 103. Crop Breeding. (2)

Second semester, alternate years. (Offered 1962-63.) Prerequisite, Bot. 117 or Zool. 104. Principles and methods of breeding annual self and cross-pollinated plants and perennial forage species. (Leffel.)

Agron. 104. Tobacco Production. (3)

Second semester. Three lectures a week. Prerequisite, Bot. 1. A study of the history, adaptation, distribution, culture, and improvement of various types of tobacco, with special emphasis on problems in Maryland tobacco production. Physical and chemical factors associated with yield and quality of tobacco will be stressed. (Street.)

Agron. 107. Cereal Crop Production. (3)

First semester, alternate years. (Offered 1962-63.) Two lectures and one laboratory period a week. Prerequisite, Bot. 1. Study of the principles and practices of corn, wheat, oats, barley, rye, and soybean production. (Clark.)

Agron. 108. Forage Crop Production. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, Bot. 1. Study of the production and management of grasses and legumes for quality hay, silage and pasture. (Decker.)

Agron. 109. Turf Management. (2)

First semester, alternate years. (Offered 1963-64.) Two lectures a week. Prerequisite, Bot. 1. A study of principles and practices in management of turf for lawns, athletic fields, playgrounds, airfields, and highway planting. (Staff.)

Agron. 151. Cropping Systems. (2)

Second semester. Two lectures a week. Prerequisite, Agron. 1 or equivalent. The co-ordination of information for various courses in the development of balanced cropping systems, appropriate to different objectives in various areas of the state and nation. (Clark.)

Agron. 152. Seed Production and Distribution. (2)

First semester, alternate years. (Offered 1962-63.) One lecture and one laboratory period a week. Prerequisite, Agron. 1 or equivalent. A study of seed production, processing, and distribution; federal and state seed control programs; seed laboratory analyses; release of new varieties and maintenance of foundation seed stocks. (Newcomer.)

Agron. 154. Weed Control. (3)

First semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period a week. Prerequisite, Agron. 1 or equivalent. A study of the use of cultural practices and chemical herbicides in the control of weeds. (Santelmann.)

Additional courses under CROPS AND SOILS may be taken.

For Graduates

Agron. 201. Advanced Crop Breeding. (2)

First semester, alternate years. (Offered 1963-64.) Prerequisite, Agron. 103 or equivalent. Genetic, cytogenetic, and statistical theories underlying methods of plant breeding. A study of quantitative inheritance, heterosis, heritability, interspecific and intergeneric hybridization, polyploidy, sterility mechanisms, inbreeding and outbreeding, and other topics as related to plant breeding. (Leffel.)

Agron. 204. Technic in Field Crop Research. (2)

Second semester, alternate years. (Offered 1962-63.) Field plot technic, application of statistical analysis to agronomic data, and preparation of the research project. (LeClerg.)

Agron. 205. Advanced Tobacco Production. (2)

First semester, alternate years. (Offered 1963-64.) Two lectures a week. Prerequisite, permission of instructor. A study of the structural adaptation and chemical response of tobacco to environmental variations. Emphasis will be placed on the alkaloids and other unique components. (Street.)

Agron. 207. Advanced Forage Crops. (2)

First semester, alternate years. (Offered 1962-63.) Two lectures a week. Prerequisites, Bot. 101, Chem. 31 and 32, or equivalent, or permission of instructor. A fundamental study of physiological and ecological responses of grasses and legumes to environmental

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factors, including fertilizer elements, soil moisture, soil temperature, air temperature, humidity, length of day, quality and intensity of light, wind movement, and defoliation practices. Relationship of these factors to life history, production, chemical and botanical composition, quality, and persistence of forages will be considered. (Decker.)

Agron. 208. Research Methods. (2)

Second semester. Prerequisite, permission of staff. Development of research viewpoint by detailed study and report on crop research of the Maryland Experiment Station or review of literature on specific phases of a problem. (Staff.)

Agron. S210. Cropping Systems. (1)

Summer session only. An advanced course primarily designed for teachers of vocational agriculture and county agents. It deals with outstanding problems and the latest developments in the field. (Staff.)

Additional courses under CROPS AND SOILS may be taken.

SOILS

For Graduates and Advanced Undergraduates

Agron. S110. Soil Management. (1)

Summer session only. An advanced course primarily designed for teachers of vocational agriculture and county agents dealing with factors involved in management of soils in general and of Maryland soils in particular. Emphasis is placed on methods of maintaining and improving chemical, physical, and biological characteristics of soils. (Strickling.)

Agron. 111. Soil Fertility Principles. (3)

First semester, alternate years. (Offered 1962-63.) Three lectures a week. Prerequisite, Agron. 10. A study of the chemical, physical, and biological characteristics of soils that are important in growing crops. Soil deficiencies of physical, chemical, or biological nature and their correction by the use of lime, fertilizers, and rotations are discussed and illustrated. (Strickling.)

Agron. 112. Commercial Fertilizers. (3)

Second semester. Three lectures a week. Prerequisite, Agron. 10 or permission of instructor. A study of the manufacturing of commercial fertilizers and their use in soils for efficient crop production. (Axley.)

Agron. 113. Soil Conservation. (3)

First semester, alternate years. (Offered 1962-63.) Two lectures and one laboratory period a week. Prerequisite, Agron. 10 or permission of instructor. A study of the importance and causes of soil erosion, and methods of soil erosion control. Special emphasis is placed on farm planning for soil conservation. The laboratory period will be largely devoted to field trips.

Agron. 114. Soil Classification and Geography. (4)

Second semester. Three lectures and one laboratory period a week. Prerequisite, Agron. 10, or permission of instructor. A study of the genesis, morphology, classification and geographic distribution of soils. The broad principles governing soil formation are explained. Attention is given to the influence of geographic factors on the development and use of soils in the United States and other parts of the world. The laboratory

periods will be largely devoted to field trips and to a study of soil maps of various countries. (Bourbeau.)

Agron. 116. Soil Chemistry. (3)

First semester, alternate years. (Offered 1962-63.) One lecture and two laboratory periods a week. Prerequisite, Agron. 10, or permission of instructor. A study of the chemical composition of soils; cation and anion exchange; acid, alkaline and saline soil conditions; and soil fixation of plant nutrients. Chemical methods of soil analysis will be studied with emphasis on their relation to fertilizer requirements. (Axley.)

Agron. 117. Soil Physics. (3)

First semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period a week. Prerequisites, Agron. 10 and a course in physics, or permission of instructor. A study of physical properties of soil with special emphasis on relationship to soil productivity. (Strickling.)

Agron. 119. Soil Mineralogy. (4)

First semester, alternate years. (Offered 1963-64.) Two lectures and two laboratory periods a week. Prerequisite, permission of instructor. A study of the fundamental laws and forms of crystal symmetry and essentials of crystal structure; structure, occurrence, association and uses of minerals, determination of minerals by means of their morphological, chemical and physical properties. Particular attention is given to soil-forming minerals. Laboratory periods will be devoted to a systematic study of about 75 minerals. (Bourbeau.)

Additional courses under CROPS AND SOILS may be taken.

For Graduates

Agron. 250. Advanced Soil Mineralogy. (3)

First semester, alternate years. (Offered 1962-63.) Three lectures a week. Prerequisites, Agron. 10, Agron. 119 and permission of instructor. A study of the structure, physical-chemical characteristics and identification methods of soil minerals, particularly clay minerals, and their relationship to soil genesis and productivity. (Bourbeau.)

Agron. 251. Advanced Methods of Soil Investigation. (3)

First semester, alternate years. (Offered 1963-64.) Three lectures a week. Prerequisites, Agron. 10 and permission of instructor. An advanced study of the theory of the chemical methods of soil investigation with emphasis on problems involving application of physical chemistry. (Axley.)

Agron. 252. Advanced Soil Physics. (3)

Second semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period a week. Prerequisites, Agron. 10 and permission of instructor. An advanced study of physical properties of soils. (Strickling.)

Agron. 253. Advanced Soil Chemistry. (3)

First semester, alternate years. (Offered 1962-63.) One lecture and two laboratory periods a week. Prerequisites, Agron. 10 and permission of instructor. A continuation of Agron. 116 with emphasis on soil chemistry of minor elements necessary for plant growth. (Axley.)

Additional courses under CROPS AND SOILS may be taken.

American Civilization

CROPS AND SOILS

For Graduates

Agron. 260. Recent Advances in Agronomy. (2-4)

First semester. Two hours each year. Total credit four hours. Prerequisite, permission of instructor. A study of recent advances in agronomy research. (Staff.)

Agron. 302. Agronomy Seminar. (1, 1)

First and second semesters. Total credit toward Master of Science degree, 2; toward Ph.D. degree, 6. Prerequisite, permission of instructor. (Staff.)

Agron. 399. Research.

First and second semesters. Credit according to work done. (Staff.)

AMERICAN CIVILIZATION

Committee on American Civilization:

Assistant Professor: BEALL, *Executive Secretary.*

Professors: HOFFSOMMER, LAND, MURPHY AND PLISCHKE.

The American Civilization Program offers work leading to both the degrees of Master of Arts and Doctor of Philosophy. The Departments of English, History, Government and Politics, and Sociology join to offer integrated plans of study. In his class work the student will emphasize the offerings of any one of these departments. For lists of courses from which his particular program is to be developed, he is to see principally the listings of the four departments just mentioned. The Executive Secretary of the program will serve as the student's adviser in consultation with the chairman of the department in the field of the student's special interest.

For Graduates and Advanced Undergraduates

Amer. Civ. 137, 138. Conference Course in American Civilization. (3, 3)

First and second semesters. Four American classics, drawn from the fields of the cooperating departments, are studied in detail each semester. Specialists from the appropriate departments lecture on these books. The classics for this year are Franklin's *Autobiography*, *The Life and Writings of Thomas Jefferson*, De Tocqueville's *Democracy in America*, Schlesinger's *The Age of Jackson*, for the first semester; and for the second semester; Thoreau's *Walden*, Howell's *A Hazard of New Fortunes*, Veblen's *The Theory of the Leisure Class*, and Riesman's *The Lonely Crowd*. The Conference course, or either semester of it, may be chosen by a student outside the program as an elective. It also counts as major credit for the four cooperating departments. The course meets, like a seminar, once a week. (Beall and cooperating specialists.)

For Graduates

Amer. Civ. 201, 202. Seminar in American Civilization. (3, 3)

First and second semesters. (Bode.)

ANIMAL HUSBANDRY

Professors: FOSTER AND GREEN.

Associate Professor: LEFFEL.

Assistant Professors: BURIC AND YOUNG.

The Department of Animal Husbandry offers work leading to the degree of Master of Science and Doctor of Philosophy. Course work and thesis problems are offered in the areas of animal breeding, nutrition, and live-stock production.

Departmental requirements have been formulated for the information and guidance of graduate students. Copies of these requirements are available from the Department of Animal Husbandry.

For Graduates and Advanced Undergraduates

A. H. 111. Animal Nutrition. (3)

First semester. Three lectures a week. Prerequisites, Chem. 31, 32, 33, 34; A. H. 110. Graduate credit allowed, with permission of instructor. Processes of digestion, absorption, and metabolism of nutrients; nutritional balances; nature of nutritional requirements for growth, production, and reproduction are considered. (Leffel.)

A. H. 120. Principles of Breeding. (3)

Second semester. Three lectures a week. Prerequisites, Zool. 104 or Bot. 117 and A. H. 130 or A. H. 131 or A. H. 132 or Dairy 20. Graduate credit (1-3 hours), allowed with permission of instructor. The practical aspects of animal breeding, heredity, variation, selection, systems of breeding and pedigree study are considered. (Green.)

A. H. 5130. Beef Cattle. (1)

Summer session. Prerequisite, permission of instructor. This course is designed primarily for teachers of vocational agriculture and Extension Service workers. Principles and practices underlying the economical production of beef cattle, including a study of the breeds and their adaptability, selection, breeding, feeding, management, and marketing of purebred and commercial cattle. (Foster.)

A. H. 150. Livestock Markets and Marketing. (2)

First semester. Two lectures a week. Prerequisites, A. H. 1; Econ. 31, 32 or Econ. 37; and A. H. 130 or A. H. 131 or A. H. 132. Graduate credit allowed, with permission of instructor. History and development of livestock markets and systems of marketing; trends of livestock marketing; effect of changes in transportation and refrigeration facilities; the merchandising of meat products are considered. (Young.)

For Graduates

A. H. 205. Advanced Breeding. (2)

Second semester, alternate years. (Offered 1961-62.) Two lectures a week. Prerequisites, A. H. 120, or equivalent, and Biological Statistics. This course deals with the more technical phases of heredity and variation, selection indices, breeding systems, and inheritance in farm animals. (Green.)

Art

A. H. 206. Advanced Livestock Management. (3)

First semester, alternate years. Two lectures and one laboratory period a week. Prerequisite, approval of staff. An intensive study of the newer developments in animal breeding, animal physiology, animal nutrition, endocrinology, and other closely allied fields as they apply to the management and production of livestock. (Staff.)

A. H. 207. Advanced Livestock Nutrition. (3)

Second semester, alternate years. (Offered 1962-63.) Three lectures a week. Prerequisites, Chem. 31, 32, 33, 34 or equivalent, and A. H. 111, or permission of instructors. Experimental techniques and recent developments in the feeding and nutrition of beef cattle, sheep and swine are presented. (Leffel, Young.)

A. H. 301. Special Problems in Animal Husbandry. (1-2) (4 Cr. Max.)

First and second semesters. Work assigned in proportion to amount of credit. Prerequisite, approval of staff. Problems will be assigned which relate specifically to the character of work the student is pursuing. (Staff.)

A. H. 302. Seminar. (1) (5 Cr. Max.)

Students and staff discuss topics related to animal husbandry. (Staff.)

A. H. 399. Research. (1-6)

Credit to be determined by the work done. With the approval of the staff, the student will be required to pursue original research in some phase of animal husbandry, carry the same to completion, and report the results in the form of a thesis. (Staff.)

ART

Professor: WHARTON.

Associate Professors: LEMBACH AND MARIL.

Assistant Professors: GRUBAR, JAMIESON AND STITES.

The Department of Art offers a graduate course of study leading to the degree of Master of Arts. Two curricula are offered: (a) Creative Art Program, which emphasizes studio work in painting, drawing and sculpture; (b) History of Art Program, in which the emphasis is placed on the history and criticism of art, and art education.

1. CREATIVE ART PROGRAM: An A.B. degree with an art major from an accredited university, or its equivalent, is required. In addition, special departmental requirements must be met. Of thirty hours of approved graduate work, twelve must be in the creative art program, and six in the history of art. All candidates for the Master of Arts degree will be required to pass a written comprehensive examination and submit a thesis or an original creative project in painting, drawing or sculpture.

2. HISTORY OF ART PROGRAM: The student enrolling in this program will submit evidence of prior study in the general field of art on the undergraduate level, or demonstrate familiarity with the subject by requesting a

special Departmental examination. Based on the recommendations of the Staff, additional courses may be required to supplement the student's undergraduate work. An adequate reading knowledge of French or German will be expected. A written comprehensive examination will be administered to each student before qualifying for the final oral examination. A thesis is required.

For Graduates and Advanced Undergraduates

Art 102, 103. Creative Painting. (3, 3)

Three two-hour laboratory periods per week. Prerequisites, Art 1, 5, 7. Assignments of pictorial composition aimed at both mural decoration and easel picture problems. The formal values in painting are integrated with the student's own desire for personal expression. (Maril.)

Art 104, 105. Life Class (Drawing and Painting, Intermediate). (3, 3)

Three two-hour laboratory periods per week. Prerequisites, Art 1 and 5. Careful observation and study of the human figure for construction, action, form, and color. (Staff.)

Art 106, 107. Portrait Class (Drawing and Painting). (3, 3)

One lecture hour and five laboratory hours per week. Prerequisites, Art 1 and 5. Thorough draftsmanship and study of characterization and design stressed. (Wharton.)

Art 108, 109. Modern Art. (3, 3)

A survey of the developments in various schools of modern art. Works of art analyzed according to their intrinsic values and in their historical background. Collections of Washington and Baltimore are utilized. (Grubar, Stites.)

Art 113, 114. Illustration. (3, 3)

Two three-hour laboratory periods per week. Prerequisites, Art 1, 5, and 104. This course is designed for the purpose of channeling fine art training into practical fields, thereby preparing the student to meet the modern commercial advertising problems. Special emphasis will be placed upon magazine and book illustrating. (Jamieson.)

Art 115, 116. Still Life Painting (Advanced). (3, 3)

Two three-hour laboratory periods per week. Prerequisite, Art 6. This course is for those who have completed Art 6 and wish to specialize in Still Life Painting, and more creative work. (Jamieson.)

Art 154, 155. Life Drawing and Painting (Advanced). (3, 3)

Three two-hour laboratory periods per week. Prerequisite, Art 105. This course is for those who have completed Art 105 and wish to develop greater proficiency in the use of the figure in creative work. (Staff.)

Art 156, 157. Portrait Painting (Advanced). (3, 3)

Two three-hour laboratory periods per week. Prerequisite, Art 106, 107. This course is for those who have completed Art 106, 107 and wish to specialize in portraiture. (Wharton.)

Art 185, 186. Renaissance and Baroque Art in Italy. (2, 2)

Prerequisite, Art 11. The first term is concerned with the emergence and development of Renaissance painting, sculpture and architecture through the first quarter of the 16th century. In the second term Mannerism and Baroque phases are studied.

(Grubar, Stites.)

Art

Art 188, 189. History of 16th and 17th Century Painting. (2, 2)

Prerequisite, Art 11. A study of the development of painting and related arts. The first semester study will center on Italian painting in the 16th and 17th century and the emergence of the Baroque style. During the second semester, the paintings of France, Spain, England, and the Low Countries will be considered. (Grubar.)

Art 190, 191. Special Problems in Art. (3, 3)

Two three-hour laboratory periods per week or its equivalent in art history and appreciation. Permission of Department Head. Designed to offer the advanced student in art special instruction in areas not offered regularly by the Department. (Staff.)

For Graduates

Art 205, 206. Advanced Problems in Drawing. (3, 3)

Prerequisite, at least one year of traditional methods in drawing from life models. An investigation of the many media of drawing and the potentials existing therein. (Staff.)

Art 210. Materials and Techniques of Painting. (3)

A technical investigation of painting methods from the Renaissance to the present. Preparation of grounds, media, underpainting, glazes, and emulsions for tempera. (Jamieson.)

Art 215, 216. Advanced Problems in Painting. (3, 3)

An understanding of the formal structures of traditional painting is expected. Problems will be developed by the individual students that will express their creative potentials. An experimental attitude will be encouraged. Investigation will be made of new painting media. (Staff.)

Art 220. Creative Tests in Plastics Media. (3)

Technical and creative tests employing the latest plastics media used by contemporary artists. Special emphasis is placed in Polymer Tempera. (Jamieson.)

Art 276, 277. Advanced Problems in Art Education. (3, 3)

A closely integrated series of definite problems pursued in an exploratory, individual manner, determined by the student's professional needs. (Lembach.)

Art 230, 231. Experimentation in Sculpture. (3, 3)

Professional aspects of sculpture, independent research and experimentation are stressed. (Freeny.)

Art 235. Materials and Techniques in Sculpture. (3)

For the advanced student interested in a better understanding of his materials. Methods of armature building, casting, and the varieties of stone, wood, metal and plastic materials will be experimented with and discussed. (Freeny.)

Art 245. Materials, Media and Techniques in Art. (3)

A laboratory-lecture course required of all majors in the history and criticism of art. An intensive study and practical application of materials, media and techniques employed during the various historic periods. (Staff.)

Art 250. American Pre-Colonial and Colonial Art. (3)

An investigation of the arts of the various Indian cultures, the period of exploration, and the early and later phases of Colonial development. (Grubar, Stites.)

Art. 255. Seminar in Nineteenth Century American Art. (3)

A critical examination of painting, sculpture and architecture from the end of the Colonial period until 1860. (Grubar.)

Art 260. Seminar in Contemporary Art. (3)

Prerequisites, Art 108, 109 and the consent of the instructor. An intensive study of the major developments in Western European and American art from 1900 until the present day. (Grubar.)

Art 265. Baroque Art. (3)

Advanced problems in Italian and Northern European art of the Baroque period. (Grubar, Stites.)

Art 270. Romanesque and Gothic Art. (3)

Architectural, sculptural and painting problems in Western Europe. (Grubar, Stites.)

Art 271. Early Christian and Byzantine Art. (3)

A study of church architecture, sculpture, painting, mosaic, and the minor arts, with particular emphasis on iconography. (Grubar, Stites.)

Art 275. Classical Art. (3)

Problems in pre-Greek, Greek, Etruscan and Roman art. (Grubar, Stites.)

Art 280. Far Eastern Art. (3)

Painting, sculpture, architecture and the minor arts of China, Japan and related countries from the earliest times to the end of the nineteenth century. (Staff.)

Art 285. Middle and Near Eastern Art. (3)

The art and architecture of India, Iran, Mesopotamia and Egypt. (Staff.)

Art 399. Research-Thesis. (1-6)

(Staff.)

BOTANY

Professors: BAMFORD, GAUCH, APPLEMAN (EMERITUS), KRAUSS, NORTON (EMERITUS) AND D. T. MORGAN.

Associate Professors: BROWN, RAPPLEYE AND SISLER.

Assistant Professors: WILSON, PATERSON, GALLOWAY, KRUSBERG, KANTZES AND BELL.

The Department of Botany offers a graduate course of study leading to the degree of Master of Science and to the degree of Doctor of Philosophy. The student may pursue major work in any one of the three main divisions of the Department, namely: plant physiology, plant pathology, or plant morphology, cytology and cytogenetics. Since a thesis based on original research is required for each degree, a qualified student may be allowed to pursue a problem of his own choosing, but it is more probable that the subject of his research will be that already in progress since the Department is devoted to a study of basic agricultural problems as well as projects of a more

Botany

fundamental nature. An individual employed at a nearby institution may submit a thesis based on his research work at the institution under the direction of, and subject to prior approval by, a member of the faculty.

Laboratory facilities are available for research in each division, and there are ample greenhouses and plot space available on the campus or adjacent University farm land.

In addition to the normal requirements of the Graduate School, one must possess a reading knowledge of one language, either French, German, Latin, or Russian, before the Master of Science degree is granted.

PLANT PHYSIOLOGY

For Graduates and Advanced Undergraduates

Bot. 101. Plant Physiology. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Bot. 1 and general chemistry. Laboratory fee, \$6.00. A survey of the general physiological activities of plants. (Krauss.)

Bot. 102. Plant Ecology. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, Bot. 1, and permission of instructor. Laboratory fee, \$5.00. A study of plants in relation to their environments. Plant successions and formations of North America are treated briefly and local examples studied.

For Graduates

Bot. 200. Plant Biochemistry. (2)

First semester. Prerequisites, Bot. 101 and elementary organic chemistry, or equivalent. A study of the important substances in the composition of the plant body and the chemical changes occurring therein. (Galloway.)

Bot. 201. Plant Biochemistry Laboratory. (2)

First semester. Two laboratory periods a week. Prerequisite, Bot. 200 or concurrent registration therein. Laboratory fee, \$10.00. Application of apparatus and techniques to the study of the chemistry of plant materials. (Galloway.)

Bot. 202. Plant Biophysics. (2)

Second semester. (Not offered, 1962-1963.) Prerequisites, Bot. 1 and introductory physics, or equivalent. An advanced course dealing with the operation of physical phenomena in plant life processes. (Galloway.)

Bot. 203. Biophysical Methods. (2)

Second semester. (Not offered, 1962-1963.) Two laboratory periods a week. Laboratory course to accompany Bot. 202. Laboratory fee, \$10.00. (Galloway)

Bot. 204. Growth and Development. (2)

First semester. (Not offered, 1962-1963.) Prerequisite, 12 semester hours of plant science. A study of current developments in the mathematical treatment of growth and

the effects of radiation, plant hormones, photoperiodism, and internal biochemical balance during the development of the plant. (Krauss.)

Bot. 205. Mineral Nutrition of Plants. (2)

Second semester. Reports on current literature are presented and discussed in connection with recent advances in the mineral nutrition of plants. (Krauss.)

Bot. 209. Physiology of Algae. (2)

First semester. Prerequisite, Bot. 201, the equivalent in allied fields or permission of instructor. Laboratory fee, \$10.00. A study of the physiology and comparative biochemistry of the algae. Laboratory techniques and recent advances in algal nutrition, photosynthesis, and growth will be reviewed. (Krauss.)

Bot. 210. Physiology of Algae-Laboratory. (1)

First semester. One laboratory period a week. Prerequisites, previous or concurrent enrollment in Bot. 209, and permission of instructor. Laboratory fee, \$10.00. Special laboratory techniques involved in the study of algal nutrition. (Krauss.)

PLANT MORPHOLOGY, CYTOLOGY, AND TAXONOMY

For Graduates and Advanced Undergraduates

Bot. 111. Plant Anatomy. (3)

First semester. One lecture and two laboratory periods a week. Prerequisite, Bot. 110 or equivalent. Laboratory fee, \$5.00. The origin and development of the organs and tissue systems in the vascular plants. (Rappleye.)

Bot. 113. Plant Geography. (2)

First semester. Prerequisite, Bot. 1 or equivalent. A study of plant distribution throughout the world and the factors generally associated with such distribution. (Brown.)

Bot. 115. Structure of Economic Plants. (3)

Second semester. (Not offered, 1962-1963.) One lecture and two laboratory periods a week. Laboratory fee, \$5.00. A detailed microscopic study of the anatomy of the chief fruit and vegetable crops. (Rappleye.)

Bot. 116. History and Philosophy of Botany. (1)

Second semester. (Not offered, 1962-1963.) Prerequisite, 20 semester hours credit in Biological Sciences, including Bot. 1 or equivalent. Discussion of the development of ideas and knowledge about plants, leading to a survey of contemporary work in botanical science. (Bamford.)

Bot. 117. General Plant Genetics. (2)

Second semester. Prerequisite, Bot. 1 or equivalent. The basic principles of plant genetics are presented; the mechanics of transmission of the hereditary factors in relation to the life cycle of seed plants, the genetics of specialized organs and tissues, spontaneous and induced mutations of basic and economic significance, gene action, genetic maps, the fundamentals of polyploidy, and genetics in relation to methods of plant breeding are the topics considered. (D. T. Morgan.)

Bot. 136. Plants and Mankind. (2)

First semester. A survey of the plants which are utilized by man, the diversity of such utilization, and their historic and economic significance. (Rappleye.)

Botany

Bot. 151S. Teaching Methods in Botany. (2)

Summer session. Five two-hour laboratory and demonstration periods a week. Prerequisite, Bot. 1, or equivalent. Laboratory fee, \$5.00. A study of the biological principles of the common plants, and demonstrations, projects, and visual aids suitable for teaching in primary and secondary schools. (Paterson.)

Bot. 153. Field Botany and Taxonomy. (2)

Summer session. Prerequisite, Bot. 1 or general biology. Laboratory fee, \$5.00. The identification of trees, shrubs, and herbs, emphasizing the native plants of Maryland. Manuals, keys, and other techniques will be used. Numerous short field trips will be taken. Each student will make an individual collection. (Brown.)

For Graduates

Bot. 211. Cytology. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisite, introductory genetics. Laboratory fee, \$10.00. A detailed study of the chromosomes in mitosis and meiosis, and the relation of these to current theories of heredity and evolution. (D. T. Morgan.)

Bot. 212. Plant Morphology. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisites, Bot. 11, Bot. 111, or equivalent. Laboratory fee, \$5.00. A comparative study of the morphology of the flowering plants, with special reference to the phylogeny and development of floral organs. (Rapplee.)

Bot. 215. Plant Cytogenetics. (3)

First semester. (Not offered, 1962-1963.) Two lectures and one laboratory period a week. Prerequisites, introductory genetics. Laboratory fee, \$10.00. An advanced study of the current status of plant genetics, particularly gene mutations and their relation to chromosome changes in corn and other favorable genetic materials. (D. T. Morgan.)

PLANT PATHOLOGY

For Graduates and Advanced Undergraduates

Bot. 122. Research Methods in Plant Pathology. (2)

First or second semester. Two laboratory periods a week. Prerequisite, Bot. 20, or equivalent. Laboratory fee, \$5.00. Advanced training in the basic research techniques and methods of plant pathology. (Wilson.)

Bot. 123. Diseases of Ornamental Plants. (2)

Second semester. (Not offered, 1962-1963.) Prerequisite, Bot. 20, or equivalent. Symptoms, control measures, and other pertinent information concerning the diseases which affect important ornamental plants grown in the eastern states. (Wilson.)

Bot. 124. Diseases of Tobacco and Agronomic Crops. (2)

First semester. Prerequisite, Bot. 20, or equivalent. The symptoms and control of the diseases of tobacco, forage crops, and cereal grains. (O. D. Morgan.)

Bot. 125. Diseases of Fruit Crops. (2)

First semester. (Not offered, 1962-1963.) Prerequisite, Bot. 20, or equivalent. Symptoms and control of the diseases affecting fruit production in the eastern United States. (Weaver.)

Bot. 126. Diseases of Vegetable Crops. (2)

Second semester. Prerequisite, Bot. 20, or equivalent. The recognition and control of diseases affecting the production of important vegetable crops grown in the eastern United States. (Bell.)

Bot. 128. Mycology. (4)

Second semester. Two lectures and two laboratory periods a week. Prerequisite, Bot. 2, or equivalent. Laboratory fee, \$6.00. An introductory study of the morphology, classification, life histories, and economics of the fungi. (Wilson.)

Bot. 152S. Field Plant Pathology. (1)

Summer session. (Not offered, 1962.) Daily lecture for three weeks. Prerequisite, Bot. 20 or equivalent. Laboratory fee, \$5.00. A course for county agents and teachers of vocational agriculture. Discussion and demonstration of the important diseases in Maryland crops. (Staff.)

For Graduates

Bot. 221. Virus Diseases. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, Bot. 20 and Bot. 101. Laboratory fee, \$10.00. Consideration of the physical, chemical, and physiological aspects of plant viruses and plant diseases. (Sisler.)

Bot. 223. Physiology of Fungi. (2)

Second semester. Prerequisites, Organic Chemistry and Bot. 101 or the equivalent in bacterial or animal physiology. A study of various aspects of fungal metabolism, nutrition, biochemical transformations, fungal products, and mechanism of fungicidal action. (Sisler.)

Bot. 224. Physiology of Fungi Laboratory. (1)

Second semester. One laboratory period a week. Prerequisite, Bot. 223 or concurrent registration therein. Laboratory fee, \$10.00. Application of equipment and techniques in the study of fungal physiology. (Sisler.)

Bot. 226. Plant Disease Control. (3)

First semester. (Not offered, 1962-1963.) Prerequisite, Bot. 20, or equivalent. An advanced course dealing with the theory and practices of plant disease control.

Bot. 241. Plant Nematology. (4)

Second semester. Two lectures and two laboratory periods a week. Prerequisite, Bot. 20 or permission of instructor. Laboratory fee \$10.00. The study of plant-parasitic nematodes, their morphology, anatomy, taxonomy, genetics, physiology, ecology, host-parasite relations and control. Recent advances in this field will be emphasized. (Krusberg.)

Bot. 301. Special Problems in Botany. (2 or 3)

First or second semester. Credit according to time scheduled and organization of course. Maximum credit toward an advanced degree for the individual student at the discretion

Business Administration

of the Department. This course may be organized as a lecture series on a specialized advanced topic, or may consist partly, or entirely, of experimental procedures. It may be taught by visiting lecturers, or by resident staff members. Problems or topics may be in: A—Physiology; B—Ecology; C—Pathology; D—Mycology; E—Nematology; F—Cytology; G—Cytogenetics; H—Morphology; I—Anatomy; or J—Taxonomy.

(Staff.)

Bot. 302. Seminar in Botany. (1)

First and second semesters. Prerequisite, permission of the instructor. Discussion of special topics and current literature in all phases of botany.

(Staff.)

Bot. 399. Research. (Credit according to work done.)

A minimum of 6 credit hours is required for the M.S. degree, and an additional minimum of 12 hours is required for the Ph.D degree. Students must be qualified to pursue with profit the research to be undertaken.

(Staff.)

BUSINESS ADMINISTRATION

Professors: FREDERICK, CLEMENS, COOK, FISHER, GENTRY, PYLE, SWEENEY, SYLVESTER, TAFF, WEDEBERG AND WRIGHT.

Associate Professors: ASHMEN, DAWSON, NELSON AND SPIVEY.

The degree of Master of Business Administration is conferred on those students who satisfactorily complete the requirements which are set forth in the section of this catalog entitled, "Requirements for the Degree of Master of Business Administration."

For Graduates and Advanced Undergraduates

B. A. 100. Office Operations and Management. (3)

Prerequisite, junior standing. Deals with the principles of scientific management as they apply to the examination, improvement, installation, and operation of the most effective paperwork methods and systems that a given organization can use to achieve its objectives. Procedure flow analysis and form design for control of paperwork; process, work distribution, and layout charts, distribution of authority and responsibility for office activities are among the areas considered.

B. A. 101. Integrated Data Processing for Internal Control. (3)

Prerequisite, junior standing. Laboratory fee, \$10.00. Comprises the bridge between accounting principles and the actualities of handling a large volume of data in modern business and government operations. Considers the measures necessary to marshall accounting and other information for internal control and for service to management at all levels. The basic principles involved in the combining of accounting and recording machines through a keyboard "language" that is "understood" by other machines will be presented. Punched-card tabulating and punched-tape methods are studied. Graphic flow-chart methods are used to integrate these data-gathering techniques into normal accounting and reporting processes.

(Staff.)

B. A. 102. Electronic Data Processing Systems. (3)

Prerequisites, B. A. 165, junior standing. Laboratory fee, \$10.00. The electronic digital computer and its use as a business data processor. The course includes the following areas: (1) Organization of business information; (2) Characteristics of commercially available equipment; (3) Flow charts; (4) Problems in reduction of processes to component parts; and (5) Programming typical internal control problems in business and government. (Staff.)

B. A. 103. Office Automation and Management Problems. (3)

Prerequisite, B. A. 114, or B. A. 165, or B. A. 168. Administrative problems experienced in introducing computer systems, feasibility studies, and the effect of office automation upon management and organization applied to case situations. Procedure distribution charts, flow diagrams, process charts, and other tools used by methods analysts are developed in actual situations. (Staff.)

B. A. 109. Accounting Techniques. (3)

Prerequisite, B.A. 21. Required of accounting majors. Specialized problems of accounting techniques; cash and accrual basis, single entry, and complex adjustments and corrections of prior year's data. (Staff.)

B. A. 110, 111. Intermediate Accounting. (3, 3)

First and second semesters. Prerequisite, a grade of "B" or better in B.A. 21 for majors in accounting or consent of instructor. A comprehensive study of the theory and problems of valuation of assets, application of funds, corporation accounts and statements, and the interpretation of accounting statements. (Staff.)

B. A. 112. Records Management. (2)

First and second semesters. Prerequisite, junior standing. Laboratory fee, \$7.50. Specific management methods and techniques that have proved valuable in the creation, use, maintenance, protection and disposition of records are studied. (Staff.)

B. A. 118. Governmental Accounting. (3)

Prerequisite, B.A. 111, or consent of instructor. The content of this course covers the scope and functions of governmental accounting. It considers the principles generally applicable to all forms and types of governmental bodies and a basic procedure adaptable to all governments. (Wright.)

B. A. 121. Cost Accounting. (4)

Prerequisite, a grade of "B" or better in B.A. 21 for majors in accounting or consent of instructor. A study of the fundamental procedures of cost accounting, including those for job orders, process and standard cost accounting systems. (Sweeney.)

B. A. 122. Auditing Theory and Practice. (3)

First semester. Prerequisite, B.A. 111. A study of the principles and problems of auditing and application of accounting principles to the preparation of audit working papers and reports. (Wright.)

B. A. 123. Income Tax Accounting. (4)

Prerequisite, a grade of "B" or better in B.A. 21 for majors in accounting, or consent of instructor. A study of the important provisions of the Federal Tax Law, using illustrative examples, selected questions and problems, and the preparation of returns. (Wedeborg.)

Business Administration

B. A. 124. Budgeting and Control. (3)

Prerequisite, B.A. 21. The use of financial data in controlling an enterprise. Budgetary formulation, execution and appraisal. The use of accounting in managerial decision making. (Staff.)

B. A. 125. C.P.A. Problems. (3)

Second semester. Prerequisite, B.A. 124, or consent of instructor. A study of the nature, form and content of C.P.A. examinations by means of the preparation of solutions to, and an analysis of, a large sample of C.P.A. problems covering the various accounting fields. (Wedeborg.)

B. A. 126. Advanced Accounting. (3)

Prerequisite, B.A. 111. Advanced accounting theory applied to specialized problems in partnerships, estates and trusts, banks, mergers and consolidations, receiverships and liquidations; also budgeting and controllership. (Wedeborg.)

B. A. 128. Advanced Cost Accounting. (2)

Prerequisite, B.A. 121. A continuation of basic cost accounting with special emphasis on process costs, standard costs, joint costs and by-product costs. (Sweeney.)

B. A. 130. Elements of Business Statistics I. (3)

Prerequisite, junior standing. Required for graduation. Laboratory fee, \$3.50. An introductory course. Emphasis is placed upon statistical inference. Topics covered include statistical observation, frequency distributions, averages, measures of variability, elementary probability, sampling distributions, problems of estimation, simple tests of hypothesis, index numbers, time series, graphical and tabular presentation. Selected applications of the techniques are drawn from economics, industrial management, marketing and accounting. (Nelson, Anderson.)

B. A. 131. Elements of Business Statistics II. (3)

Second semester. Prerequisite, B.A. 130. Laboratory fee, \$3.50. Review of elementary probability. Population distributions. Sampling distributions; binomial, Poisson, normal, "t", chi-square and F. Estimates and tests of hypotheses concerning the mean, variance and other parameters. Introduction to analysis of variance, linear regression, and correlation. (Nelson, Anderson.)

B. A. 132. Sample Surveys in Business and Economics. (3)

First semester of odd-numbered years. Prerequisite, B.A. 130. Laboratory fee, \$3.50. A general course in scientific sample survey techniques. Review of elementary probability, characteristics of good estimators, errors of observation, simple random sampling, stratified random sampling, cluster sampling, comparison of various sample designs, cost functions, examples of actual survey practices. (Nelson.)

B. A. 134. Statistical Quality Control. (3)

Second semester. Prerequisite, B.A. 130. Laboratory fee, \$3.50. Statistical fundamentals, theory, construction and use of control charts, acceptance sampling by attributes and variables, work sampling and other industrial applications of statistics. (Staff.)

B. A. 135. Time Series Analysis and Forecasting. (3)

First semester of even-numbered years. Alternates with B.A. 132. Prerequisite, B.A. 133. Laboratory fee, \$3.50. Classical time series analysis, trend, periodic and irregular components, seasonal adjustment, growth curves, recent developments in time series

analysis, techniques of forecasting and quantities as labor force, capital formation, demand and sales. (Staff.)

B. A. 140. Business Finance. (3)

Prerequisites, B.A. 21 and Econ. 140. This course deals with principles and practices involved in the organization, financing, and rehabilitation of business enterprises; the various types of securities and their use in raising funds, apportioning income, risk, and control; intercorporate relations; and new developments. Emphasis on solution of problems of financial policy faced by management. (Fisher.)

B. A. 141. Investment Management. (3)

First semester. Prerequisite, B.A. 140. A study of the principles and methods used in the analysis, selection, and management of investments; investment programs, sources of investment information, security price movements, government, real estate, public utility, railroad, and industrial securities. (Calhoun.)

B. A. 142. Banking Policies and Practices. (3)

Second semester. Prerequisite, Econ. 140. A study of the organization and management of the Commercial Bank, the operation of its departments, and the methods used in the extension of commercial credit. (Calhoun.)

B. A. 143. Credit Management. (3)

First and second semesters. Prerequisite, B.A. 140. A study of the nature of credit and the principles applicable to its extension and redemption for mercantile and consumer purposes; sources of credit information and analysis of credit reports; the organization and management of a credit department for effective control. Recent developments and effective legal remedies available. (Calhoun.)

B. A. 148. Advanced Financial Management. (3)

Second semester. Prerequisite, B.A. 140. Advanced course designed for students specializing in finance. Emphasis is placed upon the techniques employed by executives in their application of financial management practice to selected problems and cases. Critical classroom analysis is brought to bear upon actual methods and techniques used by business enterprises. (Fisher.)

B. A. 150. Marketing Management. (3)

Prerequisite, B.A. 150a. A study of the work of the marketing division in a going organization. The work of developing organizations and procedures for the control of marketing activities are surveyed. The emphasis throughout the course is placed on the determination of policies, methods, and practices for the effective marketing of various forms of manufactured products. (Staff.)

B. A. 151. Advertising. (3)

First semester. Prerequisite, B.A. 150. A study of the role of advertising in the American economy; the impact of advertising on our economic and social life, the methods and techniques currently applied by advertising practitioners, the role of the newspaper, magazine, and other media in the development of an advertising campaign, modern research methods to improve the effectiveness of advertising, and the organization of the advertising business. (Gentry.)

B. A. 152. Advertising Copy and Layout. (3)

Second semester. Prerequisites, B.A. 151, and senior standing. A study of the practices and techniques of copy writing and layout. The student will participate in ex-

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ercises designed to teach him the essential principles of writing copy for various media and presenting ideas in visual form. The course deals with the development of ideas rather than art forms. (Gentry.)

B. A. 153. Purchasing Management. (3)

First semester. Prerequisites, B.A. 150 and senior standing. Retail store organization, determining the proper sources, quality and quantity of supplies, and methods of testing quality; price policies, price forecasting, forward buying, bidding and negotiation; budgets and standards of achievement. Particular attention is given to government purchasing and methods and procedures used in their procurement. (Gentry.)

B. A. 154. Retail Store Management. (3)

First semester. Prerequisites, B.A. 150 and senior standing. Retail store organization, location, layout and store policy; pricing policies, price lines, brands, credit policies, records as a guide to buying; purchasing methods; supervision of selling; training and supervision of retail sales force; and administrative problems. (Cook.)

B. A. 155. Problems in Retail Merchandising. (3)

Second semester. Prerequisite, B.A. 154. Designed to develop skill in the planning and control of merchandise stocks. Deals with buying policies, pricing, dollar and unit control procedures, mark-up and mark-down policies, merchandise budgeting, and the gross margin-expense-net earnings relationships. (Cook.)

B. A. 156. Marketing Research Methods. (3)

Second semester. Prerequisites, B.A. 130 and B.A. 150. This course is intended to develop skill in the use of scientific methods in the acquisition, analysis and interpretation of marketing data. It covers the specialized fields of marketing research, the planning of survey projects, sample design, tabulation procedure and report preparation. (Cook.)

B. A. 157. Foreign Trade Management. (3)

Prerequisites, B.A. 150 and senior standing. Functions of various exporting agencies; documents and procedures used in exporting and importing transactions. Methods of procuring goods in foreign countries; financing of import shipments; clearing through the customs districts; and distribution of goods in the United States. (Heye.)

B. A. 158. Advertising Problems. (3)

Second semester. Prerequisite, B.A. 151. This course is concerned with the way in which business firms use advertising as a part of their marketing program. The case study method is used to present advertising problems taken from actual business practice. Cases studied illustrate problems in demand stimulation, media selection, advertising research, etc. (Gentry.)

B. A. 159. Marketing Principles and Organization. (3)

Prerequisite, Econ. 32 or 37. This is an introductory course in the field of marketing. Its purpose is to give a general understanding and appreciation of the forces operating, institutions employed, and methods followed in marketing agricultural products, natural products, services, and manufactured goods. (Staff.)

B. A. 160. Personnel Management. (3)

Prerequisite, Econ. 160. This course deals with the problems of directing and supervising employees, under modern industrial conditions. Two phases of personnel ad-

ministration are stressed, the application of scientific management and the importance of human relations in this field. (Staff.)

B. A. 161. Personnel Management Techniques. (3)

Job evaluation and merit rating and other personnel management techniques generally employed in business. (Sylvester.)

B. A. 163. Industrial Relations. (3)

Second semester. Prerequisites, B.A. 160 and senior standing. A study of the development and methods of organized groups in industry with reference to the settlement of labor disputes. An economic and legal analysis of labor union and employer association activities, arbitration, mediation, and conciliation; collective bargaining, trade agreements, strikes, boycotts, lockouts, company unions, employee representation, and injunctions. (Sylvester.)

B. A. 164. Recent Labor Legislation and Court Decisions. (3)

First semester. Prerequisites, B.A. 160 and senior standing. Case method analysis of the modern law of industrial relations. Cases include the decisions of administrative agencies, courts and arbitration tribunals. (Sylvester.)

B. A. 166. Business Communications. (3)

First and second semesters. Prerequisite, junior standing. A systematic study of the principles of effective written communications in business. The fundamental aim is to develop the ability to write clear, correct, concise, and persuasive business letters and reports. (Patrick.)

B. A. 168. Management and Organization Theory. (3)

The historical development of management and organization theory, nature of the management process and functions and its future development. The role of the manager as an organizer and director, the communication process, goals and responsibilities. (Spivey.)

B. A. 169. Production Management. (3)

First and second semesters. Prerequisites, Econ. 160 and B.A. 11. Studies the operation of a manufacturing enterprise. Among the topics covered are product development, plant location, plant layout, production planning and control, methods analysis, time study, job analysis, budgetary control, standard costs, and problems of supervision. (Staff.)

B. A. 170. Principles of Transportation. (3)

Prerequisite, Econ. 32 or 37. A general course covering the five fields of transportation, their development, service and regulation. (This course is a prerequisite for all other transportation courses.) (Taff.)

B. A. 171. Industrial Traffic Management. (3)

Prerequisite, B.A. 170. Covers the details of classification and rate construction for ground and air transportation. Actual experiences in handling tariffs and classifications is provided. It is designed for students interested in the practical aspects of shipping and receiving and is required for all majors in transportation administration. (Taff.)

B. A. 172. Motor Transportation. (3)

First semester. Prerequisite, B.A. 170. The development and scope of the motor carrier industry, different types of carriers, economics of motor transportation, services

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available, federal regulation, highway financing, allocation of cost to highway users, highway barriers. (Taff.)

B. A. 173. Water Transportation. (3)

Prerequisite, B.A. 170. Water carriers of all types, development and types of services, trade routes, inland waterways, company organization, the American Merchant Marine as a factor in national activity. (Heye.)

B. A. 174. Commercial Air Transportation. (3)

Prerequisite, B.A. 170. The air transportation system of the United States; airways, airports, airlines. Federal regulation of air transportation. Problems and services of commercial air transportation; economics, equipment, operations, financing, selling of passenger and cargo services. Air mail development and services. (Frederick.)

B. A. 175. Airline Administration. (3)

Prerequisite, B.A. 174. Practices, systems and methods of airline management; actual work in handling details and forms required in planning and directing maintenance, operations, accounting and traffic transactions, study of airline operations and other manuals of various companies. (Frederick.)

B. A. 176. Motor Carrier Administration. (3)

Second semester. Prerequisites, B.A. 170 and 172. Over the road and terminal operations and management, the use of management controls, management organization, Interstate Commerce Commission policy as affecting management decisions. (Taff.)

B. A. 177. Motion Economy and Time Study. (3)

Second semester. Prerequisites, B.A. 169 and senior standing. A study of the principles of motion economy, simo charts, micromotion study, the fundamentals of time study, job evaluation, observations, standard times, allowances, formula construction and wage payment plans. (Towson.)

B. A. 180, 181. Business Law. (3, 3)

First and second semesters. Prerequisites, senior standing. Required in all business organization curriculums. Legal aspects of business relationships, contracts, negotiable instruments, agency, partnerships, corporations, real and personal property, and sales. (Dawson, Tierney.)

B. A. 182. Advanced Business Law. (3)

Prerequisites, B.A. 180 and 181. Legal aspects of wills, insurance, torts and bankruptcy. (Dawson.)

B. A. 184. Public Utilities. (3)

Prerequisites, Econ. 32 or 37 and senior standing. Using the regulated industries as specific examples attention is focused on broad and general problems in such diverse fields as constitutional law, administrative law, public administration, government control of business, advanced economic theory, accounting, valuation and depreciation, taxation, finance, engineering and management. (Clemens.)

B. A. 189. Business and Government. (3)

Second semester. Prerequisites, Econ. 32 or 37 and senior standing. A study of the role of government in modern economic life. Social control of business as a remedy for the abuses of business enterprise arising from the decline of competition. Criteria of and limitations on government regulation of private enterprise. (Clemens.)

B. A. 190. Life Insurance. (3)

First semester. Prerequisite, Econ. 32 or 37. A general survey of life insurance: Its institutional development, selection of risks, mathematical calculations, contract provision, kinds of policies, their functional uses, industrial and group contracts and government supervision. (Clickner.)

B. A. 191. Property Insurance. (3)

Second semester. Prerequisite, Econ. 32 or 37. A study of the insurance coverages written to protect individuals and business; fire, extended coverage, business interruption, automobile, liability, fidelity, surety, inland marine and ocean marine. Hazards, rate-making, legal principles, standard forms and business practices are discussed. (Clickner.)

B. A. 195. Real Estate Principles. (3)

First semester. Prerequisite, Econ. 32 or 37. This course covers the nature and uses of real estate, real estate as a business, basic legal principles, construction problems and home ownership, city planning, and public control ownership of real estate. (Clickner.)

B. A. 196. Real Estate Finance. (3)

Second semester. Prerequisite, Econ. 32 or 37. This course includes consideration of the factors influencing real estate values, methods and techniques in the general appraisal of real estate by brokers and professional appraisers, and general problems in real estate financing. (Clickner.)

B. A. 199. Business Policy. (3)

Prerequisite, senior standing. A case study course in which the aim is to have the student apply both what he has learned of general management principles and their specialized functional applications to the overall management function in the enterprise. (Staff.)

For Graduates

B. A. 210. Advanced Accounting Theory. (2, 3)

Prerequisite, B. A. 111.

(Wedeborg, Fisher.)

B. A. 220. Managerial Accounting. (3)

(Wedeborg, Wright.)

B. A. 221, 222. Seminar in Accounting.

(Wedeborg, Wright.)

B. A. 226. Accounting Systems.

(Wedeborg, Sweeney.)

B. A. 228. Research in Accounting.

(Wedeborg.)

B. A. 229. Studies of Special Problems in the Fields of Control and Organization.

(Staff.)

B. A. 240. Seminar in Financial Management. (1-3)

Prerequisite, B. A. 140.

(Fisher.)

B. A. 249. Studies of Special Problems in the Field of Financial Administration.

(Fisher.)

B. A. 250. Problems in Sales Management. (1-3)

(Cook, Reid.)

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- B. A. 251. Problems in Advertising.* (3) (Gentry.)
- B. A. 252. Problems in Retail Store Management.* (3) (Cook.)
- B. A. 257. Seminar in Marketing Management.* (Cook, Gentry, Reid.)
- B. A. 258. Research Problems in Marketing.* (Cook, Gentry.)
- B. A. 262. Seminar in Contemporary Trends in Labor Relations.* (3) (Sylvester.)
- B. A. 265. Development and Trends in Industrial Management.* (3) (Spivey.)
- B. A. 266. Research in Personnel Management.* (Sylvester.)
- B. A. 267. Research in Industrial Relations.* (Sylvester.)
- B. A. 269. Studies of Special Problems in Employer-Employee Relationships.* (Sylvester.)
- B. A. 270. Seminar in Air Transportation.* (3) (Frederick.)
- B. A. 271. Theory of Organization.* (3) (Spivey.)
- B. A. 272. Seminar in Management of Physical Distribution.* (3) (Taff.)
- B. A. 275. Seminar in Motor Transportation.* (3) (Taff.)
- B. A. 277. Seminar in Transportation.* (3) (Frederick.)
- B. A. 280. Seminar in Business and Government Relationships.* (Staff.)
- B. A. 284. Seminar in Public Utilities.* (3) (Clemens.)
- B. A. 290. Seminar in Insurance.* (3) (Clickner.)
- B. A. 295. Seminar in Real Estate.* (3) (Clickner.)
- B. A. 399. Thesis Research.* (Staff.)

CHEMICAL ENGINEERING

Professors: BECKMANN, DUFFEY, PENNINGTON AND SCHROEDER.

Associate Professor: SILVERMAN.

Assistant Professor: GOMEZPLATA.

The Department directs the programs of graduate students who plan to qualify for the degree of Master of Science or Doctor of Philosophy in the Department of Chemical Engineering. Courses in the subject area of nuclear technology and engineering are listed with chemical engineering courses below; and courses in the subject area of metallurgy are listed on Page 59.

The basic requirements for the degrees of Master of Science and Doctor of Philosophy are set forth on pages 7 and 12 of this catalog. Supplemental regulations for the guidance of candidates for these degrees in the Department of Chemical Engineering are available in the department office.

For Graduates and Advanced Undergraduates

Ch. E. 103,f,s. Elements of Chemical Engineering. (3, 3)

First and second semesters. Three hours a week. Prerequisites, Chem. 3, Math. 21, Phys. 21. Theoretical discussion of underlying philosophy and methods in chemical engineering and elementary treatment of important operations involving fluid flow, heat flow, evaporation, humidity and air conditioning, distillation, absorption, extraction, and filtration. Illustrated by problems and consideration of typical processes.

(Gomezplata.)

Ch. E. 104. Chemical Engineering Seminar. (1)

Both semesters. One hour a week. Prerequisite, permission of the Department of Chemical Engineering. The content of this course is constantly changing so a student may receive a number of credits by re-registration. Students prepare reports on current problems in chemical engineering and participate in the discussion of such reports.

(Marsheck.)

Ch. E. 105,f,s. Advanced Unit Operations. (5, 5)

Two lectures and one all-day laboratory a week. Prerequisites, Ch. E. 103,f,s, Chem. 189, 190. Laboratory fee, \$8.00 per semester. Advanced theoretical treatment of basic chemical engineering operations. Study and laboratory operation of small scale semi-commercial type equipment. A comprehensive problem involving theory and laboratory operations is included to illustrate the development of a plant design requiring the utilization of a number of fundamental topics.

(Bonney, Staff.)

Ch. E. 106,f,s. Minor Problems. (6, 6)

Laboratory fee, \$8.00 per semester.

(Staff.)

Ch. E. 109,f,s. Chemical Engineering Thermodynamics. (3, 3)

Three hours a week. Prerequisites, Chem. 187, 189, Ch. E. 103,f,s, or permission of instructor. A study of the application of the principles of engineering and chemical thermodynamics to some industrial problems encountered in the practice of chemical engineering.

(Bonney.)

Ch. E. 112, 113. Industrial Chemical Technology. (2, 3)

Prerequisite, Ch. E. 103,f,s, or simultaneous registration therein, or permission of the Department of Chemical Engineering. A study of the major chemical processes and industries combined with quantitative analysis of process requirements and yields. Plant inspection trips, reports, and problems.

(Schroeder.)

Ch. E. 114. Applications of Electrochemistry. (4)

Laboratory fee, \$8.00.

(Staff.)

Ch. E. 116 Applied Mathematics in Chemical Engineering I. (3)

Three lectures a week. Prerequisites, Math. 20, 21 and Ch. E. 103,f,s. A study of methods for analysis and solution of chemical engineering problems by use of differential equations. Graphical, numerical and statistical methods and approximations by use of infinite series are covered.

(Gomezplata.)

Chemical Engineering

Ch. E. 117. Applied Mathematics in Chemical Engineering II. (3)

Three lectures a week. Prerequisite, Ch. E. 116 or equivalent. Material covered includes formulation and solution of partial differential equations that arise in chemical engineering problems. Solution of chemical engineering problems by the calculus of finite differences, and numerical solution of partial differential equations are covered.

(Gomezplata.)

Ch. E. 123, 124. Elements of Plant Design. (2, 3)

First and second semesters. Two lectures a week, first semester; two lectures and one laboratory period a week, second semester. Prerequisites, Ch. E. 103,f,s; Ch. E. 116; Chem. 189. The solution of typical problems encountered in the design of chemical engineering plants.

(Schroeder.)

Ch. E. 131. Chemical Engineering Economics. (2)

Second semester. Two lectures a week. Prerequisites, simultaneous registration in or completion of Ch. E. 112, 113, 109,f,s, and 123, or permission of instructor. Economic evaluation of chemical processes. Determination of investment and operating costs for chemical engineering plants. Effect of risk and taxation on profits from such plants.

(Schroeder.)

Ch. E. 140. Introduction to Nuclear Technology. (2)

Two lectures a week. Prerequisites, Math. 21 and Phys. 21. Engineering problems of the different parts of the nuclear energy complex, including basic theory, nuclear reactor design, and isotopic and chemical separations are discussed. The emphasis is on the nuclear fission reactor. This is an orientation course for those only generally interested in applied atomic energy.

(Duffey.)

Ch. E. 142. Environmental Consideration of Nuclear Engineering. (3)

First semester. Three lectures a week. Prerequisite, permission of instructor. Engineering analysis of protection of the public and the environment from the hazards of nuclear energy operations. Emphasis is on the handling and disposal of gaseous, liquid and solid radioactive wastes. Meteorological, hydrological and geological phases are included. Typical problems encountered from mining of ores through nuclear reactor operations and chemical separations are considered. Legislative and economic factors, site selection, plant design and operation as related to the environment are discussed.

(Silverman.)

Ch. E. 145. Applications of Differential Equations and Statistics in Chemical Engineering. (3)

Second semester. One lecture, two laboratory periods per week. Prerequisites, Ch. E. 103,f,s, Ch. E. 116, or permission of the instructor.

(Staff.)

Ch. E. 148. Nuclear Technology Laboratory. (2 to 4)

One or two lectures, one or two laboratory periods a week. Prerequisites, Chem. 3, Phys. 21, Math. 21, Ch. E. 140 or equivalents and permission of instructor. Laboratory fee, \$8.00 per semester. Laboratory operations of equipment demonstrating techniques of detecting and making measurements of nuclear or high energy radiation. Radiation safety experiments are included. Both a sub-critical reactor and a critical reactor are used occasionally as a source of radiation.

(Silverman.)

For Graduates

Ch. E. 201. Graduate Unit Operations. (5)

First semester. One hour conference, three or more laboratory periods a week. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00.

Advanced theoretical treatment of typical unit operations in chemical engineering. Problems. Laboratory operation of small scale semi-commercial units with supplemental reading, conferences and reports. (Bonney.)

Ch. E. 202. Gas Analysis. (3)

One semester. One lecture and two laboratory periods a week. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00. Quantitative determination of common gases, fuel gases, gaseous vapors, and important gaseous impurities. Problems. (Bonney.)

Ch. E. 203. Graduate Seminar. (1)

One hour a week. Required of all graduate students in chemical engineering. The content of this course is constantly changing so a student may receive a number of credits by re-registration. Students prepare reports on current problems in chemical engineering and participate in the discussion of such reports. (Bonney.)

Ch. E. 207,f,s. Advanced Plant Design Studies. (3, 3)

Three conference hours a week. Prerequisite, permission of the Department of Chemical Engineering. (Schroeder.)

Ch. E. 209,f,s. Plant Design Studies Laboratory. (3, 3)

Three laboratory periods a week. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00 per semester. (Bonney.)

Ch. E. 210,f,s. Gaseous Fuels. (2, 2)

Two hours a week. Prerequisite, permission of the Department of Chemical Engineering. An advanced treatment of some of the underlying scientific principles involved in the production, transmission and utilization of gaseous fuels. Problems in design and selection of equipment.

Ch. E. 214,f,s. Corrosion and Metal Protection. (4)

Four lecture hours a week. Prerequisite, Ch. E. 114 or Chem. 189 or Chem. 190 or consent of the instructor. The subjects to be covered include: theories of corrosion of ferrous and nonferrous metals, passive films, corrosion inhibitors, metal cleaning, stress corrosion, corrosive chemicals, electrolytic protection, restoration of ancient bronzes, organic coatings, metal coloring, parkerizing, hot dip coatings, plated coatings, and selection of engineering materials. Class demonstrations will illustrate the subject matter. Due to the diversity of subjects and scattered sources, considerable outside reading will be necessary.

Ch. E. 216. Unit Processes of Organic Technology. (3)

Second semester. Three lectures a week. Prerequisite, permission of the Department of Chemical Engineering. This course coordinates the study of fundamental principles of organic synthesis with the requirements of the industrial plant. (Bonney.)

Ch. E. 217. Unit Processes of Organic Technology Laboratory. (2)

Second semester. Two or more laboratory periods a week. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00 per semester. Pilot plant operation of processes such as halogenation, hydration, nitration, oxidation, reduction and sulfonation. (Bonney.)

Ch. E. 240, 241. Advanced Heat and Mass Transfer. (3, 3)

First and second semesters. Elective of graduate students in chemical engineering and others. Prerequisite, permission of the Department of Chemical Engineering. The technical and scientific elements of the mathematical theory of heat and mass transfer. (Gomezplata.)

Chemical Engineering

Ch. E. 250. Chemical Engineering Practice. (6)

Four hours conference and forty hours a week of work in laboratory and plant for eight weeks. Prerequisite, permission of the Department of Chemical Engineering. (Staff.)

Ch. E. 280, 281. Graduate Chemical Engineering Thermodynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Ch. E. 109,f,s, or Ch. E. 116, or permission of instructor. Advanced studies of the applications of the principles of engineering and chemical thermodynamics to some industrial problems encountered in the practice of chemical engineering. (Bonney.)

Ch. E. 290. Chemical Engineering Process Kinetics. (3)

First semester. Three lectures a week. Prerequisite, permission of instructor. Methods of application of kinetic data to the design of reactors for industrially important processes are illustrated by solution of typical problems. Treatment for both homogeneous and heterogeneous reactions are given. (Gomezplata.)

Ch. E. 301. Seminar in Nuclear Engineering. (1)

First and second semesters. One meeting a week. Survey of nuclear engineering literature, and oral presentation of prepared reports. Since the content of this course changes, a student may receive a number of credits by re-registration. (Duffey, Silverman.)

Ch. E. 302, 303. Nuclear Reactor Engineering. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, permission of instructor. The engineering problems of the design, construction and operation of typical nuclear reactors, including general design, nuclear reactor theory, materials of construction, heat transfer, and control. Emphasis is toward commercial nuclear reactors. (Duffey.)

Ch. E. 305. Sub-critical Nuclear Reactor Laboratory. (3)

One lecture, two laboratory periods a week. Prerequisite, permission of instructor. Laboratory fee, \$8.00 per semester. Experimental work with the subcritical nuclear reactor. The appropriate radiation detection equipment is used. Experiments, such as multiplication factors, neutron flux distribution, and neutron activation are carried out. (Duffey.)

Ch. E. 308, 309. Nuclear Reactor Laboratory. (4, 4)

Two lectures and two laboratory periods a week: Prerequisite, permission of instructor. Laboratory fee, \$10.00 per semester. Experiments demonstrating the techniques of using a critical nuclear reactor for research and development work as well as for industrial operations are performed. The University of Maryland swimming pool reactor is employed. Experiments on reactor start-up and operation, shielding, kinetics, neutron flux distributions, neutron and gamma spectrum, cross section measurements are included. Experiments will include practice with a nuclear reactor simulator. (Duffey.)

Ch. E. 311, 312. Nuclear Separation Engineering. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, Ch. E. 140 or equivalent, and permission of instructor. Application of chemical engineering to the chemical and isotopic separations necessary for nuclear reactor operation. These separations include (1) processing of uranium, thorium, and other ores; (2) chemical separation of plutonium, uranium, fission products and other elements from materials irradiated in nuclear reactors; (3) treatment of radioactive wastes; (4) isotopic separation of U235; and (5) isotopic separation of heavy water and other desired materials. Ch. E.

311 concerns primarily chemical separations, while Ch.E. 312 concerns mostly isotopic separations and fuel cycles. Ch. E. 311 is not necessarily a prerequisite for Ch. E. 312. (Silverman.)

Ch. E. 313. Selected Topics in Nuclear Engineering. (2)

Two lectures a week. Prerequisite, permission of instructor. Topics of current interest and recent advances in the nuclear engineering field. Because of the rapid advances in the field, information on special topics of much practical importance is continually becoming available. Such information will be presented in this course. Since the content changes, re-registration may be permitted. (Duffey, Silverman.)

Ch. E. 314. Special Problems in Nuclear Engineering.

Credit hours to be arranged. Prerequisite, consent of instructor. Laboratory fee, \$10.00 per semester. Research or special study. This is for individual projects on a graduate level. (Duffey, Silverman.)

Ch. E. 315, 316. Non-Power Uses of Nuclear or High Energy Radiation. (2, 2)

Two lectures a week. Prerequisite, permission of instructor. An engineering survey of the current applications and those under development. Included are such uses of radiation as synthesizing chemicals, preserving foods, control of industrial processes. Design of irradiation installations, e.g., cobalt 60 gamma ray sources, electronuclear machine arrangements, and specially built nuclear reactors are considered. (Silverman.)

Ch. E. 320, 321. Advanced Nuclear Reactor Theory. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, Ch. E. 302, 303, or equivalent and permission of instructor. The theory of the calculation of critical masses, neutron flux distribution, neutron energy spectrum, kinetics of reactor behavior and gamma ray attenuation are presented. Multigroup treatment of reflected reactors, solution of the transport equations, perturbation theory, and other advanced calculation techniques are included. (Duffey.)

Ch. E. 399. Research in Chemical Engineering.

Credit hours to be arranged. Laboratory fee, \$8.00 per semester. The investigation of special problems and the preparation of a thesis in partial fulfillment of the requirements of an advanced degree. (Bonney, Schroeder, Duffey, Gomezplata.)

Ch. E. 399. Research in Nuclear Engineering.

Credit hours to be arranged. Laboratory fee, \$10.00 per semester. The investigation of special problems and the preparation of a thesis in partial fulfillment of the requirements of an advanced degree. (Duffey, Silverman.)

METALLURGY

NOTE—Metallurgy is a subject area in the Department of Chemical Engineering.

For Graduates and Advanced Undergraduates

Met. 104. Senior Metallurgical Seminar. (1)

One hour a week. Students prepare reports on current problems in metallurgy and

Metallurgy

participate in the discussion of such reports. The content of this course is constantly changing so a student may receive a number of credits by re-registration.

(McWilliams.)

Met. 150, 151. Physical Metallurgy. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 21 and Phys. 21. States of matter, physical structure of gases, liquids and solids; physical structure and constitution of metals; properties as related to atomic structures; x-ray and crystal structure effect of mechanical working, heat treatment and composition; constitution and properties of alloy systems; phase transformation and diffusion theory; casting, shaping, welding, and testing metal objects.

(Pennington.)

Met. 152, 153. Physical Metallurgy Laboratory. (2, 2)

First and second semesters. Two three hour laboratories per week. Prerequisites, Math. 21, Phys. 21, Met. 150, 151 (may be taken concurrently). Laboratory fee, \$8.00 per semester. These courses are associated with Met. 150, 151, but are not required with the lecture courses except in the case of metallurgy majors.

(McWilliams.)

Met. 164, 166. Thermodynamics of Metallurgical Processes. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Chem. 187, 189; Chem. 188, 190. The application of the principles of thermodynamics to metallurgical systems with emphasis on steel making; laws of chemical reactions; materials and reactions in steel making processes; applications of theory to steel making; applications of theory to selected nonferrous systems.

(Pennington.)

Met. 168, 170. Metallurgical Investigations. (2, 4)

First semester. Two three-hour laboratory periods a week. Second semester. Three lectures and one three-hour laboratory period a week. Prerequisites, concurrent registration in or completion of Met. 182, 183. Laboratory fee, \$8.00 per semester. A study of the basic metals industry in which typical metallurgical processes in plant installations are considered in some detail. Class and individual assignments involving laboratory work and literature reviews.

(Pennington.)

Met. 172. Light Metals and Alloys. (2)

First semester. Two lectures a week. Prerequisites, Met. 150, 151. The physical metallurgy of aluminum, magnesium, titanium, and their alloys. Discussion of the classic researches that have determined the course of thinking regarding such metals and alloys. Pertinent phase diagrams of industrial importance to light alloys. The special metallurgical processes influencing the fabrication and use of light metals.

(Loring.)

Met. 182, 183. Optical and X-Ray Metallography. (4, 4)

First and second semesters. Three lectures and one laboratory period a week. Prerequisites, Met. 150, 151, or permission of instructor. Laboratory fee, \$8.00 per semester. The application at an advanced level of the principles of metallography, with emphasis on the correlation of associated test procedures; constitution of metal systems and phase transformation; alloy steels; hardenability and tempering of quenched steels.

(Kruger.)

Met. 188, 189. Alloy Steels I, II. (2, 2)

First and second semesters. Two lectures per week. Prerequisite, graduate or undergraduate standing. (Met. 188 is not prerequisite to Met. 189.) Recent advances in the physical metallurgy of steel; ferrite, cementite, and austenite; the isothermal transformation of austenite; decomposition of austenite by continuous cooling; the effects of various metallurgical treatments on the mechanical properties of steels. The properties

of quenched and tempered steels; importance of hardening in engineering applications; calculation of hardenability; variable affecting hardenability; intensifiers; effects of alloying elements on the mechanical properties of steels; efficient use of alloying elements in steel. (Offered off-campus.) (Loring.)

For Graduates

Met. 220, 221. Solid Phase Reactions. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Chem. 187, 189; Chem. 188, 190; Met. 182, 183; or permission of instructor. The application of thermodynamics to the study of phase equilibria and transformations in metals; mechanisms and rate determining factors in solid phase reactions in metals; order-disorder phenomena, diffusion processes, nucleation theory, precipitation from solid solution, eutectoid decomposition. (Moore.)

Met. 224, 225. Advanced X-Ray Metallography. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisites, Math. 114, 115; Met. 182, 183. Laboratory fee, \$8.00 per semester. Analysis of crystallography or martensite reactions, and transformations in general; analysis of complex diffracting systems. (Staff.)

Met. 228. Seminar in Metallurgy. (1)

First and second semesters. One meeting a week. Required of graduate students in metallurgical curriculum. Survey of metals literature, and oral presentation of prepared reports. The content of this course is constantly changing, so a student may receive a number of credits by re-registration. (Pennington.)

Met. 229. Gases in Metals. (2)

Second semester. Two lectures per week. Prerequisites, Met. 182, 183, or permission of the instructor. A consideration of the behavior of gases in metals with emphasis on the action of hydrogen in solid metals. (Pennington.)

Met. 230, 231. Mechanical Metallurgy. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 114, 115, Met. 182, 183. Theory of plastic flow and rupture of polycrystalline metals; the influence of combined stresses, rate of deformation and temperature variation on the flow and rupture of metals. Flow and fracture in single crystals; theoretical crystal plasticity, theory of failure, recovery, recrystallization, and texture formation. (Offered off-campus.) (Moore.)

Met. 232, 233. Advanced Physical Metallurgy. (3, 3)

First and second semesters. Three lectures a week. Required of graduate students in metallurgical curriculum. The principles of X-ray metallography; the atomic theory of metals; magnetic materials; phase equilibria; review of important binary and ternary systems; diffusion and transformation in the solid state. (Offered off-campus.) (Moore.)

Met. 238. Metallurgy of Nuclear Reactor Materials I. (2)

First semester. Two lectures a week. Prerequisites, Met. 150-151. Theory and practice relating to metals such as uranium, thorium, and plutonium. The preparation of such metals in their purest state for use in nuclear reactors. The physical, metallurgical and mechanical characteristics of fissionable metals, their melting, casting, fabrication, and heat treatment. The alloys of uranium, thorium, and plutonium. Theoretical con-

Chemistry

siderations and precautions in their preparation, investigation and use. Discussion of phase diagrams of nuclear alloy systems. (Offered off-campus.) (Loring.)

Met. 239. Metallurgy of Nuclear Reactor Materials II. (2)

Second semester. Two lectures a week. Prerequisite, Met. 238. Theory and practice of nuclear metals used in reactors including structural materials such as beryllium and zirconium, and metals used for transfer of heat such as sodium, bismuth, and various low melting alloys. Discussion of pertinent phase diagrams. Radiation damage, mass transfer, and other specialized effects. (Offered off-campus.) (Loring.)

Met. 399. Research in Metallurgy.

Credit hours to be arranged. Laboratory fee, \$8.00 per semester. The investigation of special problems and the preparation of a thesis in partial fulfillment of the requirements of an advanced degree. (Pennington.)

CHEMISTRY

Professors: WHITE, LIPPINCOTT, MASON*, PRATT, REEVE, ROLLINSON, SCHAMP*, SVIRBELY, VEITCH AND WOODS.

Research Professor: BAILEY.

Associate Professors: JAQUITH, PICKARD, PURDY, STUNTZ AND VANDERSLICE*.

Assistant Professors: BOYD, FALLON*, GORDON, GRIM, HENERY-LOGAN, KASLER, LAKSHMANAN, MAISCH* AND WEISSMAN*.

Departmental regulations have been assembled for the guidance of candidates for graduate degrees. Copies of these regulations are available from the Department of Chemistry.

Laboratory fees in Chemistry are \$12.00 per laboratory course per semester, except in Chemistry 270, for which the fee is \$20.00.

ANALYTICAL CHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 123. Quantitative Analysis. (4)

First semester. Two lectures and two three-hour laboratory periods per week. Prerequisite, Chem. 21 or equivalent. An intensive study of the theory and techniques of inorganic quantitative analysis, including volumetric, gravimetric, electrometric and colorimetric methods. Required of all students majoring in chemistry. (Stuntz.)

Chem. 125. Instrumental Analysis. (4)

Second semester. Two lectures and six hours of laboratory per week. Prerequisite, Chem. 189, 190 or concurrent registration therein. A study of the application of physico-chemical methods to analytical chemistry. Techniques such as polarography, potentiometry, conductivity and spectrophotometry will be included. (Purdy.)

* Members of the Institute for Molecular Physics.

Chem. 166, 167. Food Analysis. (3, 3)

First and second semesters. One lecture and two three-hour laboratory periods per week. Prerequisites, Chem. 33, 34. (Staff.)

For Graduates

Chem. 206, 208. Spectrographic Analysis. (1, 1)

One three-hour laboratory a week. Prerequisite, Chem. 188, 190, and consent of the instructor. Registration limited. (White.)

Chem. 221, 223. Chemical Microscopy. (2, 2)

First and second semesters. One lecture and one three-hour laboratory period a week. Prerequisite, consent of instructor. Registration limited. A study of the construction and optics of the microscope and its applications in chemistry, with particular emphasis on the optical properties of crystals. (Stuntz.)

Chem. 225. Advanced Instrumental Analysis. (4)

Second semester. Two lectures and six hours of laboratory per week. Prerequisite, Chem. 189, 190 or concurrent registration therein. An intensive study of physio-chemical methods as applied to analytical chemistry. Laboratory work will include experiments in such fields as polarography, coulometry and amperometry, potentiometry and spectrophotometry, nephelometry. (Purdy.)

Chem. 226. Advanced Quantitative Analysis. (4)

First semester. Two lectures and two three-hour laboratory periods per week. Prerequisite, Chem. 125, 225, or consent of instructor. A study of advanced methods with emphasis on the modern techniques of analytical chemistry. (Purdy.)

BIOCHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 161, 163. Biochemistry. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, Chem. 33, or Chem. 37. (Henery-Logan.)

Chem. 162, 164. Biochemistry Laboratory. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisite, Chem. 34, or Chem 38. (Henery-Logan.)

For Graduates

Chem. 261, 263. Advanced Biochemistry. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, Chem. 143 or consent of instructor. (Veitch.)

Chem. 262, 264. Advanced Biochemistry Laboratory. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisite, consent of the instructor. (Veitch.)

Chem. 265. Enzymes. (2)

First semester. Two lectures a week. Prerequisite, Chem. 163. (Veitch.)

Chemistry

Chem. 267. The Chemistry of Natural Products. (2)

First or second semester. Two lectures a week. Prerequisite, Chem. 143. The chemistry and physiological action of natural products. Methods of isolation, determination of structure, and synthesis. (Henery-Logan.)

Chem. 268. Special Problems in Biochemistry. (2-4)

First and second semesters. Two to four three-hour laboratory periods a week. Prerequisites, Chem. 161, 162, 163, 164, and consent of the instructor. (Veitch, Henery-Logan.)

Chem. 269. Advanced Radiochemistry. (2)

Second semester. Two lectures per week. Prerequisite, Chem. 205 or consent of instructor. Utilization of radioisotopes with special emphasis on applications to problems in the life sciences. (Lakshmanan.)

Chem. 270. Advanced Radiochemistry Laboratory. (1 or 2)

Second semester. One or two four-hour laboratory periods per week. Prerequisites, Chem. 210 and Chem. 269 (or concurrent registration in Chem. 269) and consent of instructor. Registration limited. Laboratory training in utilization of radioisotopes with special emphasis on applications to problems in life sciences. (Lakshmanan.)

INORGANIC CHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 101. Advanced Inorganic Chemistry. (2)

Second semester. Two lectures a week. Prerequisites, Chem. 37, 123. (Staff.)

Chem. 102. Inorganic Preparations. (2)

Second semester. Two three-hour laboratory periods per week. Prerequisite, Chem. 123. (Boyd.)

Chem. 111. Chemical Principles. (4)

Two lectures and two three-hour laboratory periods a week. Prerequisites, Chem. 1 and 3, or equivalent. Not open to students seeking a major in the physical sciences, since the course content is covered elsewhere in their curricula. A course in the principles of chemistry with accompanying laboratory work consisting of single quantitative experiments. (Credit applicable only toward degree in College of Education.) (Jaquith.)

For Graduates

Chem. 201, 203. The Chemistry of the Rarer Elements. (2, 2)

First and second semesters. Two lectures a week. (Gordon, White.)

Chem. 202, 204. Advanced Inorganic Laboratory. (2)

First and second semesters. Two three-hour laboratory periods a week. (Staff.)

Chem. 205. Radiochemistry. (2)

Two lectures a week. (Rollinson.)

Chem. 207. Chemistry of Coordination Compounds. (2)

Two lectures a week. (Rollinson.)

Chem. 209. Non-aqueous Inorganic Solvents. (2)

First or second semester. Two lectures a week. (Jaquith.)

Chem. 210. Radiochemistry Laboratory. (1 or 2)

One or two four-hour laboratory periods a week. Registration limited. Prerequisites, Chem. 205 (or concurrent registration therein) and consent of instructor.

(Lakshmanan.)

Chem. 211, 213. Selected Topics in Inorganic Chemistry. (2, 2)

First or second semester. Two lectures a week. Prerequisites, Chem. 201, 203 or equivalent. An examination of some current topics in modern inorganic chemistry.

(Boyd, Grim.)

ORGANIC CHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 141, 143. Advanced Organic Chemistry. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, Chem. 37, 38. An advanced study of the compounds of carbon. (Reeve.)

Chem. 144. Advanced Organic Laboratory. (2-4)

First and second semesters. Two three-hour laboratory periods a week. Prerequisites, Chem. 37, 38. (Pratt.)

Chem. 146, 148. The Identification of Organic Compounds. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisites, Chem. 141, 143, or concurrent registration therein. The systematic identification of organic compounds. (Pratt.)

Chem. 150. Organic Quantitative Analysis. (2)

First and second semesters. Two three-hour laboratory periods per week. Prerequisite, consent of instructor. The semi-micro determination of carbon, hydrogen, nitrogen, halogen and certain functional groups. This course may be substituted for Chem. 144 in the chemistry major curriculum. (Kasler.)

For Graduates

(One or more courses from the following group 241-254 will customarily be offered each semester.)

Chem. 240. Organic Chemistry of High Polymers. (2)

Two lectures a week. Prerequisites, Chem. 141, 143. An advanced course covering the synthesis of monomers, mechanism of polymerization, and the correlation between structure and properties in high polymers. (Bailey.)

Chem. 241. Stereochemistry. (2)

Two lectures a week. (Woods.)

Chem. 245. The Chemistry of the Steroids. (2)

Two lectures a week. (Pratt.)

Chemistry

- Chem. 249. Physical Aspects of Organic Chemistry.* (2)
Two lectures a week. (Woods.)
- Chem. 251. The Heterocyclics.* (2)
Two lectures a week. (Pratt.)
- Chem. 254. Advanced Organic Preparations.* (2-4)
First and second semesters. Two or four three-hour laboratory periods a week. (Pratt.)
- Chem. 258. The Identification of Organic Compounds, an Advanced Course.* (2-4)
First and second semesters. Two to four three-hour laboratory periods a week. Prerequisites, Chem. 141, 143, or concurrent registration therein. (Pratt.)

PHYSICAL CHEMISTRY

For Graduates and Advanced Undergraduates

- Chem. 187, 189. Physical Chemistry.* (3, 3)
First and second semesters. Three lectures a week. Prerequisites, Chem. 19 or 21; Phys. 20, 21; Math. 20, 21. This course must be accompanied by Chem. 188, 190, unless excused by the instructor. (Svirbely.)
- Chem. 188, 190. Physical Chemistry Laboratory.* (2, 2)
First and second semesters. Two three-hour laboratory periods a week. A laboratory course for students taking Chem. 187, 189. (Staff.)
- Chem. 192, 194. Glassblowing Laboratory.* (1, 1)
First and second semesters. One three-hour laboratory period a week. Prerequisite, consent of instructor. (Carruthers.)

For Graduates

The common prerequisites for the following courses are Chem. 187 and 189.
One or more courses of the group, 281-323, will be offered each semester, depending on demand.

- Chem. 281. Theory of Solutions.* (2)
Two lectures a week. Prerequisite, Chem. 307, or equivalent. (Svirbely.)
- Chem. 285. Colloid Chemistry.* (2)
Two lectures a week. (Pickard.)
- Chem. 287. Infra-red and Raman Spectroscopy.* (2)
Two lectures a week. Prerequisites, Chem. 141, 143, 187, 189 and consent of instructor. (Lippincott.)
- Chem. 295. Heterogeneous Equilibria.* (2)
Two lectures a week. (Pickard.)
- Chem. 299. Reaction Kinetics.* (3)
Three lectures a week. (Svirbely.)
- Chem. 303. Electrochemistry.* (3)
Three lectures a week. (Pickard.)

Chem. 304. Electrochemistry Laboratory. (2)

Two three-hour laboratory periods a week. Prerequisite, consent of instructor.
(Svirbely.)

Chem. 307. Chemical Thermodynamics. (3)

Three lectures a week. (Pickard.)

Chem. 311. Physicochemical Calculations. (2)

Two lectures a week. (Pickard.)

Chem. 313. Molecular Structure. (3)

Three lectures a week. (Staff.)

Chem. 317. Chemical Crystallography. (3)

Three lectures per week. Prerequisite, consent of instructor. (Staff.)

Chem. 319, 321. Quantum Chemistry. (3, 2)

Three and two lectures a week. Prerequisite, Chem. 307, or equivalent.
(Lippincott, Mason.)

Chem. 323. Statistical Mechanics and Chemistry. (3)

Three lectures a week. Prerequisite, Chem. 307 or equivalent. (Staff.)

SEMINAR AND RESEARCH

Chem. 351. Seminar. (1)

First and second semesters. (Staff.)

Chem. 399. Thesis Research.

First and second semesters, summer session. (Staff.)

CIVIL ENGINEERING

Professors: LOONEY, ALLEN, LEPPER, MAVIS AND OTTS.

Associate Professors: BARBER, COURNYN, PIPER AND WEDDING.

Lecturers: BLOEM, ROBERTS AND WALKER.

The Civil Engineering Department offers graduate work in the following fields: engineering materials, highway engineering, hydraulic engineering, sanitary engineering, soils and foundations, and structural engineering, leading to the degrees of Master of Science and Doctor of Philosophy.

For Graduates and Advanced Undergraduates

C. E. 100. Seminar. (3)

Second semester. Two lectures each week. Prerequisite, Math. 64 or concurrent registration.
(Looney, Garber.)

Civil Engineering

C. E. 101. Civil Engineering Planning. (3)

First and second semesters. One lecture and two laboratories each week. (Piper.)

C. E. 110. Surveying I. (3)

First semester. Two lectures and one laboratory period a week. (Gohr, Staff.)

C. E. 111. Surveying II. (3)

Second semester. Two lectures and one laboratory period a week. (Gohr, Staff.)

C. E. 112. Photogrammetry. (2)

First or second semester. Two lectures and one laboratory period a week. (Gohr.)

C. E. 121, 122. Advanced Strength of Materials. (3, 3)

First and second semesters. Two lectures and one laboratory period a week.
(Lepper, Wedding.)

C. E. 140. Fluid Mechanics. (3)

First semester. Three lectures and required laboratory each week. (Cournyn.)

C. E. 142. Advanced Fluid Mechanics. (3)

First semester. Three lectures a week. (Cournyn.)

C. E. 150. Soil Mechanics. (4)

First semester. Three lectures and one laboratory period each week. (Barber.)

C. E. 160. Structural Design. (4)

Second semester. Three lectures and one laboratory period each week. (Allen, Piper.)

C. E. 161. Structural Design. (4)

First semester. Three lectures and one laboratory period each week. (Allen, Piper.)

C. E. 162. Structural Analysis. (3)

First semester. Two lectures per week. (Looney, Garber.)

C. E. 163. Structural Analysis. (3)

Second semester. Two lectures per week. (Looney, Garber.)

C. E. 170. Water Supply. (3)

First semester. Three lectures and required laboratory each week. (Otts.)

C. E. 171. Sewerage. (4)

Second semester. Three lectures and required laboratory each week. (Otts.)

C. E. 180. Transportation. (3)

Second semester. Three lectures per week. (Wedding.)

C. E. 181. Highways. (3)

Second semester. Two lectures and one laboratory period a week. (Barber.)

C. E. 199. Research. (3)

First and second semesters. Prerequisite, senior standing. (Staff.)

For Graduates

C. E. 221, 222. Advanced Strength of Materials. (3, 3)

First and second semesters. Prerequisites, C.E. 23 and 30 or equivalent. Analyses for stress and deformation in engineering members by the methods of mechanics of materials and elementary theories of elasticity and plasticity. Problems in flexure, torsion, plates and shells, stress concentrations, indeterminate combinations, residual stresses, stability. (Lepper.)

C. E. 223. Experimental Stress Analysis. (3)

Second semester. Prerequisite, C.E. 221 or permission of instructor. Experimental methods of stress and strain analysis for static and impact forces. Use of structural models; brittle and plastic material methods; analogies; photoelasticity; optical, mechanical and electrical strain gages and instrumentation. (Wedding.)

C. E. 224. Advanced Engineering Materials Laboratory. (3)

First or second semester. Prerequisite, C.E. 23 and 30, or equivalent. Critical examination of the methods for testing engineering materials and structures under static, repeated, sustained and impact forces. Laboratory experiments for the determination of strength and stiffness of structural alloys, concrete and other construction materials. Critical examination of the effects of test factors on the determination of engineering properties. (Lepper, Wedding.)

C. E. 225, 226. Advanced Properties of Materials. (3, 3)

First and second semesters. Prerequisite, C.E. 221 and 222. Modern theories of the structure of matter applied to the study of elastic and plastic deformation of materials under static, repeated, sustained and impact forces. Elements of solid state physics, crystal structure, slip and dislocation theory; polycrystalline solids. Effects of low and high temperature, loading rates, and state of stress on mechanical properties and fracture. Critical study of tests and their application to strength of members. (Lepper.)

C. E. 227, 228. Theories of Concrete and Granular Materials. (3, 3)

First and second semesters. Prerequisites, C.E. 221, 222, and 224. Critical reviews of analytical and experimental investigations of the behavior of concretes under diverse conditions of loading and environment. Mechanics of granular aggregates and the chemistry of cements. Theories for the design of Portland cement and asphaltic concrete mixtures. Relations between laboratory testing and field experience. (Wedding.)

C. E. 231, 232. Theory of Concrete Mixtures I, II. (3, 3)

First and second semesters. Prerequisite, C.E. 30, or equivalent. The second semester of this course is open only to students who are majoring in materials. Methods for the design of concrete mixtures, and a study of factors affecting the properties of the resulting concrete. (Wedding.)

C. E. 241. Hydraulic Engineering. (3)

First or second semester. Prerequisite, C.E. 140, 141, or equivalent. Water power and flood control. Analysis of the principal features of a water power project with special reference to reservoir, waterway, dam, plant accessories, and power house equipment. Complete report on a water power project required, including costs and power valuation. (Cournyn.)

C. E. 251. Soil Mechanics. (3)

First or second semester. Prerequisite, C.E. 150. (Barber.)

Civil Engineering

C. E. 252. Advanced Foundations. (3)

First or second semesters. Prerequisites, C.E. 150, 162, and 163, or equivalents.

(Barber.)

C. E. 261. Civil Engineering Planning. (3)

First semester. Prerequisites, C.E. 160, 161, 162 and 163, or equivalent. General planning of large engineering projects involving industrial plants, bridges, highways, railroads, and port developments. Emphasis on general planning followed by design construction and cost estimates.

(Piper.)

C. E. 262. Civil Engineering Planning. (3)

Second semester. Prerequisite, C.E. 261. City and regional planning and development. Special problem of municipal development. Emphasis on preparing engineering reports, financing and cost estimates. Preparation of presentation to public bodies.

(Piper.)

C. E. 263. Theory of Structural Design. (3)

First semester. Prerequisite, C.E. 160, 161, 162, and 163, or equivalent. Advanced structural theory applied to the design of bridges and buildings. Methods of analysis for indeterminate structures, including movement distribution, Maxwell's method, virtual work, reciprocal theory, Muller Breslau's principle, and classical analytical methods.

(Looney.)

C. E. 264. Theory of Structural Design. (3)

Second semester. Prerequisite, C.E. 263. Correlation of theory, experience, and experiments in study of structural behavior, proportioning, and preliminary design. Special design problems of fatigue, buckling, vibrations, and impact.

(Looney.)

C. E. 265, 266. Concrete Structures. (3, 3)

First and second semesters. Prerequisites, C.E. 263 and 264. Examination of the fundamental basis for the design of reinforced concrete structures. Correlation of laboratory research, advanced structural theory and mechanics, and design methods. Application to the design of modern forms of concrete structures, such as folded plates, slabs, thin shells, life slabs, prestressing, and precasting.

(Looney.)

C. E. 267, 268. Steel Structures. (3, 3)

First and second semesters. Prerequisites, C.E. 263 and 264. Design of large steel structures, such as cantilever and continuous trusses and girders, steel arches, suspension bridges, and tall building frames. Special problems of secondary stresses, wind bracing, stability and bracing, and interaction and deformation stresses. Study of specifications, factor of safety and ultimate strength, and the relation between structural tests and design.

(Looney.)

C. E. 271, 272. Sanitary Engineering Design. (3, 3)

First and second semesters. Prerequisite, C.E. 170 and 171, or equivalent. Practical problems in the design of sewer systems and appurtenances; sewage treatment plants; water collection and distribution systems; water purification plants. Selected design of structures related to the operation of water supply and sewerage systems and industrial waste treatment plants.

(Otts.)

C. E. 281, 282. Advanced Highway Engineering. (3, 3)

First and second semesters. Prerequisites, C.E. 150, 180, and 181 or equivalent. Reconnaissance and location, surveys and plans, drainage, subgrade structure, low-cost roads, base courses, flexible and rigid pavement design. Highway organization planning economy, and finance. Geometric design and traffic engineering.

(Barber.)

C. E. 298. Seminar.

First or second semester. Credit in accordance with work outlined by the Department. Prerequisite, consent of the Department of Civil Engineering. (Staff.)

C. E. 399. Research.

First and second semesters. Credit in accordance with work done. (Staff.)

CLASSICAL LANGUAGES AND LITERATURES

Professor: AVERY.

The Department of Classical Languages and Literatures offers no program leading to the degrees of Master of Arts or Doctor of Philosophy at the present time. The following courses, however, are offered upon sufficient demand to supply the needs of graduate students in other fields, such as English, history, and modern foreign languages, who may wish to work in Latin in connection with their degree programs in such fields. Students should consult their major professors with respect to application of credit hours in Latin to their graduate programs.

For Graduates and Advanced Undergraduates

Prerequisite, Latin 61 or equivalent.

Latin 101. Catullus and the Roman Elegiac Poets. (3)

Lectures and readings on Catullus as a writer of lyric, an imitator of the Alexandrians, and as a writer of elegy, and on Tibullus, Propertius, and Ovid as elegists. The reading of selected poems of the four authors. Reports. (Avery.)

Latin 102. Tacitus. (3)

Lectures and readings on Greek and Roman historiography before Tacitus and on the author as a writer of history. The reading of selections from the Annals and Histories. Reports. (Avery.)

Latin 103. Roman Satire. (3)

Lectures and readings on the origins and development of Roman satire. The reading of selections from the satires of Horace, Petronius' *Cena Trimalchionis*, and the satires of Juvenal. Reports. (Avery.)

Latin 104. Roman Comedy. (3)

Lectures and readings on the origins and development of Roman comedy. The reading of selected plays of Plautus and Terence. Reports. (Avery.)

Latin 105. Lucretius. (3)

Lectures and readings on Greek and Roman Epicureanism. The reading of selections from the *De rerum natura*. Reports. (Avery.)

Latin 111. Advanced Latin Grammar. (3)

An intensive study of the morphology and syntax of the Latin language supplemented by rapid reading. (Avery.)

Comparative Literature

For Graduates

Prerequisite, Latin 61 or equivalent.

Latin 210. Vulgar Latin Readings. (3)

An intensive study of the phonology, morphology, and syntax of Classical Latin, followed by the study of the deviations of Vulgar Latin from the classical norms, with the reading of illustrative texts. The reading of selections from the *Preregrinatio ad loca sancta* and the study of divergences from classical usage therein, with special emphasis on those which anticipate subsequent developments in the Romance Languages. Reports. (Avery.)

COMPARATIVE LITERATURE

Professors: ALDRIDGE, COOLEY, FALLS, GOODWYN, MCMANAWAY (P.T.), MURPHY, PRAHL AND ZEEVELD.

Associate Professors: MANNING, PARSONS AND WEBER.

The Department of Comparative Literature offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy.

MASTER OF ARTS

Candidates for the degree must have an undergraduate major in one language or literature acceptable for admission to graduate work in that department. Those who offer a major in English must have in addition a knowledge of at least one foreign language. Requirements for the degree include Comparative Literature 201 and nine other hours of courses in Comparative Literature as well as 12 hours of courses in English, classical or foreign languages.

DOCTOR OF PHILOSOPHY

Candidates must have an M.A. degree in comparative literature or any language or literature. Departmental requirements for the degree include Comparative Literature 301 and 33 additional hours of courses in comparative literature, English, classical or foreign languages. The student must designate as a special field a chronological period (such as the Renaissance, Enlightenment, or Age of Realism) or a literary type (such as epic, drama or novel) or a literary theme (such as patriotism, the Faust legend or primitivism). The majority of his courses must relate to the special field and be selected from at least three departments so as to satisfy the major-minor requirements of the Graduate School. The dissertation must be related to the major field.

For Graduates and Advanced Undergraduates

Comp. Lit. 101, 102. Introductory Survey of Comparative Literature. (3, 3)

First semester: Survey of the background of European literature through study of Greek

and Latin literature in English translations, discussing the debt of modern literature to the ancients. Second semester: Study of medieval and modern Continental literature. (Staff.)

Comp. Lit. 103. The Old Testament as Literature. (3)

Second semester. A study of the sources, development and literary types. (Staff.)

Comp. Lit. 105. Romanticism in France. (3)

First semester. Lectures and readings in the French romantic writers from Rousseau to Baudelaire. Texts are read in English translations. (Parsons.)

Comp. Lit. 106. Romanticism in Germany. (3)

Second semester. Continuation of *Comp. Lit. 105*. German literature from Buerger to Heine in English translations. (Prahl.)

Comp. Lit. 107. The Faust Legend in English and German Literature. (3)

First semester. A study of the Faust legend of the Middle Ages and its later treatment by Marlowe in *Dr. Faustus* and by Goethe in *Faust*. (Prahl.)

Comp. Lit. 112. Ibsen. (3)

First semester. A study of the life and chief works of Henrik Ibsen with special emphasis on his influence on the modern drama. (Staff.)

Comp. Lit. 114. The Greek Drama. (3)

First semester. The chief works of Aeschylus, Sophocles, Euripides and Aristophanes in English translations. Emphasis on the historic background, on dramatic structure, and on the effect of the Attic drama upon the mind of the civilized world. (Prahl.)

Comp. Lit. 125. Literature of the Middle Ages. (3)

Narrative, dramatic, and lyric literature of the Middle Ages; studies in translations. (Cooley.)

In addition, all literature courses numbered 100 or above offered in the Classics, English, and Foreign Languages Departments may be accepted for Comparative Literature credit.

For Graduates

Comp. Lit. 201. Problems in Comparative Literature. (3)

For M.A. candidates only. (Aldridge.)

Comp. Lit. 258. Folklore in Literature. (3)

A study of folk heroes, motifs, and ideas as they appear in the world's masterpieces. (Goodwyn.)

Comp. Lit. 301. Seminar in Themes and Types. (3)

Second semester. Prerequisites, one year's work in literature and the knowledge of one language other than English. Intensive study of fundamental motifs and trends in western literature. (Aldridge.)

In addition, all literature courses numbered 200 or above offered in the Classics, English, and Foreign Languages Departments may be accepted for Comparative Literature credit.

DAIRY

Professors: ARBUCKLE, DAVIS AND KEENEY.

Associate Professor: MATTICK.

Assistant Professors: HEMKEN, KING, STEWART, VANDERSALL AND WILLIAMS.

The Dairy Department offers work leading to the degree of Master of Science and Doctor of Philosophy. Candidates for the Doctor of Philosophy degree have the option of studying in one of two major fields: dairy production, which is concerned with breeding, nutrition and physiology of dairy animals, or dairy technology, which is concerned with chemical, bacteriological, and nutritional aspects of dairy products, as well as the industrial phases of milk processing.

For Graduates and Advanced Undergraduates

Dairy 102. Physiology of Reproduction. (3)

Second semester, alternate years. (Offered 1962-63.) Two lectures and one laboratory per week. Prerequisite, permission of instructor. Anatomy, endocrine physiology, reproductive processes and artificial insemination of cattle. (Williams.)

Dairy 103. Physiology of Milk Secretion. (3)

Second semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period per week. Prerequisite, permission of instructor. The anatomy and growth of the mammary gland and the metabolism and physiology of biosynthesis in the ruminant. (Williams.)

Dairy 105. Dairy Cattle Breeding. (3)

Second semester, alternate years. (Offered 1962-63.) Two lectures and one laboratory period a week. Prerequisites, Dairy 1, Zool. 104. A specialized course in breeding dairy cattle. Emphasis is placed on methods of evaluation and selection, systems of breeding, and breeding programs. (Davis.)

Dairy 108. Dairy Technology. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Dairy 1, Microb. 133, Chem. 1, 3. Laboratory fee, \$3.00. (Keeney.)

Dairy 109. Market Milk. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Dairy 1, Microb. 133, Chem. 1, 3. Laboratory fee, \$3.00. (King.)

Dairy 110. Concentrated Milk, Cheese and Butter. (4)

First semester. Two lectures and one five-hour laboratory a week. Prerequisites, Dairy 1, Microb. 133 or equivalent; Chem. 1 and 3. Laboratory fee, \$3.00. Methods of production of butter, cheese, condensed and evaporated milk and milk products. Consideration is given to the procedures of processing quality control and the physiochemical principles involved. (Mattick.)

Dairy 112. Ice Cream Making. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisite, Dairy 108. Laboratory fee, \$3.00. (Arbuckle.)

Dairy 116. Dairy Plant Management. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, at least three advanced dairy products technology courses. Principles of dairy plant management, record systems; personnel, plant design and construction; dairy machinery and equipment. (Mattick.)

For Graduates

Dairy 201. Advanced Ruminant Nutrition. (3)

First semester, alternate years. (Offered 1962-63.) Three one-hour lectures per week. Prerequisites, A.H. 110 or Dairy 101, organic chemistry and permission of the Department. Biochemical, physiological and bacteriological aspects of the nutrition of ruminants and other animals. (Vandersall.)

Dairy 202. Research Methods. (3)

First semester, alternate years. (Offered 1963-64.) One lecture and two laboratory periods per week. Prerequisite, permission of instructor. The application of biochemical, physico-chemical and statistical methods to problems in biological research. (Stewart.)

Dairy 301. Special Problems in Dairying. (1-5) (4 Cr. Max.—M.S., 8 Cr. Max.—Ph.D.)

First and second semesters. Prerequisite, permission of professor in charge of work. Credit in accordance with the amount and character of work done. Methods of conducting dairy research and the presentation of results are stressed. A research problem which relates specifically to the work the student is pursuing will be assigned. (Staff.)

Dairy 302. Advanced Dairy Seminar. (1)

First and second semesters. M.S. candidates can obtain 4 credits; Ph.D. candidates can obtain 6 credits. Assigned readings, presentation and discussion of timely topics and fundamental research in dairy science. (Staff.)

Dairy 399. Research.

First and second semesters. Credit to be determined by the amount and quality of work done. Original investigation by the student of some subject assigned by the major professor, the completion of the assignment and the preparation of a thesis in accordance with requirements for an advanced degree. (Staff.)

ECONOMICS

Professors: DILLARD, GRUCHY AND ULMER.

Associate Professors: GRAYSON AND SCHULTZE.

Assistant Professors: DALTON, DODGE, KNIGHT, MEASDAY, PACKARD AND SMITH.

Lecturers: JOHNSON AND F. T. MOORE.

MASTER OF ARTS

Requirements for the master's degree include (1) course work in economics as the Department deems appropriate in view of the candidate's pre-

Economics

vious training, (2) course work in a minor subject, (3) a thesis on a topic approved by the Department, and (4) a comprehensive oral examination covering the major and the minor subjects and defense of the thesis.

DOCTOR OF PHILOSOPHY

The Ph.D. degree in economics is under the joint direction of the faculties of the Department of Economics and the Department of Business Organization and Administration. Before being advanced to candidacy doctoral students must pass comprehensive written and oral examinations in five of the following fields: (1) Accounting, (2) Comparative Economic Systems and Economic Planning, (3) Economic Development, (4) Economic Theory (required), (5) Financial Administration, (6) History of Economic Thought (required), (7) Industrial Administration, (8) International Economics, (9) Labor and Industrial Relations, (10) Marketing, (11) Money and Banking, (12) Public Finance and Fiscal Policy, (13) Public Utilities and Social Control of Business, (14) Transportation, (15) any other field, including the minor, approved by the faculty. Students should consult with members of the faculty concerning the choice of fields and the choice of courses within these fields.

Six semester hours of statistics with grades of "B" or better must be presented. Normally the foreign language requirements are taken before the comprehensive examinations.

Further information concerning requirements and procedures may be obtained from the departments administering the program.

For Graduates and Advanced Undergraduates

Econ. 102. National Income Analysis. (3)

First and second semesters. Prerequisite, Econ. 32. An analysis of national income accounts and the level of national income and employment. (Schultze.)

Econ. 130. Mathematical Economics. (3)

Second semester. Prerequisites, Econ. 102 and 132 or permission of instructor. A course designed to enable economics majors to understand the simpler aspects of mathematical economics. Those parts of the calculus and algebra required for economic analysis will be presented. (Ulmer.)

Econ. 131. Comparative Economic Systems. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. An investigation of the theory and practice of various types of economic systems. The course begins with an examination and evaluation of the capitalistic system and is followed by an analysis of alternative types of economic systems such as fascism, socialism, and communism. (Gruchy, Dodge.)

Econ. 132. Advanced Economic Principles. (3)

First and second semesters. Prerequisite, Econ. 32. Required for economics majors. This course is an analysis of price and distribution theory with special attention to recent developments in the theory of imperfect competition. (Knight.)

Econ. 134. Contemporary Economic Thought. (3)

First semester. Prerequisites, Econ. 32 and senior standing. A survey of recent trends in American, English, and continental economic thought with special attention to the work of such economists as W. C. Mitchell, J. R. Commons, T. Veblen, W. Sombart, J. A. Hobson and other contributors to the development of economic thought since 1900. (Gruchy.)

Econ. 136. International Economic Policies and Relations. (3)

First semester. Prerequisite, Econ. 32 or 37. A descriptive and theoretical analysis of international trade. Full consideration is given to contemporary problems facing international trade and to the impact of governmental policy upon international commercial relations. (Staff.)

Econ. 137. The Economics of National Planning. (3)

Second semester. Prerequisite, Econ. 32 or 37. An analysis of the principles and practice of economic planning with special reference to the planning problems of Great Britain, Russia, and the United States. (Gruchy.)

Econ. 138. Economics of the Soviet Union. (3)

Second semester. Prerequisite, Econ. 32 or 37. An analysis of the organization, operating principles and performance of the Soviet economy with attention to the historical and ideological background, planning, resources, industry, agriculture, domestic and foreign trade, finance, labor, and the structure and growth of national income. (Dodge.)

Econ. 140. Money and Banking. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A study of the organization, functions, and operation of our monetary, credit, and banking system; the relation of commercial banking to the Federal Reserve System; the relation of money and credit to prices; domestic and foreign exchange and the impact of public policy upon banking and credit. (Staff.)

Econ. 141. Theory of Money, Credit, and Prices. (3)

Second semester. Prerequisites, Econ. 32 and 140. A study of recent domestic and international monetary policies, their objectives and theoretical foundations. (Staff.)

Econ. 142. Public Finance and Taxation. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A study of government fiscal policy with special emphasis upon sources of public revenue, the tax system, government budgets, and the public debt.

Econ. 147. Business Cycles. (3)

First semester. Prerequisite, Econ. 140. A study of the causes of depressions and unemployment, cyclical and secular instability, theories of business cycles, and the problem of controlling economic instability. (Schultze.)

Econ. 149. International Finance and Exchange. (3)

Second semester. Prerequisite, Econ. 140; Econ. 136 recommended. This course considers the theory and practice of international finance and exchange. The increased importance of public authority in foreign trade, international policies, and finance is given due emphasis. (Staff.)

Economics

Econ. 160. Labor Economics. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. The historical development and chief characteristics of the American labor movement are first surveyed. Present-day problems are then examined in detail; wage theories, unemployment, social security, labor organization, and collective bargaining. (Dalton, Knight, Measday.)

Econ. 170. Monopoly and Competition. (3)

Second semester. Prerequisite, Econ. 32 or 37. Changing structure of the American economy; price policies in different industrial classifications of monopoly and competition in relation to problems of public policy. (Smith.)

Econ. 171. Economics of American Industries. (3)

Second semester. Prerequisite, Econ. 32 or 37. A study of the technology, economics and geography of twenty representative American industries. (Clemens.)

For Graduates

Econ. 200. Micro-Economic Analysis. (3)

First semester. Prerequisite, Econ. 132. Price, output, and distribution analysis as developed by Chamberlin, Triffin, Hicks and others. Considerable attention is given to contributions in periodicals. (Ulmer.)

Econ. 201. Advanced Micro-Economic Analysis. (3)

Second semester. Prerequisite, Econ. 200 or consent of instructor. A review and critical analysis of resource allocation and the theory of the firm, including recent developments in linear programming, activity analysis, and input-output analysis. (Ulmer.)

Econ. 202. Macro-Economic Analysis. (3)

Second semester. Prerequisite, Econ. 132. National income accounting: determination of national income and employment especially as related to the modern theory of effective demand; consumption function; multiplier and acceleration principles; the role of money as it affects output and employment as a whole. (Schultze.)

Econ. 204. Origins and Development of Capitalism. (3)

Study of the transition from feudalism to capitalism and the subsequent development of leading capitalist institutions in industry, agriculture, commerce, banking, and the social movement. (Dillard.)

Econ. 205. Economic Development of Underdeveloped Areas. (3)

First semester. Principles and problems of economic developments in underdeveloped areas; policies and techniques which hasten economic development. (Johnson.)

Econ. 206. Seminar in Economic Development. (3)

Second semester. Prerequisite, Econ. 205 or consent of instructor. Problems and policies of economic development in specified underdeveloped areas. (Johnson.)

Econ. 230. History of Economic Thought. (3)

First semester. Prerequisite, Econ. 132 or consent of instructor. A study of the development of economic thought and theories including the Greeks, Romans, canonists, mercantilists, physiocrats, Adam Smith, Malthus, Ricardo. Relation of ideas to economic policy. (Dillard.)

Econ. 231. Economic Theory in the Nineteenth Century. (3)

Second semester. Prerequisite, Econ. 230 or consent of the instructor. A study of various nineteenth and twentieth century schools of economic thought, particularly the classicists, neo-classicists, Austrians, German historical school, American economic thought and the socialists. (Dillard.)

Econ. 232, 233. Seminar in Institutional Economic Theory. (3, 3)

First and second semesters. A study of recent developments in the field of institutional economic theory in the United States and abroad. (Gruchy.)

Econ. 234. Economic Growth in Mature Economies. (3)

Given in sequence with Econ. 232 and 233. Analysis of policies and problems for achieving stable economic growth in mature economies such as the United States, the United Kingdom, and the Scandinavian countries. (Gruchy.)

Econ. 236. Seminar in International Economic Relations. (3)

(Arranged.) A study of selected problems in international economic relations. (Staff.)

Econ. 237. Special Seminar in Economic Growth and Development. (3)

Visiting academic and government economists who are specialists in various aspects of economic growth and development will address the seminar on special topics. Students may enroll for credit and write papers under the supervision of the faculty member directing the seminar. (Staff.)

Econ. 238. Seminar in Economic Development of the Soviet Union. (3)

Prerequisite, Econ. 138 or consent of instructor. Measurement and evaluation of Soviet economic development including interpretation and use of Soviet statistics, measurement of national income and rates of growth, fiscal and monetary policies, investment and technological change, planning and economic administration, manpower and wage policies, foreign trade and aid, and selected topics in Bloc development. (Dodge.)

Econ. 240. Seminar in Monetary Theory and Policy. (3)

Theories of money, prices, and national income with emphasis on recent developments. Monetary theories of income fluctuations. Domestic and international monetary policies. (Staff.)

Econ. 241. Money and Finance in Economic Development. (3)

Second semester. Prerequisite, Econ. 240 or consent of instructor. An analysis of the role of money and other financial assets, financial institutions, and financial markets during various stages of economic development; the role of financial factors in different economic systems. (Staff.)

Econ. 242. Public Finance and Fiscal Policy. (3)

Prerequisite, Econ. 142 or consent of instructor. Taxation, public expenditures, and public debt; the use of fiscal policy as a stabilization device against inflation and recession.

Econ. 247. Economic Growth and Instability. (3)

Second semester. An analytical study of long-term economic growth in relation to short-term cyclical instability. Attention is concentrated on the connection between

Education

accumulation of capital and the capital requirements of secular growth and business cycles. Earlier writings as well as recent growth models are considered. (Schultze.)

Econ. 248. The Economics of Technical Change. (3)

Second semester. Prerequisite, consent of instructor. A study of the determinants and impact of inventions and innovations. Attention is given to the qualitative and quantitative aspects of technical change, both at the micro-economic and macro-economic levels, and under different conditions of economic development. (Schultze.)

Econ. 260. Seminar in Labor Economics. (3)

Prerequisite, Econ. 160 or consent of instructor. Theories of wage determination, including analysis of wage structures and wage-price spiral; organization of labor markets, including factors influencing labor mobility and unemployment. (Knight)

Econ. 270. Seminar in Economics and Geography of American Industries. (3)

(Arranged.)

(Clemens.)

Econ. 399. Thesis.

(Arranged.)

(Staff.)

EDUCATION

Professors: V. ANDERSON, BLOUGH, BYRNE, GRENTZER, HOVET, KURTZ, MALEY, MAYOR, MC CLURE, MERSHON, MORGAN, NEWELL, PATRICK, PERKINS, PRESCOTT, SCHINDLER, THOMPSON, VAN ZWOLL, WAETJEN AND WIGGIN.

Associate Professors: BRANDT, BOWIE, HARRISON, JACOBSEN, JOHNSON, KELSEY, O'NEILL, RISINGER, SPENCER, TIERNEY AND ULRY.

Assistant Professors: P. ANDERSON, GOERING, HEBELER, MARX, W. MASSEY, MENDELOFF, SCHMIDT, ORR AND PECK.

MASTER OF ARTS AND MASTER OF EDUCATION

A student in education has the option of qualifying for the degree of Master of Arts or Master of Education.

In addition to the general requirements for admission to the Graduate School, applicants for unconditional admission with a major in education must have had sixteen semester hours of acceptable undergraduate work in education and must meet other standards set by this department of the Graduate School.

During the first semester of graduate work, the student is required to take a test battery, at a fee of \$5.00, and to submit professional recommendations.

Not later than the completion of the first two courses, the student must select a major adviser and a major area the course requirements for which

must be met for favorable consideration for graduation. Following is a list of the major areas:

Adult Education	History, Philosophy, and Comparative Education
Business Education	Home Economics Education
Educational Administration and Supervision	Secondary School Curriculum and Instruction
Elementary	English
General	Foreign Languages
Higher Ed.	Mathematics
Secondary	Science
Elementary School Curriculum and Instruction	Social Studies
Corrective and Remedial Reading Instruction	Human Growth and Development
Guidance and Personnel	Industrial Arts Education
Higher Education	Vocational Industrial Education
Music Education	

The time limit for completing either degree is the same as that prescribed for the Master of Arts and the Master of Science degrees of the Graduate School.

MASTER OF ARTS REQUIREMENTS

No student is recommended to the Graduate Council for advancement to candidacy for the Master of Arts degree until he has successfully passed the qualifying examination and has completed at least twelve hours of satisfactory graduate work at the University of Maryland. The candidate must meet all requirements including thesis and successful passing of the oral examination as prescribed by the Graduate School for the Master of Arts degree.

MASTER OF EDUCATION REQUIREMENTS

A student may be recommended for advancement to candidacy on the basis of course work plus recommendations of his major adviser and the Education Master's Committee acting for the Department of Education. The Master of Education candidate will write two seminar papers and will take a final comprehensive examination covering all course work. The final examination must be taken by the full-time student in the second semester of course work and by the part-time student during the time he is enrolled for the last six hours of course work.

Currently both the qualifying and comprehensive examinations are administered on the second Saturday of January and May and on the Saturday of the fourth week of the summer session.

For further information respecting the master's degrees in education, see the statement of policy issued by the Department of Education.

Education

ADVANCED GRADUATE SPECIALIST IN EDUCATION

The major areas of the program are as follows:

Adult Education	Music Education
Curriculum and Instruction	Physical Education, Recreation, and Health
Educational Administration and Supervision	Human Development Education
Elementary Education	Industrial Arts Education
Guidance	Secondary Education
Higher Education	Vocational-Industrial Education

A student in this program is admitted to the Graduate School on a special non-degree basis and must have earned at least a master's degree in some recognized university or college. The background tests for graduate students in Education are required for admission.

The minimum number of semester credits of graduate work required to complete the program is sixty, thirty of which must be taken at the University of Maryland. At least 12 hours, exclusive of field experience, must be taken on the College Park campus. Registration in some kind of field study, field experience, apprenticeship, or internship is required. Candidates may be required to take a substantial portion of work in departments other than Education. A faculty adviser must be selected before admission.

Half of the student graduate work must be in 200's or 300's courses or in work elsewhere comparable to these courses at the University of Maryland. Students are required to maintain a "B" average and to demonstrate a high degree of professional competence in their selected field.

A final examination of not less than six hours in length must be passed in order to complete the program. A certificate or diploma is awarded upon the completion of the program.

DOCTOR OF PHILOSOPHY AND DOCTOR OF EDUCATION

Each candidate is required to achieve exceptional ability in at least one major area and one minor area of competence.

The candidate should choose his major from the following list of areas:

Curriculum and Instruction	Teaching Major in an Education Specialty
Educational Administration and Supervision	History, Philosophy, and Com- parative Education
Elementary Education	Human Development Education
Guidance and Personnel	Industrial Arts Education
*Physical Education, Recreation, and Health	Secondary Education
Higher Education	Vocational-Industrial Education

*The Ph.D. program in this area is administered under a separate department of the Graduate School.

Minors may be chosen from fields other than education as approved by the Committee on Candidacy, from the foregoing list of major areas, or from the following list:

Adult Education	Higher Education
**Agricultural Education	Home Economics Education
Business Education	Music Education

In addition to the general University requirements for a doctor's degree, the following requirements must be met:

1. The preliminary examination for admission to candidacy for the doctor's degree will cover the student's preparation in major and minor fields, and will include such other examinations as may be required by the faculty. A student must be admitted to candidacy in order to have the Department's official permission to be a candidate for a doctor's degree.

2. A comprehensive examination covering the general fields of major and minor study must be passed by each candidate, after which the final examination is administered by a committee appointed by the Dean of the Graduate School.

In general the requirements for the Doctor of Education degree are the same as those for the degree Doctor of Philosophy. The most important differences between the two degrees are as follows:

1. The purpose of the Doctor of Education degree is to prepare persons of exceptional competence to work in the field. The emphasis for this degree is placed on broad understanding, whereas that for the degree of Doctor of Philosophy is placed on specialized research.

2. A reading knowledge of foreign languages is required for the degree of Doctor of Education only when needed for research and study in the doctoral program.

3. In order to meet the residence requirements, a candidate for the Ph.D. degree must spend at least two semesters in full-time study on the College Park campus. A candidate for the Ed.D. degree may substitute two summers of residence for one semester of residence, or four summers for two semesters.

4. The doctoral study for the Ed.D. consists of a project rather than a dissertation. The project requires research to meet a practical field problem. Credit of six to nine hours is allowed for a project as compared with twelve to eighteen hours for a Ph.D. dissertation. For further information respecting the doctor's degree, see the "Statement of Policy, Doctoral Degrees in Education" issued by the Department of Education.

HISTORY, PRINCIPLES, CURRICULUM, AND ADMINISTRATION

For Graduates and Advanced Undergraduates

Ed. 100. History of Education in Western Civilization. (3)

Educational institutions through the ancient, mediaeval, and early modern periods in the western civilization, as seen against a background of socio-economic development. (Wiggin.)

** Administered under a separate department of the Graduate School.

Education

Ed. 102. History of Education in the United States. (3)

A study of the origins and development of the chief features of the present system of education in the United States. (Wiggin.)

SCIENCE EDUCATION

Ed. 105. Science in the Elementary Schools. (2-3)

Laboratory fee, \$2.00. Designed to help teachers acquire general science understandings and to develop teaching materials for practical use in classrooms. Includes experiments, demonstrations, constructions, observations, field trips, and use of audio-visual materials. The emphasis is on content and method related to science units in common use in elementary schools. (Blough.)

Ed. 107. Philosophy of Education. (2-3)

A study of the great educational philosophers and systems of thought affecting the development of modern education. (Wiggin.)

Ed. 121. The Language Arts in the Elementary School. (2-3)

Teaching of spelling, handwriting, oral and written expression, and creative expression. Special emphasis given to skills having real significance to pupils. (Staff.)

Ed. 122. The Social Studies in the Elementary School. (2-3)

Consideration given to curriculum, organization and methods of teaching, evaluation of newer materials, and utilization of environmental resources. (O'Neill.)

Ed. 123. The Child and the Curriculum. (3)

Relationship of the elementary school curriculum to child growth and development. Recent trends in curriculum organization; the effect of environment on learning; readiness to learn; and adapting curriculum content and methods to maturity levels of children. (Denecke.)

Ed. 124. Arithmetic in the Elementary School. (2-3)

Emphasis on materials and procedures which help pupils sense arithmetical meanings and relationships. Helps teachers gain a better understanding of the number system and arithmetical processes. (Schindler.)

Ed. 125. Art in Elementary Schools. (2)

Concerned with art methods and materials for elementary schools. Includes laboratory experiences with materials appropriate for elementary schools. (Lembach.)

Ed. 127. Teaching in Elementary Schools. (2-6)

An overview of elementary school teaching designed for individuals without specific preparation for elementary school teaching or for individuals without recent teaching experience. (Staff.)

Ed. 130. The Junior High School. (2-3)

A general overview of the junior high school. Purposes, functions and characteristics of this school unit; a study of its population, organization, program of studies, methods, staff, and other similar topics, together with their implications for prospective teachers. (Staff.)

Ed. 133. Methods of Teaching Social Studies in Secondary School. (2-3)

Designed to give practical training in the everyday teaching situations. Use of various lesson techniques, audio and visual aids, reference materials, and testing programs and the adaption of teaching methods to individual and group differences. Present tendencies and aims of instruction in the social studies. (Risinger.)

Ed. 134. Materials and Procedures for the Secondary School Core Curriculum. (3)

Laboratory fee, \$1.00. This course is designed to bring practical suggestions to teachers who are in charge of core classes in junior and senior high schools. Materials and teaching procedures for specific units of work are stressed. (Grambs.)

Ed. 137. Methods of Teaching Mathematics and Science in Secondary School. (2-3)

Laboratory fee, \$2.00. Considers such topics as objectives, selection, organization, and presentation of subject matter, appropriate classroom methods and procedures, instructional materials and evaluation of learning experiences in the areas of mathematics, the physical sciences, and the biological sciences. (Ulry, Mayor.)

Ed. 140. Curriculum, Instruction, and Observation. (3)

Graduate credit is allowed only by special permission. First and/or second semesters. Twenty periods of observation. Students must reserve all day each Wednesday for observation in public schools. Offered in separate sections for the various subject matter areas, namely, English, social studies, foreign language, science, mathematics, art education, business education, industrial education, music education, and physical education. Registration cards must include the subject-matter area as well as the name and number of course. The objectives, selection and organization of subject matter, appropriate methods, lesson plans, textbooks, and other instructional materials, measurement, and other topics pertinent to the particular subject matter area are treated. (Staff.)

Ed. 141. Methods of Teaching English in Secondary Schools. (3)

Content and methods in teaching the English language arts. (Bryan.)

Ed. 142. Oral-aural Method of Teaching Foreign Languages. (3)

Graduate credit allowed by special arrangement and adviser's approval. Designed for high school teachers. Methods in making and using tape recordings, using electronic laboratories, developing oral-aural skills and direct approach to language teaching are emphasized. (Mendeloff.)

Ed. 143. Foreign Language Methods in Elementary Schools. (3)

Graduate credit allowed by special arrangement and adviser's approval. Registration limited and based upon approval of adviser. Methods and techniques for developmental approach to the teaching of modern foreign languages in elementary schools. Use of realia, development of oral-aural skills and understanding of young children in language development are stressed. (Mendeloff.)

Ed. 145. Principles and Methods of Secondary Education. (2-3)

First and second semesters and summer session. This course is concerned with the principles and methods of teaching in junior and senior high schools. Instructional problems common to all of the subject fields are considered in relation to the needs and interests of youth, the urgent social problems of today, and the central values to which our society is committed. (McClure, Grambs, Risinger.)

Education

Ed. 147. Audio-Visual Education. (3)

First semester and summer session. Laboratory fee, \$1.00. Sensory impressions in their relation to learning; projection apparatus, its cost and operation; slides, film-strips, and films; physical principles underlying projection; auditory aids to instruction; field trips; pictures, models, and graphic materials; integration of sensory aids with organized instruction. Recommended for all education students. (Maley.)

Ed. 150. Educational Measurement. (3)

First and second semesters and summer session. Constructing and interpreting measures of achievement. (Johnson.)

Ed. 151. Statistical Methods in Education. (3)

Designed as a first course in statistics for students in education. Emphasis is upon educational applications of descriptive statistics, including measures of central tendency, variability, and association. (Johnson.)

Ed. 153. The Teaching of Reading. (2-3)

Concerned with the fundamentals of developmental reading instruction, including reading readiness, use of experience records, procedures in using basal readers, the improvement of comprehension, teaching reading in all areas of the curriculum, uses of children's literature, the program in word analysis, and procedures for determining individual needs. (Schindler, Fish, Massey.)

Ed. 154. Remedial Reading Instruction. (3)

Prerequisite, Ed. 153 or the equivalent. For supervisors and teachers who wish to help retarded readers. Concerned with causes of reading difficulties, the identification and diagnosis of retarded pupils, instructional materials, and teaching procedures. (Massey.)

Ed. 155. Laboratory Practices in Reading for Elementary and Secondary Schools. (2-4)

Prerequisite, Ed. 153 or Ed. 154. A laboratory course in which each student has one or more pupils for analysis and instruction. At least one class meeting per week to diagnose individual cases and to plan instruction. (Massey.)

Ed. 160. Educational Sociology. (3)

Deals with data of the social sciences which are germane to the work of teachers. Implications of democratic ideology for educational endeavor, educational tasks imposed by changes in population and technological trends, the welfare status of pupils, the socio-economic attitudes of individuals who control the schools, and other elements of community background. (Risinger, Grambs.)

Ed. 161. Principles of Guidance. (3)

First and second semesters and summer session. Overview of principles and practices of guidance-oriented education. (Byrne, Marx.)

Ed. 162. Mental Hygiene in the Classroom. (3)

The practical application of the principles of mental hygiene to classroom problems. (Denecke.)

Ed. 185. Pupil Transportation. (2)

Includes consideration of the organization and administration of state, county, and district pupil transportation service with emphasis on safety and economy. The planning

of bus routes; the selection and training of bus drivers, and maintenance mechanics; the specification of school buses; and procurement procedures are included. (Staff.)

Ed. 187. Field Experience in Education. (1-4)

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|-------------------------------|------------------------------------|
| a. Adult Education | e. Higher Education |
| b. Curriculum and Instruction | f. Industrial Arts Education |
| c. Educational Administration | g. Supervision |
| d. Guidance and Personnel | h. Vocational-Industrial Education |

Planned field experience may be provided for selected graduate students who have had teaching experience and whose application for such field experience has been approved by the education faculty. Field experience is offered in a given area to both major and non-major students. Prerequisites, at least six semester hours in education at the University of Maryland plus such other prerequisites as may be set by the major area in which the experience is to be taken. (Staff.)

Ed. 188. Special Problems in Education. (1-3)

Prerequisite, consent of instructor. Available only to mature students who have definite plans for individual study of approved problems. (Staff.)

Note: Course cards must have the title of the problem and the name of the faculty member who has approved it.

Ed. 189. Workshops, Clinics, and Institutes. (1-6)

The following types of educational enterprises may be scheduled under this course heading: workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals, and supervisors. The maximum number of credits that may be earned under this course symbol toward any degree is six semester hours; the symbol may be used two or more times until six semester hours have been reached. (Staff.)

Ed. 190. Problems and Trends in Contemporary American Education. (2-4)

Designed to present a broad overview of some key issues and trends that relate to the improvement of instruction at elementary, secondary and teacher education levels. Lectures by visiting educators of national prominence will be reviewed and analyzed in discussion groups led by regular University staff members. (Staff.)

For Graduates

Ed. 202. The Junior College. (2)

The philosophy and development of the junior college in the United States with emphasis on curriculum and administrative controls. Special attention is devoted to the importance, need, place and development of technical-terminal curricula. (Kelsey.)

Ed. 203. Problems in Higher Education. (3)

A study of present problems in higher education. (Kelsey.)

Ed. 205. Comparative Education. (3)

A study of historical changes in ways of looking at national school systems, and of problems in assessing their effectiveness. (Wiggin.)

Education

Ed. 206. Seminar in Comparative Education. (2) (Wiggin.)

Ed. 207. Seminar in History and Philosophy of Education. (2) (Wiggin.)

Ed. 209. Adult Education. (3)

A study of adult education in the United States, with attention to adult abilities and intelligence, programs of adult education, and a rationale for adult education. (Wiggin.)

Ed. 210. The Organization and Administration of Public Education. (3)

First semester. The basic course in school administration. Deals with the organization and administration of school systems—at the local, state, and federal levels; and with the administrative relationships involved. (Newell.)

Ed. 211. The Organization, Administration, and Supervision of Secondary Schools. (3)

Second semester. The work of the secondary school principal. Includes topics such as personnel problems, supervision, school-community relationships, student activities, schedule making, and internal financial accounting. (P. Anderson.)

Ed. 212. School Finance and Business Administration. (3)

An introduction to principles and practices in the administration of the public school finance activity. Sources of tax revenue, the budget, and the function of finance in the educational program are considered. (Van Zwoll.)

Ed. 214. School Plant Planning. (2)

An orientation course in which the planning of school buildings is developed as educational designing with reference to problems of site, building facilities, and equipment. (Van Zwoll.)

Ed. 216. Public School Supervision. (3)

The nature and functions of supervision; various supervisory techniques and procedures; human relationship factors; and personal qualities for supervisor. (P. Anderson.)

Ed. 217. Administration and Supervision in Elementary Schools. (3)

Problems in administering elementary schools and improving instruction. (Denecke.)

Ed. 218. School Surveys. (2-6)

Prerequisite, consent of instructor. Includes study of school surveys with emphasis on problems of school organization and administration, finance and school plant planning. Field work in school surveys is required. (Newell.)

Ed. 219. Seminar in Educational Administration and Supervision. (2-4)

Prerequisite, at least four hours in educational administration and supervision or consent of instructor. A student may register for two hours and may take the seminar a second time for an additional two hours. (Newell, Van Zwoll.)

Ed. 221. Advanced School Plant Planning. (2)

Ed. 214 is a prerequisite to this course. However students with necessary background may be admitted without completion of Ed. 214. This is an advanced course in school plant planning problems. Emphasis is given to analysis of the educational program and planning of physical facilities to accommodate that program. (Van Zwoll.)

Ed. 223. Practicum in Personnel Relationships. (2-6)

Prerequisite, consent of instructor. Enrollment limited. Designed to help teachers, school administrators, and other school staff members to learn to function more effec-

tively in developing educational policy in group situations. Each student in the course is required to be working concurrently in the field with a group of school staff members or citizens on actual school problems. (Newell.)

Ed. 224. Apprenticeship in Education. (6-9)

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| a. Curriculum and Instruction | e. Industrial Arts Education |
| b. Educational Administration | f. Supervision |
| c. Guidance and Personnel | g. Vocational Industrial Education |
| d. Higher Education | |

Apprenticeships in the major area of study are available to selected students whose application for an apprenticeship has been approved by the Education faculty. Each apprentice is assigned to work for at least a semester full-time or the equivalent with an appropriate staff member of a cooperating school, school system, or educational institution or agency. The sponsor of the apprentice maintains a close working relationship with the apprentice and the other persons involved. Prerequisites, teaching experience, a master's degree in education, and at least six semester hours in education at the University of Maryland. (Staff.)

Note: The total number of credits which a student may earn in Ed. 187, Ed. 224, and Ed. 287 is limited to a maximum of twenty (20) semester hours.

Ed. 225. School Public Relations. (3)

A study of the interrelationships between the community and the school. Public opinion, propaganda, and the ways in which various specified agents and agencies within the school have a part in the school public relations program are explored. (Van Zwoll.)

Ed. 226. Child Accounting. (2)

An inquiry into the record keeping activities of the school system, including an examination of the marking system. (Van Zwoll.)

Ed. 227. Public School Personnel Administration. (3)

A comparison of practices with principles governing the satisfaction of school personnel needs, including a study of tenure, salary schedules, supervision, rewards, and other benefits. (Van Zwoll.)

Ed. 228. Introduction to Student Personnel. (2)

Prerequisite, consent of instructor. (Same as Psych. 228.) A systematic analysis of research and theoretical literature on a variety of major problems in the organization and administration of student personnel services in higher education. Included will be discussion of such topics as the student personnel philosophy in education, counseling services, discipline, housing, student activities, financial aid, health, remedial services, etc. (Byrne, Marx.)

Ed. 229. Seminar in Elementary Education. (2)

Primarily for individuals who wish to write seminar papers. Enrollment should be preceded by at least 12 hours of graduate work in education. (Staff.)

Ed. 234. The School Curriculum. (2-3)

A foundations course embracing the curriculum as a whole from early childhood through adolescence, including a review of historical developments, an analysis of conditions affecting curriculum change, an examination of issues in curriculum making, and a consideration of current trends in curriculum design. (Hovet.)

Education

Ed. 235. Principles of Curriculum Development. (3)

Curriculum planning, improvement, and evaluation in the schools; principles for the selection and organization of the content and learning experiences; ways of working in classroom and school on curriculum improvement. (Hovet, V. Anderson.)

Ed. 237. Curriculum Theory and Research. (2)

The school curriculum considered within the totality of factors affecting pupil behavior patterns, an analysis of research contributing to the development of curriculum theory, a study of curriculum theory as basic to improved curriculum design, the function of theory in guiding research, and the construction of theory, through the utilization of concepts from the behavior research disciplines. (Hovet.)

Ed. 239. Seminar in Secondary Education. (2) (Risinger.)

Ed. 241. Problems in the Teaching of Reading. (3)

- A. Elementary Schools
- B. Secondary Schools

Implications of current theory and the results of research for the teaching of reading. Attention is given to all areas of developmental reading instruction, with special emphasis on persistent problems. (Prerequisites: Ed. 153 or equivalent.) (Massey.)

Ed. 242. Coordination in Work-Experience Programs. (2)

Surveys and evaluates the qualifications and duties of a teacher-coordinator in a work-experience program. Deals particularly with evolving patterns in city and country schools in Maryland, and is designed to help teacher-coordinators, guidance counselors, and others in the supervisory and administrative personnel concerned with functioning relationships of part-time cooperative education in a comprehensive educational program.

Ed. 243. Problems of Teaching Arithmetic in Elementary Schools. (2)

Implications of theory and results of research for the teaching of arithmetic in the elementary schools. (Schindler.)

Ed. 244. Problems of Teaching Language Arts in Elementary Schools. (2)

Implications of current theory and results of research for the language arts in the elementary schools. (W. Massey.)

Ed. 245. Introduction to Research. (2)

Intensive reading, analysis, and interpretation of research; applications to teaching fields; the writing of abstracts, research reports, and seminar papers. (Hovet.)

Ed. 246. Problems of Teaching Social Studies in Elementary Schools. (2)

Application to the social studies program of selected theory and research in the social sciences, emphasizing patterns of behavior, environmental influences, and critical thinking. (O'Neill.)

Ed. 247. Seminar in Science Education. (2)

An opportunity to pursue special problems in curriculum making, course of study development, or other science teaching problems. Class members may work on problems related directly to their own school situations. (Blough, Ulry.)

Ed. 248. Seminar in Industrial Arts and Vocational Education. (2)

(See Ind. Ed. 248)

(Maley.)

Ed. 250. Analysis of the Individual. (3)

Prerequisites, Ed. 161, Ed. 151, Ed. 263, or permission of instructor. Collecting and interpreting non-standardized pupil appraisal data; synthesis of all types of data through case study procedures. (Marx.)

Ed. 251. Intermediate Statistics in Education. (3)

Prerequisite, Ed. 151 or equivalent. A study of the basic statistical techniques used for graduate research in education, including tests of significance and sampling techniques. Necessary arithmetic skills are developed as part of the course. (Johnson.)

Ed. 253. Occupational Choice: Theory and Information. (2)

Research and theory related to occupational and educational decisions; school programs of related information and other activities in occupational decisions. (Byrne.)

Ed. 254. Organization and Administration of Guidance Programs. (2)

Prerequisite, permission of instructor. All guidance courses except Seminar are prerequisites. Instilling the guidance point of view and implementing guidance practices. (Byrne, Marx.)

Ed. 255, 256. Advanced Laboratory Experiences in Reading Instruction. (3-3)

Prerequisites: at least 21 credits applicable to the master's program in Corrective and Remedial Reading. The first semester of the course deals with diagnostic techniques. Each participant will assist in diagnosing reading disabilities and in recommending instructional programs for individual pupils. The second semester deals with instruction of pupils with reading disabilities. Each participant will plan and execute a program of instruction for an individual or a small group, applying findings of the preliminary diagnosis. (Massey.)

Ed. 260. School Counseling: Theoretical Foundations and Practice. (3)

Prerequisites, Ed. 161, 250, 253. Exploration of learning theories as applied to counseling in schools, and practices which stem from such theories. (Byrne.)

Ed. 261. Practicum in Counseling. (2-6)

Two hour class plus laboratory. Prerequisites, Ed. 260 and permission of instructor. Sequence of supervised counseling experiences of increasing complexity. Limited to 8 applicants in advance. (Byrne, Marx, Schmidt.)

Ed. 262. Measurement in Pupil Appraisal. (3)

Prerequisite, Ed. 150. Study of group tests typically employed in school testing programs; discussion of evidence relating to the measurement of abilities. (Johnson.)

Ed. 265. Theory of Measurement. (2)

Prerequisites, Ed. 150 and Ed. 151. Treats such topics as theory and techniques used in various scaling methods, test analysis, predictive accuracy of scores, and equivalence of scores. For students desiring more advanced treatment of problems. (Johnson.)

Ed. 267. Curriculum Construction Through Community Analysis. (2)

Prerequisites, Ed. 163, 164, 165. Selected research problems in the field of community study with emphasis on Baltimore area. (Staff.)

Ed. 268. Seminar in Educational Sociology. (2)

(Risinger.)

Education

Ed. 269. *Seminar in Guidance.* (2)

Systematic examination of research related to various guidance topics. For advanced guidance majors, and others by permission of instructor. (Staff.)

Ed. 271. *Advanced Statistics in Education.* (3)

Prerequisites, Ed. 251 or equivalent. Primarily for the education student desiring more advanced work in statistical methodology. Survey of major types of statistical design in educational research; application of multivariate statistical techniques to educational problems. (Johnson.)

Ed. 275, 276. *Advanced Problems in Art Education.* (3, 3)

These courses are centered about problems of teaching art in the elementary and secondary schools in terms of the philosophy of art education today, techniques and processes in the visual arts, and creative opportunities in the visual arts and in art education. The student also will have the opportunity to do special work centered about his problems in art education.

Ed. 279. *Seminar in Adult Education.* (2) (Wiggin.)

Ed. 280. *Research Methods and Materials.* (2)

Research methodology for case studies, surveys, and experiments; measurements and statistical techniques; design, form, and style for theses and research reports. Primarily for advanced students and doctoral candidates. (Johnson.)

Ed. 281. *Source Materials in Education.* (2)

Bibliography development through a study of source materials in education, special fields in education, and for seminar papers and theses. (Wiggin.)

Ed. 287. *Internship in Education.* (12-16)

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| a. Curriculum and Instruction | d. Industrial Arts Education |
| b. Educational Administration | e. Supervision |
| c. Guidance and Personnel | f. Vocational-Industrial Education |

Internships in the major area of study are available to selected students who have teaching experience. The following groups of students are eligible: (a) any student who has been advanced to candidacy for the doctor's degree; and (b) any student who receives special approval by the education faculty for an internship, provided that prior to taking an internship, such student shall have completed at least sixty semester hours of graduate work, including at least six semester hours in education at the University of Maryland. Each intern is assigned to work on a full-time basis for at least a semester with an appropriate staff member in a cooperating school, school system, or educational institution or agency. The internship must be taken in a school situation different from the one where the student is regularly employed. The intern's sponsor maintains a close working relationship with the intern and the other persons involved.

Note: The total number of credits which a student may earn in Ed. 187, Ed. 224, and Ed. 287 is limited to a maximum of twenty (20) semester hours. (Staff.)

Ed. 288. *Special Problems in Education.* (1-6)

First and second semesters and summer session. Master of Education or doctoral candidates who desire to pursue special research problems under the direction of their advisers may register for credit under this number. (Staff.)

Note: Course card must have the title of the problem and the name of the faculty member under whom the work will be done.

Ed. 290. Doctoral Seminar. (1-3)

Prerequisite, passing the preliminary examinations for a doctor's degree in education, or recommendation of a doctoral adviser. Analysis of doctoral projects and theses, and of other on-going research projects. A doctoral candidate may participate in the Seminar during as many University sessions as he desires, but may earn no more than three semester hours of credit in the Seminar. An Ed.D. candidate may earn in total no more than nine semester hours, and a Ph.D. candidate, no more than eighteen semester hours, in the Seminar and in Ed. 399. (Staff.)

Ed. 399. Research—Thesis. (1-6)

First and second semesters and summer session. Students who desire credit for a master's thesis, a doctoral dissertation, or a doctoral project should use this number. (Staff.)

BUSINESS EDUCATION

For Graduates and Advanced Undergraduates

B. Ed. 101. Problems in Teaching Office Skills. (2)

Problems in development of occupational competency, achievement tests, standards of achievement, instructional materials, transcription, and the integration of office skills. For experienced teachers. (Patrick.)

B. Ed. 102. Methods and Materials in Teaching Bookkeeping and Related Subjects. (2)

Important problems and procedures in the mastery of bookkeeping and related office knowledges and skills including a consideration of materials and teaching procedures. (Patrick.)

B. Ed. 104. Basic Business Education in the Secondary Schools. (2)

Includes consideration of course objectives; subject matter selection; and methods of organizing and presenting business principles, knowledges, and practices. (Patrick.)

For Graduates

B. Ed. 200. Administration and Supervision of Business Education. (2)

Major emphasis on departmental organization, curriculum, equipment, budget making, guidance, placement and follow-up, visual aids and the in-service training of teachers. For administrators, supervisors, and teachers of business subjects. (Staff.)

B. Ed. 205. Seminar in Business Education. (2)

The study and evaluation of the literature and research in Business Education.

B. Ed. 255. Principles and Problems of Business Education. (2)

Principles and practices in business education; growth and present status; vocational business education; general business education; relation to consumer education and to education in general. (Patrick.)

B. Ed. 256. Curriculum Development in Business Education. (2-3)

This course is especially designed for graduate students interested in devoting the summer session to a concentrated study of curriculum planning in business education. Emphasis will be placed on the philosophy and objectives of the business education program, and on curriculum research and organization of appropriate course content. (Staff.)

Education

CHILDHOOD EDUCATION

For Graduates and Advanced Undergraduates

C. Ed. 110. Child Development III. (3)

First and second semesters. Developmental growth of the child from the prenatal period through the early childhood years, with implications for home and school practice. For students in other colleges of the University. (Hymes.)

C. Ed. 115. Children's Activities and Activities Materials. (3)

First and second semesters. Prerequisite, C. Ed. 50, 51, or 110. Laboratory fee, \$5.00. Storytelling; selection of books; the use, preparation, and presentation of such raw materials as clay, paint (easel and finger), blocks, wood, and scrap materials. (Staff.)

C. Ed. 116. Creative Music for Young Children. (2-3)

First and second semesters. Prerequisite, Music 16 or equivalent. Creative experiences in songs and rhythms; correlation of music and everyday teaching with the abilities and developments of each level; study of songs and materials; observation and teaching experience with each age level. (Brown.)

C. Ed. 119. Curriculum, Instruction, and Observation—Cooperative Nursery School. (2-3)
(Staff.)

C. Ed. 140. Curriculum, Instruction, and Observation—Early Childhood Education (Nursery School and Kindergarten). (3)

Prerequisites, C. Ed. 50, 51, or 110. Philosophy of early childhood education; observation of the development needs at various age levels, with emphasis upon the activities, materials, and methods by which educational objectives are attained. (Stant.)

C. Ed. 145. Guidance of Young Children. (3)

First and second semesters. Development of an appreciation and understanding of young children from different home and community backgrounds; study of individual and group problems. (Hymes.)

C. Ed. 160. Methods and Materials in Parent Education. (2-3)

A survey of child development, child guidance, and related fields; a review of current materials, books, periodicals, leaflets, films, skits; study of individual parent conferences, guided observation, discussion leading, role playing, preparing materials and programs for parent groups and television skits with laboratory practice through the group itself. (Staff.)

HOME ECONOMICS EDUCATION

For Graduates and Advanced Undergraduates

H. E. Ed. 102. Problems in Teaching Home Economics. (3)

First and second semesters. Prerequisites, H. E. Ed. 140. A study of the managerial aspects of teaching and administering a home-making program; the physical environment, organization, and sequence of instructional units, resource materials, evaluation, home projects. (Spencer.)

H. E. Ed. 120. Evaluation of Home Economics. (3)

The meaning and function of evaluation in education; the development of a plan for evaluating a homemaking program with emphasis upon types of evaluation devices, their construction, and use. (Spencer.)

H. E. Ed. 140. Curriculum, Instruction, and Observation. (3)

The place and function of home economics education in the secondary school curriculum. Philosophy of education for home and family living; characteristics of adolescence, construction of source units, lesson plans, and evaluation devices; directed observation in junior and senior high school home economics departments. (Spencer.)

For Graduates

H. E. Ed. 200. Seminar in Home Economics Education. (2) (Spencer.)*H. E. Ed. 202. Trends in the Teaching and Supervision of Home Economics. (2-4)*

Study of home economics programs and practices in light of current educational trends. Interpretation and analysis of democratic teaching procedures, outcomes of instruction, and supervisory practices. (Spencer.)

HUMAN DEVELOPMENT EDUCATION

For Graduates and Advanced Undergraduates

H. D. Ed. 100, 101. Principles of Human Development I and II. (3, 3)

These courses give a general overview of the scientific principles that describe human development and behavior and relate these principles to the task of the school. A year-long study of an individual child is an integral part of the course and will require one half-day per week for observing children in nearby schools. *This course is designed to meet the usual certification requirements in educational psychology.* H. D. Ed. 100 is prerequisite to H. D. Ed. 101. (Staff.)

H. D. Ed. 102, 103, 104. Child Development Laboratory I, II and III. (2, 2, 2)

These courses involve the direct study of children throughout the school year. Each participant gathers a wide body of information about an individual, presents the accumulating data from time to time to the study group for criticism and group analysis and writes an interpretation of the dynamics underlying the child's learning, behavior and development. Provides opportunity for teachers in-service to earn credit for participation in their own local child study group. (Staff.)

H. D. Ed. 112, 114, 116. Scientific Concepts in Human Development I, II, III. (3, 3, 3)

Summer session. (Staff.)

H. D. Ed. 113, 115, 117. Laboratory in Behavior Analysis I, II, III. (3, 3, 3)

Summer session. (Staff.)

For Graduates

H. D. Ed. 200. Introduction to Human Development and Child Study. (3)

Offers a general overview of the scientific principles which describe human development and behavior and makes use of these principles in the study of individual children. Each student will observe and record the behavior of an individual child throughout the semester and must have one half-day a week for this purpose. It is basic to further work in child study and serves as a prerequisite for advanced courses where the student has not had field work or at least six weeks of workshop experience in child study. When offered during the summer intensive laboratory work with case records may be substituted for the study of an individual child. (Waetjen, Prescott.)

Education

H. D. Ed. 201. Biological Bases of Behavior. (3)

H. D. Ed. 200 or its equivalent must be taken before H. D. 210 or concurrently. Emphasizes that understanding human life, growth and behavior depends on understanding the ways in which the body is able to capture, control and expend energy. Application throughout is made to human body processes and implications for understanding and working with people. (Brandt, Matteson.)

H. D. Ed. 202. Social Bases of Behavior. (3)

H. D. Ed. 200 or its equivalent must be taken before H. D. Ed 202 or concurrently. Analyzes the socially inherited and transmitted patterns of pressures, expectations and limitations learned by an individual as he grows up. These are considered in relation to the patterns of feeling and behaving which emerge as the result of growing up in one's social group. (Brandt.)

H. D. Ed. 203. Integrative Bases of Behavior. (3)

H. D. Ed. 200, or its equivalent, H. D. Ed. 201 and H. D. Ed. 202 are prerequisite. Analyzes the organized and integrated patterns of feeling, thinking and behaving which emerge from the interaction of basic biological drives and potentials with one's unique experience growing up in a social group. (Peck)

H. D. Ed. 204, 205. Physical Processes in Human Development. (3, 3)

Describes in some detail the major organic processes of: conception, biological inheritance; differentiation and growth of the body; capture, transportation and use of energy; perception of the environment; coordination and integration of function; adaptation to unusual demands and to frustration; normal individual variation in each of the above processes. (Goering, Bowie.)

H. D. Ed. 206, 207. Socialization Processes in Human Development I, II. (3, 3)

Analyzes the processes by which human beings internalize the culture of the society in which they live. The major sub-cultures in the United States, their training procedures, and their characteristic human expressions in folk-knowledge, habits, attitudes, values, life-goals, and adjustment patterns are analyzed. Other cultures are examined to highlight the American way of life and to reveal its strengths and weaknesses. (Mershon, Kurtz.)

H. D. Ed. 208, 209. Self Processes in Human Development I and II. (3, 3)

Analyzes the effects of the various physical and growth processes, affectional relationships, socialization processes, and peer group roles and status on the integration, development, adjustment, and realization of the individual self. This analysis includes consideration of the nature of intelligence and of the learning process; the development of skills, concepts, generalizations, symbolizations, reasoning and imagination, attitudes, values, goals and purposes; and the conditions, relationships and experiences that are essential to full human development. The more common adjustment problems experienced in our society at various maturity levels, and the adjustment mechanisms used to meet them are studied. (Perkins, Orr.)

H. D. Ed. 210. Affectional Relationships and Processes in Human Development. (3)

H. D. Ed. 200 or its equivalent must be taken before or concurrently. Describes the normal development, expression and influence of love in infancy, childhood, adolescence and adulthood. It deals with the influence of parent-child relationship involving normal acceptance, neglect, rejection, inconsistency, and over-protection upon health, learning, emotional behavior and personality adjustment and development. (Orr.)

H. D. Ed. 211. *Peer-culture and Group Processes in Human Development.* (3)

H. D. Ed. 200 or its equivalent must be taken before or concurrently. Analyzes the process of group formation, role-taking and status-winning. It describes the emergence of the "peer-culture" during childhood and the evolution of the child society at different maturity levels to adulthood. It analyzes the developmental tasks and adjustment problems associated with winning belonging and playing roles in the peer group. (Brandt.)

H. D. Ed. 212, 214, 216. *Advanced Scientific Concepts in Human Development I, II, III.* (3, 3, 3)

Summer session. (Staff.)

H. D. Ed. 213, 215, 217. *Advanced Laboratory in Behavior Analysis I, II, III.* (3, 3, 3)

Summer session. (Staff.)

H. D. Ed. 218. *Workshops in Human Development.* (6)

Summer session. Prerequisites, H. D. Ed. 212, 213, 214, 215, 216, 217. (Staff.)

H. D. Ed. 219. *Psycho-Social Development of Exceptional Children.* (3)

Summer session. Studies intensively the psychology of exceptional children with stress upon the interrelationship among the psychological, physical, and social development of these children. (Staff.)

H. D. Ed. 220. *Developmental Tasks.* (3)

H. D. Ed. 200 or its equivalent, H. D. Ed. 201, and H. D. Ed. 202 are prerequisite. Describes the series of developmental tasks faced by children. These tasks, made necessary by the normal processes of growth and development, are learnings that the child needs and desires to accomplish because of emerging capacities for action and relationship, because of the demands and expectancies of his family and of society, and because of the progressive clarification and the directive powers of his own interest, attitudes, values and aspirations. Emphasis will be placed on the use of developmental tasks concepts in educational planning and practice. (Staff.)

H. D. Ed. 221. *Learning Theory and the Educative Process.* (3)

Prerequisites, H. D. Ed. 100 and 101 or equivalent. Provides a systematic review of the major theories of learning and their impact on education. Considers factors that influence learning. (Brandt.)

H. D. Ed. 230, 231. *Field Program in Child Study I and II.* (2-6)

Prerequisite, consent of instructor. Offers apprenticeship training preparing properly qualified persons to become staff members in human development workshops, consultants to child study field programs and coordination of municipal or regional child study programs for teachers or parents. Extensive field experience is provided. In general this training is open only to persons who have passed their preliminary examinations for the doctorate with a major in human development or psychology. (Morgan.)

H. D. Ed. 250a, 250b, 250c. *Direct Study of Children.* (1, 1, 1)

May not be taken concurrently with H. D. Ed. 102, 103, or 104. Provides the opportunity to observe and record the behavior of an individual child in a nearby school. These records will be used in conjunction with the advanced courses in human development and this course will be taken concurrently with such courses. Teachers active in their jobs while taking advanced courses in human development may use

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records from their own classrooms for this course. A minimum of one year of direct observation of human behavior is required of all human development students at the master's level. This requirement may be satisfied by this course. (Staff.)

H. D. Ed. 260. Synthesis of Human Development Concepts. (3)

Prerequisites, H. D. Ed. 204, 206 and 208. A seminar wherein advanced students work toward a personal synthesis of their own concepts in human growth and development. Emphasis is placed on seeing the dynamic interrelations between all processes in the behavior and development of an individual. (Prescott.)

H. D. Ed. 270. Seminars in Special Topics in Human Development. (2-6)

Prerequisite, consent of the instructor. An opportunity for advanced students to focus in depth on topics of special interest growing out of their basic courses in human development. (Staff.)

INDUSTRIAL EDUCATION

For Graduates and Advanced Undergraduates

Ind. Ed. 105. General Shop. (2)

Laboratory fee, \$5.00. Designed to meet needs in organizing and administering a secondary school general shop. Students are rotated through skill and knowledge developing activities in a variety of shop areas. (Crosby.)

Ind. Ed. 140. (Ed. 140.) Curriculum, Instruction, and Observation. (3)

Twenty periods of observation. Major functions and specific contributions of industrial art education; its relation to the general objectives of the junior and senior high schools; selection and organization of subject matter in terms of modern practices and needs; methods of instruction; expected outcomes; measuring results; professional standards. (Maley.)

Ind. Ed. 143. Industrial Safety Education I. (2)

This course deals briefly with the history and developing of effective safety programs in modern industry and treats causes, effects, and values of industrial safety education inclusive of fire prevention and hazard controls. (Staff.)

Ind. Ed. 144. Industrial Safety Education II. (2)

In this course exemplary safety practices are studied through conference discussions, group demonstrations, and organized plant visits to selected industrial situations. Methods of fire precautions and safety practices are emphasized. Evaluative criteria in safety programs are formulated. (Staff.)

Ind. Ed. 150. Training Aids Development. (3)

Study of the aids in common use as to their source and application. Special emphasis is placed on principles to be observed in making aids useful to shop teachers. Actual construction and application of such devices will be required. (Maley.)

Ind. Ed. 157. Tests and Measurements. (2)

Prerequisite, Ed. 150 or consent of instructor. The construction of objective tests for occupational and vocational subjects. (Staff.)

Ind. Ed. 161. Principles of Vocational Guidance. (2)

This course identifies and applies the underlying principles of guidance to the problems of educational and vocational adjustment of students. (Staff.)

Ind. Ed. 164. Shop Organization and Management. (2)

This course covers the basic elements of organizing and managing an industrial education program including the selection of equipment and the arrangement of the shop. (Crosby.)

Ind. Ed. 165. Modern Industry. (3)

This course provides an overview of manufacturing industry in the American social, economic, and culture pattern. Representative basic industries are studied from the viewpoints of personnel and management organization, industrial relations, production procedures, distribution of products, and the like. (Harrison.)

Ind. Ed. 166. Educational Foundations of Industrial Arts. (2)

A study of the factors which place industrial arts education in any well-rounded program of general education. (Jacobsen.)

Ind. Ed. 167. Problems in Occupational Education. (2)

The purpose of this course is to secure, assemble, organize, and interpret data relative to the scope, character and effectiveness of occupational education. (Staff.)

Ind. Ed. 168. Trade or Occupational Analysis. (2)

This course should precede Ind. Ed. 169. Provides a working knowledge of occupational and job analysis which is basic in organizing vocational-industrial courses of study. (Jacobsen.)

Ind. Ed. 169. Course Construction. (2)

Surveys and applies techniques of building and reorganizing courses of study for effective use in vocational and occupational schools. (Crosby.)

Ind. Ed. 170. Principles of Vocational Education. (2)

The course develops the vocational education movement as an integral phase of the American program of public education. (Maley.)

Ind. Ed. 171. History of Vocational Education. (2)

An overview of the development of vocational education from primitive times to the present. (Maley, Jacobsen)

Ind. Ed. 175. Recent Technological Developments in Products and Processes. (3)

This course is designed to give the student an understanding of recent technological developments as they pertain to the products and processes of industry. The nature of the newer products and processes is studied as well as their effect upon modern industry and/or society. (Merrill.)

For Graduates

Ind. Ed. 207. Philosophy of Industrial Arts Education. (3)

This course is intended to assist the student in his development of a point of view in regard to industrial arts and its relationship with the total educational program. He

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should, thereby, have a "yardstick" for appraising current procedures and proposals and an articulateness for his own professional area. (Harrison.)

Ind. Ed. 214. School Shop Planning and Equipment Selection. (3)

This course deals with principles involved in planning a school shop and provides opportunities for applying these principles. Facilities required in the operation of a satisfactory shop program are catalogued and appraised. (Tierney.)

Ind. Ed. 216. Supervision of Industrial Arts. (2)

(Tierney.)

Ind. Ed. 220. Organization, Administration, and Supervision of Vocational Education. (2)

This course surveys objectively the organization, administration, supervision, curricular spread and viewpoint, and the present status of vocational education. (Staff.)

Ind. Ed. 240. Research in Industrial Arts and Vocational Education. (2)

This is a course offered by arrangement for persons who are conducting research in the areas of industrial arts and vocational education. (Staff.)

Ind. Ed. 241. Content and Method of Industrial Arts. (3)

Various methods and procedures used in curriculum development are examined and those suited to the field of industrial arts education are applied. Methods of and devices for industrial arts instruction are studied and practiced. (Maley.)

Ind. Ed. 248. Seminar in Industrial Arts and Vocational Education. (2)

(Staff.)

MUSIC EDUCATION

For Graduates and Advanced Undergraduates

Mus. Ed. 128. Music for Elementary Classroom Teacher. (2-3)

Prerequisite, Music 16 or consent of instructor. A study of the group activities and materials through which the child experiences music. The course is designed to aid both music specialists and classroom teachers. It includes an outline of objectives and a survey of instructional methods. (Grentzer, Henke.)

Mus. Ed. 129. Methods of Class Instrumental Instruction. (2)

Prerequisites, or concurrent registration in Music 80, 81. Organization of and techniques for teaching beginning instrumental classes in the public schools. Two one-hour laboratories and one lecture per week. (Berman.)

Mus. Ed. 132. Music in the Secondary School. (2-3)

Prerequisite, consent of instructor. A study of the vocal and instrumental programs in the secondary schools. A survey of the needs in general music and the relationship of music to the core curriculum. (Henke.)

Mus. Ed. 139. Music for the Elementary School Specialist. (2)

First semester. Prerequisite, senior standing. A survey of instructional materials; objectives; organization of subject matter; lesson planning; methods and procedures in singing, listening, rhythms, simple instruments, and creative activities for the music specialist in the elementary school. Twenty periods of observation will be required for three credits. (Henke.)

Mus. Ed. 163. Band Techniques and Administration. (2)

Prerequisites, Music 81 and 161. Two lectures and two laboratory hours per week. Intensive study of a secondary wind instrument and of rehearsal techniques. A survey of instructional materials, administrative procedures, and band pageantry will be included. (Henderson.)

Mus. Ed. 170. Methods and Materials for Class Piano Instruction. (2)

The study of the principles and techniques of teaching class piano. The following groups, beginning and advanced, will be used for demonstrations: elementary school children, junior and senior high school students, adults. Special emphasis will be placed on the analysis of materials. (De Vermont.)

Mus. Ed. 171. String Teaching in the Public Schools. (2)

A study of the problems of organizing and developing the string program in the public schools. Emphasis is placed on exploratory work in string instruments, on the study of teaching techniques, and on the analysis of music literature for solo, small ensembles, and orchestra. (Berman.)

Mus. Ed. 173. The Vocal Music Teacher and School Organization. (2)

Prerequisite, practice teaching or teaching experience. Study of the function of the vocal music teacher in the elementary and secondary schools. Students will serve as resource teachers for those enrolled in Mus. Ed. 139. Open to graduate students by permission of instructor. (Grentzer.)

Mus. Ed. 175. Methods and Materials in Vocal Music for the High School. (2)

Prerequisite, consent of instructor. A survey of suitable vocal and choral repertoire for the high school. Problems of diction, interpretation, tone production, and phrasing. The course is designed primarily for choral directors and teachers of voice classes. (Grentzer.)

Mus. Ed. 180. Instrumental Seminar. (2)

Prerequisite, consent of instructor. Problems in the music directing of public-school instrumental organizations. A study of representative orchestral, band, and small-ensemble scores, and of the teaching problems involved. (Jordan.)

For Graduates

Mus. Ed. 200. Research Methods in Music and Music Education. (3)

The application of methods of research to problems in the fields of music and music education. The preparation of bibliographies and the written exposition of research projects in the area of the student's major interest. (Grentzer.)

Mus. Ed. 201. Administration and Supervision of Music in the Public Schools. (3)

The study of basic principles and practices of supervision and administration with emphasis on curriculum construction, scheduling, budgets, directing of in-service teaching, personnel problems, and school-community relationships. (Grentzer.)

Mus. Ed. 204. Current Trends in Music Education. (Seminar). (2)

A survey of current philosophies and objectives of music in the schools. The scope and sequence of the music curricula, vocal and instrumental, on the elementary and secondary levels. (Grentzer.)

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Mus. Ed. 205. Seminar in Vocal Music in the Elementary Schools. (2)

A comparative analysis of current methods and materials used in the elementary schools. A study of the music curriculum as a part of the total school program, and of the roles of the classroom teacher and the music specialist. (Grentzer.)

Mus. Ed. 206. Choral Conducting and Repertoire. (2)

The study and reading of choral literature of all periods, including the contemporary, suitable for use in school and community choruses. Style, interpretation, tone quality, diction, rehearsal and conducting techniques are analyzed. (Staff.)

Mus. Ed. 207. Seminar in Vocal Music in the Secondary Schools. (2)

A comparative analysis of current methods and materials used in teaching junior and senior high-school classes in general music, history and appreciation, theory, and voice; and in directing choral groups and community singing. (Grentzer.)

Mus. Ed. 208. The Teaching of Music Appreciation. (2)

A study of the objectives for the elementary and secondary levels; the techniques of directed listening, the presentation of theoretical and biographical materials, course planning, selection and use of audio-visual aids, and library materials, and the correlation between music and other arts. (Ulrich.)

Mus. Ed. 209. Seminar in Instrumental Music. (2)

A consideration of acoustical properties and basic techniques of the instruments. Problems of ensemble and balance, intonation, precision, and interpretation are studied. Materials and musical literature for orchestras, bands and small ensembles are evaluated. (Staff.)

Mus. Ed. 210. Advanced Orchestration and Band Arranging. (Seminar). (2)

Prerequisite, Music 147 or the equivalent, or consent of the instructor. A study of arranging and transcription procedures in scoring for the orchestra and band. Special attention is given to the arranging problems of the instrumental director in the public schools. (Henderson.)

SPECIAL EDUCATION

Sp. Ed. 170. Introduction to Special Education. (3)

Designed to give an understanding of the needs of all types of exceptional children, stressing preventive and remedial measures. (Hebeler.)

Sp. Ed. 171. Characteristics of Exceptional Children. (3-6)

A. Mentally Retarded. B. Gifted. Studies the diagnosis, etiology, physical, social, and emotional characteristics of exceptional children. Describes how the educational program should be modified to utilize the full capacity of these children. (Hebeler.)

Sp. Ed. 172. Education of Exceptional Children. (3-6)

A. Mentally Retarded. B. Gifted. Prerequisite, Sp. Ed. 171 or equivalent. Offers practical and specific methods of teaching exceptional children. Selected observation of actual teaching may be arranged. (Hebeler.)

Sp. Ed. 173. Curriculum for Exceptional Children. (3-6)

A. Mentally Retarded. B. Gifted. Prerequisite, Sp. Ed. 171 or equivalent. Examines the principles and objectives guiding curriculum for exceptional children; gives

experience in developing curriculum for these children; studies various curricula currently in use. (Hebeler.)

Sp. Ed. 278. Seminar in Special Education. (2)

An overview of education of exceptional children. (Hebeler.)

ELECTRICAL ENGINEERING

Professors: CORCORAN, REED, WAGNER AND WEBER.

Associate Professors: PRICE, SIMONS AND RUTELLI.

Lecturers: CHU, FREEMAN, KATZIN, SCHUCHARD, TRENT AND VANDERSLICE.

A written qualifying examination is required of all candidates for the master's degree in electrical engineering. This examination is held on the Saturday immediately prior to the fall registration period. Off-campus and part-time students must have satisfactorily completed a minimum of nine semester hours of graduate course work before being admitted to the written qualifying examination. Full-time students having less than nine semester hours of graduate course work are permitted to take this examination by special arrangement. The student must have been admitted to the Graduate School (electrical engineering) before taking this examination.

Students working toward the Master of Science degree in electrical engineering must take a minimum of six semester hours of course work from resident professors of electrical engineering. Students working toward the Doctor of Philosophy degree must take a minimum of twenty-four semester hours of course work from resident professors of electrical engineering and satisfactorily pass a written qualifying examination; students presenting a minor in electrical engineering must include at least six semester hours of electrical engineering from resident professors.

For Graduates and Advanced Undergraduates

E. E. 100. Alternating-Current Circuits. (4)

First semester. Three lectures and one laboratory period a week. Prerequisites, Math. 20, 21, Phys. 20, 21, and E. E. 1. Laboratory fee, \$4.00. Required of juniors in electrical engineering. Single and polyphase-circuit analysis under sinusoidal and non-sinusoidal conditions of operation. Mesh-current and nodal methods of analysis. Harmonic analysis by the Fourier series method. Theory and design of tuned coupled circuits. (Price, Simons.)

E. E. 101. Engineering Electronics. (4)

Second semester. Three lectures and one laboratory period a week. Prerequisite, E. E. 100. Laboratory fee, \$4.00. Required of juniors in electrical engineering. Theory and applications of electron tubes and associated circuits with emphasis on equivalent-circuit and graphical analysis of audio amplifiers; theory of feedback amplifiers. (Price, Simons.)

Electrical Engineering

E. E. 102. Alternating-Current Machinery. (4)

First semester. Three lectures and one laboratory period a week. Prerequisites, E. E. 65 and E. E. 100. Laboratory fee, \$4.00. Required of seniors in electrical engineering. The operating principles of alternating-current machinery considered from theoretical, design, and laboratory points of view. Synchronous generators and motors; single and polyphase transformers; three-phase induction generators and motors; single-phase induction motors. (Reed.)

E. E. 103. Engineering Analysis. (2)

Second semester. Two lectures a week. Prerequisite, E. E. 100. Analysis of physical systems with emphasis on the selection and application of appropriate mathematical methods. (Corcoran, Price.)

E. E. 104. Communications. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 60 and E. E. 100. Required of juniors in electrical engineering. Long-line theory applied to audio-frequency and ultra-high-frequency systems. Elements of filter theory; impedance matching; Maxwell's equations in rectangular and cylindrical coordinates; elements of waveguide theory. (Reed.)

E. E. 105, 106. Radio Engineering. (4, 4)

First and second semesters. Three lectures and one laboratory period a week. Prerequisites, E. E. 101, E. E. 105. Laboratory fee, \$4.00. Required of seniors in electrical engineering. Characteristics of radio-frequency circuits including the design of tuned couple circuits and Class C amplifiers. Amplification, oscillation, modulation, and detection with particular emphasis on radio-frequency amplification and broadcast-range reception. Elements of wave propagation and antenna systems. (Wagner, Price.)

E. E. 107. Electrical Measurements. (4)

Second semester. Three lectures and one laboratory period a week. Prerequisites, E. E. 100 and Math. 64. Laboratory fee, \$4.00. Measurement and calibration techniques employing ballistic galvanometers, potentiometers, bridges, electromagnetic and cathode-ray oscillographs, watt-hour meters, and electronic instruments. (Thompson.)

E. E. 108. Electric Transients. (3)

First semester. Three lectures a week. Prerequisites, E. E. 101, Math. 64. Required of seniors in electrical engineering. Current, voltage, and power transients in lumped-parameter networks. Introduction and utilization of Laplace transforms. Emphasis on natural circuit behavior as obtained from step and impulse excitation. (Price, Simons.)

E. E. 109. Pulse Techniques. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 108, Math. 64. Required of seniors in electrical engineering. Generation, shaping, amplification, and delay of non-sinusoidal wave-forms. Circuit design techniques and application to radar, television, and computers. (Simons, Schulman.)

E. E. 110. Transistor Circuitry. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 101. P-n junction theory; point-contact and junction type transistors; transistor parameters; equivalent circuits; typical transistor amplifier and oscillator circuits. (Corcoran, Simons.)

E. E. 114. Applied Electronics. (3)

First and second semesters. Three lectures a week. Prerequisite, E. E. 101. Detectors and discriminators; gas tube characteristics and associated circuits; photoelectric tubes and associated circuits; rectifiers and regulators; vacuum tube instruments. (Staff.)

E. E. 115. Feedback Control Systems. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 101 and E. E. 108. Servomechanisms and automatic regulators; investigations of electric, hydraulic, pneumatic, and mechanical elements; analysis of system differential equations and development of transfer functions; stability criteria. (Price.)

E. E. 116. Feedback Control Systems Laboratory. (1)

Second semester. One laboratory period a week. Prerequisite, E. E. 115 or concurrent registration in E. E. 115. Laboratory fee, \$4.00. Laboratory exercises involving some of the basic concepts of feedback control systems. (Price.)

E. E. 117. Power Transmission and Distribution. (3)

First semester. Three lectures a week. Prerequisite, concurrent registration in E. E. 102. Inductance and capacitance calculations of polyphase transmission lines on a per wire basis; effective resistance calculations and depth-of-penetration formula; generalized parameters of four-terminal networks and long-line theory applied to power distribution systems; use of transmission line charts. (Reed.)

E. E. 120. Electromagnetic Waves. (3)

Second semester. Three lectures a week. Prerequisites, Math. 64, senior standing in electrical engineering or physics. The basic mathematical theory of electromagnetic wave propagation employing Maxwell's equations in scalar and vector form and in generalized coordinates; application to wave-guide transmission; propagation in space. (Reed.)

E. E. 130. Electronic Analog Computers. (3)

First semester. Three lectures a week. Prerequisites, E. E. 101, Math. 64. Principles of electronic computers of the analog type. Analog computing components, operational amplifiers, d-c amplifiers, instrument servos, multipliers, and function generators. (Chu.)

E. E. 131. Electronic Digital Computers. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 101, Math. 64. Principles of electronic computers of the digital type. Digital computing operations, basic computing and control circuits, logical design, arithmetic unit, memory systems, and control units. (Chu.)

E. E. 160, 161. Vacuum Tubes. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 64, senior standing in electrical engineering or physics. Electron emission; laws of electron motion; space charge effects; noise in vacuum tubes; magnetic lenses; klystrons; magnetrons; photoelectric tubes; other special-purpose tubes. (Weber.)

For Graduates

E. E. 200. Symmetrical Components. (3)

First semester. Three lectures a week. Prerequisites, E. E. 102. Application of the method of symmetrical components to synchronous generators, transmission lines, trans-

Electrical Engineering

formers, static loads possessing mutual coupling, and induction motor loads. Complete network solutions in terms of symmetrical components. (Reed.)

E. E. 201. Electromagnetic Theory. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 120 or E. E. 215. Theoretical analysis and engineering applicants of Laplace's, Poisson's and Maxwell's equations. (Weber.)

E. E. 202, 203. Transients in Linear Systems. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, undergraduate major in electrical or mechanical engineering or physics. Operational circuit analysis; the Fourier integral; transient analysis of electrical and mechanical systems and vacuum tube circuits by the Laplace transform method. (Wagner.)

E. E. 206, 207. Microwave Engineering. (3, 3)

First and second semesters. Three lectures a week first semester and two lectures and one laboratory period a week second semester. Prerequisite, E. E. 201 or E. E. 216. Laboratory fee, E. E. 207, second semester, \$4.00. Basic consideration in solving field problems by differential equations; circuit concepts and their validity at high frequency; propagation and reflection of electromagnetic waves; guided electromagnetic waves; high-frequency oscillators and tubes; radiation engineering. (Weber.)

E. E. 209. Stability in Power Systems. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 200. An extension of symmetrical components. E. E. 200, as applied to power systems; study of the stability problem; the swing equation and its solution; the equal-area and Routh's criteria for stability; solutions of faulted three-phase networks; system design. (Reed.)

E. E. 212, 213. Servomechanisms. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, undergraduate major in electrical or mechanical engineering or physics. (It is desirable that the student should have had E. E. 202.) The design and analysis of regulatory systems, emphasizing servo-mechanisms. Regulatory systems are analyzed by means of the governing differential equations to provide background for more practical studies of frequency spectrum analysis. Characteristics of actual systems. (Price.)

E. E. 215, 216. Radio Wave Propagation. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, undergraduate major in electrical engineering, physics, or mathematics. Maxwell's wave equation; concept of retarded magnetic vector potential; propagation over plane earth; propagation over spherical earth; refraction; meteorological effects; complex antennas; air-to-air propagation; lobe modulation. (Reed.)

E. E. 218, 219. Signal Analysis and Noise. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, undergraduate major in electrical engineering or physics. Fourier series and integrals; phase and frequency modulation; noise figures of linear systems; shot effect; power spectra; applications of correlation function; properties of noise. (Freeman.)

E. E. 220, 221. Theory of Communication. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, E. E. 219. Measure of information and channel capacity; methods of describing random signals and circuit analysis involving those signals. The statistical theory of communication systems. Systems which are statistically optimum. (Weber.)

E. E. 222. Graduate Seminar. (1-3)

Second semester. Prerequisite, approved application for candidacy to the degree of Master of Science or Doctor of Philosophy in Electrical Engineering. Seminars are held on topics such as micro-wave engineering, radiation engineering, non-linear circuit analysis, tensor analysis, and other topics of current interest. Since the subject matter is continually changing, a student may receive a number of credits by re-registration. (Corcoran, Reed, Wagner, Weber.)

E. E. 230. Mathematics of Circuit Analysis.

First semester. Three lectures a week. Prerequisite, undergraduate major in electrical engineering or physics. The mathematics of circuit analysis, including determinants, matrices, complex variable, and the Fourier integral. (Vanderslice.)

E. E. 231. Active Network Analysis. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 230. The complex frequency plane; conventional feedback amplifier theory; Bode's mathematical definitions of feedback and sensitivity; theorems for feedback circuits; stability and physical realizability of electrical networks; Nyquist's and Routh's criteria for stability. (Vanderslice.)

E. E. 232, 233. Network Synthesis. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, E. E. 231 or equivalent. Design of driving-point and transfer impedance functions with emphasis on the transfer loss and phase of minimum-phase networks; flow diagrams; physical network characteristics, including relations existing between the real and imaginary components of network functions; modern methods of network synthesis. (Vanderslice.)

E. E. 235. Applications of Tensor Analysis. (3)

First semester. Three lectures a week. Prerequisite, E. E. 202 or E. E. 230. The mathematical background of tensor notation which is applicable to electrical engineering problems. Applications of tensor analysis to electric circuit theory and to field theory. (Wagner.)

E. E. 399. Electrical Engineering Research.

Prerequisite, approved application for candidacy to the degree of Master of Science or Doctor of Philosophy in electrical engineering. Six semester hours of credit in E. E. 399 are required of M.S. degree candidates and minimum of eighteen semester hours is required of Ph.D. candidates. A thesis covering an approved research problem and written in conformity with the regulations of the Graduate School is a partial requirement for either the degree of Master of Science or the degree of Doctor of Philosophy in electrical engineering. (Staff.)

ENGLISH LANGUAGE AND LITERATURE

Professors: MURPHY, ALDRIDGE, COOLEY, BODE, HARMAN (EMERITUS), MCMANAWAY (P.T.) AND ZEEVELD.

Associate Professors: HOVEY, JERMAN AND MISH.

Assistant Professors: BEALL, BROWN, LUTWACK AND MYERS.

The Department of English offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Candidates normally take both

English Language and Literature

major and minor work within the Department of English, but with permission students may take minor work in other departments.

Departmental requirements for the degree of Master of Arts include: (1) Eng. 201; (2) 3 credits from the following: Eng. 101, 102, 107, 202; (3) a written examination on English and American literature. Candidates must meet a foreign language requirement by either (1) passing the Graduate School reading examination in French or German; or (2) submitting a record of 12 undergraduate credits in one of the following languages: French, German, Spanish, Italian, Latin, or Greek. Students who wish to continue their work in this department towards the doctorate will be expected to elect the first alternative.

Departmental requirements for the degree of Doctor of Philosophy include: (1) a reading knowledge of French and German; (2) 6 credits from the following: Eng. 102, 202, 203; (3) an oral qualifying examination (normally waived for University of Maryland Masters of Arts in English), to be taken in the first year of residence after the master's degree or its equivalent; (4) a comprehensive written examination on English and American literature.

For Graduates and Advanced Undergraduates

- Eng. 101. History of the English Language.* (3)
Second semester. (Herman.)
- Eng. 102. Old English.* (3)
First semester. (Ball.)
- Eng. 104. Chaucer.* (3)
First semester. (Cooley.)
- Eng. 107. American English.* (3)
Second semester. (Ball.)
- Eng. 110, 111. Elizabethan and Jacobean Drama.* (3, 3)
First and second semesters. (Zeeveld, Mish.)
- Eng. 112. The Poetry of the Renaissance.* (3)
(Not offered 1962-63.) (Zeeveld.)
- Eng. 113. Prose of the Renaissance.* (3)
(Not offered 1962-63.) (Zeeveld, Mish.)
- Eng. 115, 116. Shakespeare.* (3, 3)
First and second semesters. (Zeeveld.)
- Eng. 120. English Drama from 1660 to 1880.* (3)
Second semester. (Ward.)
- Eng. 121. Milton.* (3)
Second semester. (Murphy.)

English Language and Literature

- Eng. 122. Literature of the Seventeenth Century, 1600-1660.* (3)
First semester. (Murphy.)
- Eng. 123. Literature of the Seventeenth Century, 1660-1700.* (3)
Second semester. (Aldridge.)
- Eng. 125, 126. Literature of the Eighteenth Century.* (3, 3)
First and second semesters. (Aldridge.)
- Eng. 129, 130. Literature of the Romantic Period.* (3, 3)
First and second semesters. (Weber.)
- Eng. 134, 135. Literature of the Victorian Period.* (3, 3)
First and second semesters. (Jerman, Cooley.)
- Eng. 139, 140. The English Novel.* (3, 3)
First and second semesters. (Ward, Jerman.)
- Eng. 143. Modern Poetry.* (3)
First semester. (Fleming.)
- Eng. 144. Modern Drama.* (3)
First semester. (Weber.)
- Eng. 145. The Modern Novel.* (3)
Second semester. (Andrews.)
- Eng. 148. The Literature of American Democracy.* (3)
Second semester. (Barnes.)
- Eng. 150, 151. American Literature.* (3, 3)
First and second semesters. (Bode, Manning, Gravely, Lutwack.)
- Eng. 155, 156. Major American Writers.* (3, 3)
First and second semesters. (Gravely, Manning, Portz.)
- Eng. 157. Introduction to Folklore.* (3)
First semester. (Cooley.)
- Eng. 160. Advanced Expository Writing.* (3)
Second semester. Prerequisite, permission of the instructor. (Myers.)
- Eng. 170. Creative Writing.* (3)
First semester. (Fleming.)
- Eng. 171. Advanced Creative Writing.* (3)
Second semester. Prerequisite, permission of the instructor. (Fleming.)
- Eng. 172. Playwriting.* (3)
Second semester. Prerequisite, permission of the instructor. (Fleming.)

Entomology

For Graduates

- Eng. 201. Bibliography and Methods.* (3)
First semester (Mish.)
- Eng. 202. Middle English.* (3)
Second semester. (Cooley.)
- Eng. 203. Gothic.* (3)
(Not offered 1962-63.)
- Eng. 204. Seminar in Medieval Literature.* (3)
First semester. (Cooley.)
- Eng. 206, 207. Seminar in Renaissance Literature.* (3, 3)
First and second semesters. (McManaway, Zeeveld.)
- Eng. 210. Seminar in Seventeenth Century Literature.* (3)
Second semester. (Mish.)
- Eng. 212, 213. Seminar in Eighteenth Century Literature.* (3, 3)
First and second semesters. (Aldridge.)
- Eng. 214, 215. Seminar in Nineteenth Century Literature.* (3, 3)
First and second semesters. (Jerman.)
- Eng. 216, 217. Literary Criticism.* (3, 3)
First and second semesters. (Lutwack.)
- Eng. 225, 226. Seminar in American Literature.* (3, 3)
First and second semesters. (Bode, Hovey.)
- Eng. 227, 228. Problems in American Literature.* (3, 3)
(Not offered 1962-63.) (Aldridge.)
- Eng. 241, 242. Studies in Twentieth Century Literature.* (3, 3)
(Bode, Hovey.)
- Eng. 399. Thesis Research.* (1-6)
Arranged. (Staff.)

ENTOMOLOGY

Professors: BICKLEY, DITMAN AND LANGFORD.

Associate Professor: JONES.

Assistant Professors: HARRISON, HAVILAND AND STEINHAEUER.

The Department of Entomology offers work toward the degrees of Master of Science and Doctor of Philosophy. Candidates for the Ph.D. degree

who are not employed by the Department are expected to register for a minimum of 24 semester hours credit during two semesters at College Park.

For Graduates and Advanced Undergraduates

Ent. 100. Advanced Apiculture. (3)

Second semester. One lecture and two three-hour laboratory periods a week. Prerequisite, Ent. 4. The theory and practice of apiary management. Designed for the student who wishes to keep bees or requires a practical knowledge of bee management. \$3.00 Lab fee. (Abrams.)

Ent. 105. Medical Entomology. (3)

First semester. Two lectures and one two-hour laboratory period a week. Prerequisite, Ent. 1, or consent of the Department. A study of insects and related arthropods that affect the health and comfort of man directly and as vectors of disease. In discussions of the control of such pests the emphasis will be upon community sanitation. \$3.00 Lab fee. (Jones.)

Ent. 107. Insecticides. (2)

Second semester. Prerequisite, consent of the Department. The development and use of contact and stomach poisons, fumigants and other important chemicals, with reference to their chemistry, toxic action, compatibility, and host injury. Recent research emphasized. (Shepard.)

Ent. 109. Insect Physiology. (2)

Second semester. Two lectures and occasional demonstrations. Prerequisite, consent of the Department. The functioning of the insect body with particular reference to blood, circulation, digestion, absorption, excretion, respiration, reflex action and the nervous system, and metabolism. (Jones.)

Ent. 115. Quarantine Procedures. (2)

Second semester. Prerequisite, consent of the Department. Lectures on the principles and procedures involved in preventing the introduction of foreign pests and the limitation of spread of endemic or introduced pests. (Johnson.)

Ent. 116. Insect Pests of Ornamentals and Greenhouse Plants. (3)

Second semester. Two lectures and one two-hour laboratory period a week. Prerequisite, Bot. 1 and Zool. 1. The recognition, biology, and control of insects injurious to plants grown in ornamental plantings, nurseries, and under glass. \$3.00 Lab fee. (Haviland.)

Ent. 119. Insect Pests of Domestic Animals. (2)

First semester. One lecture and one two-hour laboratory period a week. Prerequisite, Ent. 1 or consent of the Department. The recognition, biology, and control of insects and related arthropods injurious to horses, cattle, hogs, sheep, goats, and poultry. \$3.00 Lab. fee. (Haviland.)

Ent. 120. Insect Taxonomy and Biology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Ent. 1. Introduction to the principles of systematic entomology and the study of all orders and the important families of insects; immature forms considered. \$3.00 Lab. fee. (Bickley.)

Entomology

Ent. S121. *Entomology for Science Teachers.* (4)

Summer session. Five lectures and five two-hour laboratory periods a week. Laboratory fee, \$3.00. This course will include the elements of morphology, taxonomy and biology of insects using examples commonly available to high school teachers. It will include practice in collecting, preserving, rearing and experimenting with insects insofar as time will permit. (Haviland.)

Ent. 198. *Special Problems.* (1-3)

First and second semesters. Credit and prerequisites, to be determined by the Department. Investigations of assigned entomological problems. (Staff.)

Ent. 199. *Seminar.* (1, 1)

First and second semesters. Prerequisite, senior standing. Presentation of original work, reviews and abstracts of literature. (Staff.)

For Graduates

Ent. 203. *Advanced Insect Morphology.* (3)

First semester. One lecture and two three-hour laboratory periods a week. Insect structure with special reference to function. Given in preparation for advanced work in physiology or research in morphology. \$3.00 Lab. fee. (Haviland.)

Ent. 205. *Insect Ecology.* (2)

Second semester. One lecture and one two-hour laboratory period a week. Prerequisite, consent of the Department. A study of fundamental factors involved in the relationship of insects to their environment. Emphasis is placed on the insect as a dynamic organism adjusted to its surroundings. \$3.00 Lab. fee. (Harrison.)

Ent. 206. *Culicidology.* (2)

Second semester. One lecture and one three-hour laboratory period a week. (Alternate years; not offered 1962-63.) The classification, distribution, ecology, biology, and control of mosquitoes. \$3.00 Lab. fee. (Bickley.)

Ent. 207. *Advanced Insect Physiology.* (4)

Second semester. Two lectures and two three-hour laboratory periods a week. (Alternate years; not offered 1962-63.) Prerequisites, one year of organic chemistry and Ent. 109 or equivalent. In this course students rear experimental insects, make up reagents and solutions to be used, set up equipment, calibrate it, and make detailed measurements and observations on the functions of selected organ systems. \$3.00 Lab. fee. (Jones.)

Ent. 301. *Advanced Entomology.* (1-6)

Credit and prerequisites to be determined by the Department. First and second semesters. Studies of minor problems in morphology, physiology, taxonomy and applied entomology, with particular reference to the preparation of the student for individual research. (Staff.)

Ent. 399. *Research.*

First and second semesters. Required of graduate students majoring in entomology. This course involves research on an approved project. A dissertation suitable for publication must be submitted at the conclusion of the studies as a part of the requirements for an advanced degree. (Staff.)

FOREIGN LANGUAGES AND LITERATURE

Professors: ALDEN, ZUCKER (EMERITUS), FALLS, GOODWYN, PRAHL AND SMITH.

Associate Professors: DOBERT, HERING, PARSONS, QUINN, RAND AND ROSENFELD.

Assistant Professor: NEMES.

MASTER OF ARTS

Candidates must pass, in addition to written examinations in the courses pursued, a written examination based on the reading lists in their respective fields of French, German and Spanish, established by the Department. The examination will test the general familiarity of the candidate with his respective field and his powers of analysis and criticism. The oral examination will deal chiefly with the field of his thesis.

DOCTOR OF PHILOSOPHY

Candidates must pass a comprehensive written examination at least three months before the degree is awarded. This examination will include linguistics and each of the major literary fields.

Attention is called to the courses in Comparative Literature listed on pages 72-73.

FRENCH

For Graduates and Advanced Undergraduates

French 0. Intensive Elementary French. (0)

First and second semesters and summer session. Graduate students should register as auditors only. Intensive elementary course in the French language designed particularly for graduate students who wish to acquire a reading knowledge. (Hall.)

French 100. French Literature of the Sixteenth Century. (3)

First semester. The Renaissance in France; humanism; Rabelais and Calvin; the Pleiade; Montaigne. (Falls.)

French 101, 102. French Literature of the Seventeenth Century. (3, 3)

First and second semesters. First semester: Descartes, Pascal, Corneille, Racine. Second semester: the remaining great classical writers, with special attention to Moliere. (Quynn, Rosenfield.)

French 103, 104. French Literature of the Eighteenth Century. (3, 3)

First and second semesters. First semester: development of the philosophical and scientific movement; Montesquieu. Second semester: Voltaire, Diderot, Rousseau. (Falls, Bingham.)

French 105, 106. French Literature of the Nineteenth Century. (3, 3)

First and second semesters. First semester: drama and poetry from Romanticism to Symbolism. Second semester: the major prose writers of the same period. (Bingham, Quinn.)

Foreign Languages and Literature

French 107, 108. French Literature of the Twentieth Century. (3, 3)

First and second semesters. First semester: drama and poetry from Symbolism to the present time. Second semester: the contemporary novel. (Falls.)

French 121, 122. Advanced Composition. (3, 3)

First and second semesters. Translation from English into French, free composition, letter writing. (Falls.)

French 161, 162. French Civilization. (3, 3)

First and second semesters. French life, customs, culture, traditions. First semester: the historic development. Second semester: present-day France. (Rosenfield, Bingham.)

French 171. Practical French Phonetics. (3)

First semester. Pronunciation of modern French. The sounds and their production, the stress group, intonation. (Smith, Hall.)

French 199. Rapid Review of the History of French Literature. (1)

Second semester. Especially designed for French majors. Weekly lectures stressing the leading concepts in the history of French literature. (Falls.)

For Graduates

The requirements of students will determine which courses will be offered.

French 207, 208. The French Novel in the First Half of the Nineteenth Century. (2, 2)

First and second semesters. First semester: Chateaubriand to Dumas. Second semester: Stendhal to Merimee. (Falls.)

French 209, 210. The French Novel in the Second Half of the Nineteenth Century. (2, 2)

First and second semesters. First semester: Flaubert to Valles. Second semester: Huysmans to A. France. (Falls, Alter.)

French 211. French Linguistics. (3)

First semester. The development of the French language from its origins in Latin. (Smith.)

French 212. Old French Readings. (3)

Second semester. Reading of texts in Old French with emphasis on the literature as an expression of medieval culture. (Smith.)

French 215, 216. Moliere. (3, 3)

First and second semesters. Moliere's plays considered in the development of French comedy. (Quynn.)

French 221, 222. Reading Course.

(Arranged.) Designed to give the graduate student a background of a survey of French literature. (Staff.)

French 230. Introduction to European Linguistics. (3)

Linguistic problems considered on the basis of several languages. (Smith, Bulatkin.)

French 251, 252. Seminar. (3, 3)

Required of all graduate majors in French.

(Staff.)

French 399. Research.

Credits determined by work accomplished.

GERMAN

For Graduates and Advanced Undergraduates

German 0. Intensive Elementary German. (0)

First and second semesters and summer session. Graduate students should register as auditors only. Intensive elementary course in the German language designed particularly for graduate students who wish to acquire a reading knowledge.

(Hering, Anderson.)

German 101, 102. German Literature of the Eighteenth Century. (3, 3)

First and second semesters. The main works of Klopstock, Wieland, Lessing, Herder, Goethe, Schiller.

(Prahl.)

German 103, 104. German Literature of the Nineteenth Century. (3, 3)

First and second semesters. Outstanding works of Kleist, Grillparzer, Grabbe, Hebbel, Ludwig, Stifter, Keller, Anzengruber.

(Prahl.)

German 105, 106. Modern German Literature. (3, 3)

First and second semesters. Prose and dramatic writings from Gerhart Hauptmann to the present time (1890-1950).

(Prahl, Dobert.)

German 107, 108. Goethe's Faust. (2, 2)

First and second semesters. First and second parts of the drama.

(Hering.)

German 121, 122. Advanced Composition. (3, 3)

First and second semesters. Translations from English into German, free composition, letter writing.

(Anderson, Dobert.)

German 161, 162. German Civilization. (3, 3)

First and second semesters. A survey of two thousand years of German history, outlining the cultural heritage of the German people, their great men, tradition, customs, art and literature, with special emphasis on the interrelationship of social and literary history.

(Prahl.)

German 199. Rapid Review of the History of German Literature. (1)

Second semester. Especially designed for German majors. Weekly lectures stressing the leading concepts in the history of German literature.

(Staff.)

Attention is called to Comp. Lit. 106, *Romanticism in Germany*, and Comp. Lit. 107, *The Faust Legend in English and German Literature*.

For Graduates

The requirements of students will determine which courses will be offered.

German 202, 203. The Modern German Drama. (3, 3)

First and second semesters. Study of dramas from Hauptmann to Zuckmeyer.

(Staff)

Foreign Languages and Literature

German 204. Schiller. (3)

Study of Schiller's works with emphasis on his dramas. (Prahl.)

German 205. Goethe's Works outside of Faust. (2)

Particular attention given to Goethe's lyrics and novels. (Staff.)

German 206. The Romantic Movement. (3)

Special consideration given to the ideas and the style of romantic writers. (Prahl.)

German 221, 222. Reading Course.

(Arranged.) First and second semesters. Designed to give the graduate student a background of a survey of German literature. (Staff.)

German 230. Introduction to European Linguistics. (3)

First semester. Linguistic problems considered on the basis of several languages. (Smith.)

German 231. Middle High German. (3)

Second semester. Walther von der Vogelweide, the Nibelungenlied, Wolfgang von Eschenbach. (Anderson.)

German 251, 252. Seminar. (3, 3)

Required of all graduate majors in German. (Staff.)

German 399. Research.

Credits determined by work accomplished. (Staff.)

SPANISH

For Graduates and Advanced Undergraduates

Spanish 101. Epic and Ballad. (3)

First semester. The legendary and heroic matter of Spain. Readings of the *Poema del Cid* and of ballads of various cycles. (Parsons.)

Spanish 102. The Spanish Popular Ballad. (3)

Second semester. Typical ballads composed and developed in the Spanish-speaking world during and since the Golden Age, with stress on the folkloristic point of view. (Goodwyn.)

Spanish 104. The Drama of the Golden Age. (3)

Second semester. Selected plays of Lope de Vega, Calderon de la Barca, Tirso de Molina and others. (Parsons.)

Spanish 107. Cervantes: Plays and Exemplary Novels. (3)

First semester. (Rand.)

Spanish 108. Lope de Vega. (3)

First semester. Selected works of Lope de Vega. (Parsons.)

Spanish 109. Cervantes: Don Quijote. (3)

Second semester. (Goodwyn.)

Foreign Languages and Literature

Spanish 110. Modern Spanish Poetry. (3)

First semester. Significant poems of the nineteenth and twentieth centuries. (Rand.)

Spanish 111. The Spanish Novel of the Nineteenth Century. (3)

First semester. Readings of some of the significant novels of the nineteenth century. (Parsons.)

Spanish 112. Modern Spanish Drama. (3)

Second semester. Significant plays of the nineteenth and twentieth centuries. (Nemes.)

Spanish 113. The Spanish Novel of the Twentieth Century. (3)

Second semester. Significant novels of the twentieth century. (Rand.)

Spanish 115. Modern Spanish Thought. (3)

First semester. The generation of 1898 and other significant and interpretative writings of the twentieth century. (Rand.)

Spanish 121, 122. Advanced Composition. (3, 3)

First and second semesters. Training in self-expression in Spanish, free composition, letter writing. (Goodwyn.)

Spanish 151. Spanish-American Fiction. (3)

First semester. The novel and short story from the Wars of Independence to the present and their reflection of society in the republics of the Western Hemisphere. (Nemes.)

Spanish 152. Spanish-American Poetry. (3)

Second semester. Representative poetry after 1800 and its relation to European trends and writers. (Nemes.)

Spanish 153. Spanish-American Essay. (3)

First or second semester. Social and political thought from Bolivar to Vasconcelos and its relationship to social and political conditions in Spanish America. (Nemes.)

Spanish 161, 162. Spanish Civilization. (3, 3)

First and second semesters. Introductory study of the literary, educational, artistic traditions; great men, customs, and general culture. (Rand.)

Spanish 163, 164. Latin-American Civilization. (3, 3)

First and second semesters. Introductory study of the cultures of Latin America; the historical-political background and the dominating concepts in the lives of the people. (Goodwyn.)

Spanish 199. Rapid Review of the History of Spanish Literature. (1)

Second semester. Especially designed for Spanish majors. Weekly lectures stressing the leading concepts in the history of Spanish literature. (Parsons.)

For Graduates

Spanish 202. The Golden Age in Spanish Literature. (3)

First semester. Intensive study of selected classics. (Goodwyn.)

Foreign Languages and Literature

Spanish 203, 204. Spanish Poetry. (3, 3)

First and second semesters. First semester: poetry of the Golden Age. Second semester: romantic and modern poetry. (Goodwyn.)

Spanish 205, 206. Spanish Literature of the Twentieth Century. (3, 3)

First and second semesters. First semester: significant works of Angel Ganivet, Unamuno, Pio Baroja. Second semester: Azorin, Valle Inclan, Antonio Machado. (Rand.)

Spanish 211. Spanish Linguistics. (3)

First semester. The development of the Spanish language from its origins in Latin. (Mendeloff, Bulatkin.)

Spanish 212. Old Spanish Readings. (3)

Second semester. Reading of texts in Old Spanish, with emphasis on the literature as an expression of medieval culture. (Parsons.)

Spanish 221, 222. Reading Course.

(Arranged.) Designed to give the graduate student a background of a survey of Spanish literature. (Staff.)

Spanish 230. Introduction to European Linguistics. (3)

Linguistic problems considered on the basis of several languages. (Smith.)

Spanish 251, 252. Seminar. (3, 3)

Required of all graduate majors in Spanish. (Staff.)

Spanish 399. Research.

Credit determined by work accomplished. (Staff.)

RUSSIAN

For Graduates and Advanced Undergraduates

Russian 101, 102. Modern Russian Literature. (3, 3)

First and second semesters. Works of Maxim Gorky, Alexei Tolstoy, P. Romanov, M. Zoshchenko, M. Sholokhov. (Hitchcock.)

Russian 103, 104. Russian Literature of the Nineteenth Century. (3, 3)

First and second semesters. Selected writings of Pushkin, Gogol, Lermantov, Turgenev, Dostoevsky, Leo Tolstoy, Chekhov. (Hitchcock.)

CHINESE

Chinese 101, 102. Readings from Chinese History. (3, 3)

First and second semesters. Based on an anthology of historians from the Chou to the Ching dynasties. (Chen.)

Chinese 161, 162. Chinese Civilization. (3, 3)

First and second semesters. This course supplements Geography 134 and 135, *Cultural Geography of East Asia*. It deals with Chinese literature, art, folklore, history, government, and great men. Second semester: developments in China since 1911. Chinese 161 and 162 may be counted as history credits in meeting major and minor requirements. (Chen.)

HEBREW

Hebrew 101. The Hebrew Bible. (3)

Reading of selected portions of the Pentateuch. (Greenberg.)

Hebrew 102. The Hebrew Bible. (3)

Reading of selected portions of the Prophets. (Greenberg.)

Hebrew 103. Modern Hebrew Literature. (3)

The period of the Haskalah (Enlightenment). (Greenberg.)

Hebrew 104. Modern Hebrew Literature. (3)

The period of the Tehiah (Modern Revival). (Greenberg.)

GEOGRAPHY

Professors: VAN ROYEN, HU AND AUGELLI.

Consulting Professors: ROTERUS AND MC BRYDE.

Lecturer with rank of Professor: LEMONS.

Assistant Professor: AHNERT.

Students seeking graduate degrees in geography are expected to have acquired a broad foundation in the subject and in allied fields. This foundation must have included a minimum of 24 semester hours in geography, of which 6 semester hours shall have been in morphology and map reading and interpretation, 6 semester hours in weather and climate, and 12 semester hours in human, economic, or regional geography. In addition the student must have taken successfully the following courses, or their equivalents, in allied fields: anthropology (3 semester hours), economics (6 semester hours), history (6 semester hours), introductory or general botany (3 semester hours), sociology (3 semester hours), foreign language (12 semester hours). Students who do not have this background will be accepted as graduate students in a provisional status only and will be required to make up their deficiencies before being admitted to candidacy for an advanced degree. Graduate credit will not be given for courses taken to make up for deficiencies in background.

In addition to meeting the general requirements of the Graduate School, candidates for the master's degree in geography are required to have taken successfully: one field course (Geog. 170 or 200, or equivalent), a course in cartography, a course in soils, and one seminar. In addition to the final oral examination, the candidate for the master's degree in geography is required to pass satisfactorily a written examination covering the field in which he has worked, his understanding of basic principles, and his power of reasoning.

A graduate student seeking the Doctor of Philosophy degree in geography must take a comprehensive written and oral examination to determine

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whether he has sufficiently broad and profound knowledge and understanding of the entire field of geography to qualify as a candidate for the doctor's degree.

For Graduates and Advanced Undergraduates

Geog. 100. Regional Geography of Eastern Anglo-America. (3)

Second semester, alternate years. Prerequisite, Geog. 1, 2 or Geog. 10, or permission of instructor. A study of the cultural and economic geography, and the geographic regions of eastern United States and Canada, including an analysis of the significance of the physical basis for present-day diversification of development, and the historical geographic background. (McArthur.)

Geog. 101. Regional Geography of Western Anglo-America. (3)

Second semester, alternate years. Prerequisite, Geog. 1, 2 or Geog. 10 or permission of instructor. A study of western United States, western Canada, and Alaska along the lines mentioned under Geog. 100. (McArthur.)

Geog. 103. Geographic Concepts and Source Materials. (3)

First or second semester. A comprehensive and systematic survey of geographic concepts designed exclusively for teachers. Stress will be placed upon the philosophy of geography in relation to the social and physical sciences, the use of the primary tools of geography, source materials, and the problems of presenting geographic principles. (Staff.)

Geog. 104. Geography of Major World Regions. (3)

First or second semester. A geographic analysis of the patterns, problems, and prospects of the world's principal human-geographic regions, including Europe, Anglo-America, the Soviet Union, the Far East, and Latin America. Emphasis upon the casual factors of differentiation and the role geographic differences play in the interpretation of the current world scene. This course is designed especially for teachers. (Staff.)

Geog. 105. Geography of Maryland and Adjacent Areas. (3)

First or second semester. An analysis of the physical environment, natural resources, and population in relation to agriculture, industry, transport, and trade in the state of Maryland and adjacent areas. (Staff.)

Geog. 110. Economic and Cultural Geography of Caribbean America. (3)

First semester. An analysis of the physical framework, broad economic and historical trends, cultural patterns, and regional diversification of Mexico, Central America, the West Indies, and parts of Colombia and Venezuela. (Augelli.)

Geog. 111. Economic and Cultural Geography of South America. (3)

Second semester. A survey of natural environment and resources, economic development, and cultural diversity of the South American republics, with emphasis upon problems and prospects of the countries. (Augelli.)

Geog. 120. Economic Geography of Europe. (3)

First semester. The natural resources of Europe in relation to agricultural and industrial development and to present-day economic and national problems. (Van Royen, Anderson.)

Geog. 122. Economic Resources and Development of Africa. (3)

First or second semester. The natural resources of Africa in relation to agricultural and mineral production; the various stages of economic development and the potentialities of the future.
(Deshler.)

Geog. 123. Problems of Colonial Geography. (3)

First or second semester. Problems of development of colonial areas, with special emphasis upon the development of tropical regions and the possibilities of white settlement in the tropics.
(Staff.)

Geog. 125. Geography of Asia. (3)

Lands, climates, natural resources and major economic activities in Asia (except Soviet Asia). Outstanding differences between major regions.

Geog. 130. Economic and Political Geography of Eastern Asia. (3)

Study of China, Korea, Japan, the Philippines; physical geographic setting; population; economic and political geography. Potentialities of major regions and recent developments.

Geog. 131. Economic and Political Geography of South and Southeast Asia. (3)

Study of the Indian subcontinent, Farther India, Indonesia; physical geographic setting; population; economic and political geography. Potentialities of various countries and regions and their role in present Asia.

Geog. 134. Cultural Geography of China and Japan. (3)

Survey of geographical distribution and interpretation of cultural patterns of China and Japan. Emphasis on basic cultural institutions, outlook on life, unique characteristics of various groups. Trends of cultural change and contemporary problems.

Geog. 140. Soviet Lands. (3)

First or second semester. The natural environment and its regional diversity. Geographic factors in the expansion of the Russian state. The geography of agricultural and industrial production, in relation to available resources, transportation problems, and diversity of population.
(Anderson.)

Geog. 146. The Near East. (3)

First semester. The physical, economic, political, and strategic geography of the lands between the Mediterranean and India.
(Staff.)

Geog. 150. History and Theory of Cartography. (3)

Second semester. The development of maps throughout history, geographical orientation, coordinates, and map scales. Map projections, their nature, use, and limitations. Principles of representation of features on physical and cultural maps. Modern uses of maps and relationships between characteristics of maps and use types.
(Van Bergen van der Grijp.)

Geog. 151, 152. Cartography and Graphics Practicum. (3, 3)

First and second semesters. One hour lecture and two two-hour laboratory periods a week. Techniques and problems of compilation, design, and construction of various types of maps and graphs. Relationships between map making and modern methods of production and reproduction. Trips to representative plants. Laboratory work directed toward cartographic problems encountered in the making of non-topographic maps.
(Wiedel.)

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Geog. 153. Problems in Cartographic Representation and Procedure. (3)

First or second semester. Two hours lecture and two hours laboratory a week. Study of cartographic compilation methods. Principles and problems of symbolization, classification, and representation of map data. Problems of representation of features at different scales and for different purposes. Place-name selection and lettering stick-up and map composition. (Van Bergen van der Grijp.)

Geog. 154. Problems of Map Evaluation. (3)

First or second semester. Two hours lecture and two hours laboratory a week. Schools of topographic concepts and practices. Theoretical and practical means of determining map reliability, map utility, and source materials. Nature, status, and problems of topographic mapping in different parts of the world. Non-topographic special use maps. Criteria of usefulness for purposes concerned and of reliability. (Wiedel.)

Geog. 155. Problems and Practices of Photo Interpretation. (3)

First or second semester. Two hours of lecture and two hours of laboratory per week. Interpretation of aerial photographs with emphasis on the recognition of landforms of different types and man-made features. Study of vegetation, soil, and other data that may be derived from aerial photographs. Types of aerial photographs and limitations of photo interpretation. (Ahnert.)

Geog. 160. Advanced Economic Geography I. Agricultural Resources. (3)

First semester, alternate years. Prerequisite, Geog. 1 and 2, or Geog. 10. The nature of agricultural resources, the major types of agricultural exploitation in the world, and the geographic distribution of certain major crops and animals in relation to the physical environment and economic geographic conditions. Main problems of conservation. (Van Royen.)

Geog. 161. Advanced Economic Geography II. Mineral Resources. (3)

First semester, alternate years. Prerequisite, Geog. 1 and 2, or Geog. 10. The nature and geographic distribution of the principal power, metallic, and other minerals. Economic geographic aspects of modes of exploitation. Consequences of geographic distribution and problems of conservation. (Van Royen.)

Geog. 170. Local Field Course. (3)

First semester. Training in geographic field methods and techniques. Field observation of land use in selected rural and urban areas in eastern Maryland. One lecture per week with Saturday and occasional weekend field trips. Primarily for undergraduates. (Ahnert.)

Geog. 180. History, Nature and Methodology of Geography. (3)

First semester. A comprehensive and systematic study of the history, nature, and basic principles of geography, with special reference to the major schools of geographic thought; a critical evaluation of some of the important geographical works and methods of geographic research. (Hu.)

Geog. 190. Political Geography. (3)

Second semester. Geographical factors in national power and international relations; an analysis of the role of "Geopolitics" and "Geostrategy", with special reference to the current world scene. (Augelli.)

Geog. 195. Geography of Transportation. (3)

Second semester. The distribution of transport routes on the earth's surface; patterns of transport routes; the adjustment of transport routes and media to conditions of the natural environment; transportation centers and their distribution. (McArthur.)

Geog. 197. Urban Geography. (3)

First semester. Origins of cities, followed by a study of the elements of site and location with reference to cities. The patterns and functions of some major world cities will be analyzed. Theories of land use differentiation within cities will be appraised.

(McArthur.)

Geog. 199. Topical Investigations. (1-3)

First and second semesters. Restricted to advanced undergraduate students with credit for at least 24 hours of geography. Independent study under individual guidance. Choice of subject matter requires joint approval of adviser and Head of the Department of Geography.

(Staff.)

For Graduates

Geog. 200. Field Course. (3)

Field work in September, conferences and reports during first semester. For graduate students in geography. Open to other students by special permission of the Head of the Department of Geography. Practical experience in conducting geographic field studies. Intensive training in field methods and techniques and in the preparation of reports.

(Staff.)

Geog. 210, 211. Seminar in the Geography of Latin America. (3, 3)

First and second semesters. Prerequisites, Geog. 110, 111 or consent of instructor. An analysis of recent changes and trends in industrial development, exploitation of mineral resources and land utilization.

(Augelli, McBryde.)

Geog. 220, 221. Seminar in the Geography of Europe and Africa. (3, 3)

First and second semesters. Prerequisites, Geog. 120, 122 or consent of instructor. Analysis of special problems concerning the resources and development of Europe and Africa.

(Van Royen, Deshler.)

Geog. 230, 231. Seminar in the Geography of East Asia. (3, 3)

First and second semesters. Analysis of problems concerning the geography of East Asia with emphasis on special research methods and techniques applicable to the problems of this area.

(Hu.)

Geog. 240, 241. Seminar in the Geography of the U.S.S.R. (3, 3)

First and second semesters. Prerequisites, reading knowledge of Russian and Geog. 140 or consent of instructor. Investigation of special aspects of Soviet geography. Emphasis on the use of Soviet materials.

(Staff.)

Geog. 246. Seminar in the Geography of the Near East. (3)

(Staff.)

Geog. 250. Seminar in Cartography.

(Credit to be arranged.) First or second semester. The historical and mathematical background of cartographic concepts, practices and problems, and the various philosophical and practical approaches to cartography. Discussions will be supplemented by the presentation of specific cartographic problems investigated by the students.

(Van Bergen van der Grijp.)

Geog. 260. Advanced General Climatology. (3)

First semester. Prerequisite, Geog. 41, or consent of instructor. Advanced study of elements and controls of the earth's climates. Principles of climatic classification. Special analysis of certain climatic types.

(Lemons.)

Government and Politics

Geog. 261. Applied Climatology. (3)

Second semester. Prerequisite, Geog. 41, or consent of instructor. Study of principles, techniques, and data of micro-climatology, physical and regional climatology relating to such problems and fields as transportation, agriculture, industry, urban planning, human comfort, and regional geographic analysis. (Lemons.)

Geog. 262, 263. Seminar in Meteorology and Climatology. (3,3)

First and second semesters. Prerequisite, consent of instructor. Selected topics in meteorology and climatology chosen to fit the individual needs of advanced students. (Lemons.)

Geog. 280. Geomorphology. (3)

Second semester. An advanced comparative study of selected geomorphic processes and land forms; theories of land forms evolution and geomorphological problems. (Van Royen.)

Geog. 290, 291. Selected Topics in Geography. (1-3)

First and second semesters. Prerequisite, joint consent of adviser and Head of the Department of Geography. Readings and discussion on selected topics in the field of geography. (Staff.)

Geog. 399. Thesis Research.

(Credit to be arranged.) First and second semesters; summer session. (Staff.)

GOVERNMENT AND POLITICS

Professors: PLISCHKE, BURDETTE, DILLON AND STEINMEYER.

Associate Professors: ANDERSON, HARRISON AND HATHORN.

Assistant Professors: BYRD, MCNELLY AND O'DONNELL.

The Department of Government and Politics offers a graduate course of study leading to the degree of Master of Arts and the degree of Doctor of Philosophy. For the master's degree, the student may either pursue a general program in government and politics, or he may specialize in international affairs or in public administration.

For the master's degree, a comprehensive written examination is given on graduate course work in the major field. At the discretion of the Department, an oral examination may be substituted for the written examination.

The doctoral candidate must show in a written examination satisfactory competence in five of the following fields: (1) comparative government; (2) international affairs; (3) political theory; (4) public administration; (5) public law; (6) public policy; (7) state and local government. No candidate may attempt the comprehensive examination prior to completion of the language requirements for the doctorate, and no candidate may attempt the comprehensive examination more than twice.

Additional information respecting requirements and procedures may be obtained from the Department.

For Graduates and Advanced Undergraduates

G. & P. 101. International Political Relations. (3)

First semester. Prerequisite, G. & P. 1. A study of the major factors underlying international relations, the influence of geography, climate, nationalism, and imperialism, and the development of foreign policies of the major powers. (Harrison.)

G. & P. 102. International Law. (3)

Second semester. Prerequisite, G. & P. 1. Fundamental principles governing the relation of states, including matters of jurisdiction over landed territory, water, airspace, and persons; treatment of aliens; treaty-making; diplomacy; and the laws of war and neutrality. (Harrison.)

G. & P. 104. Inter-American Relations. (3)

Prerequisite, G. & P. 1. An analytical and historical study of the Latin-American policies of the United States and of problems in our relations with individual countries, with emphasis on recent developments. (Harrison.)

G. & P. 105. Recent Far Eastern Politics. (3)

First semester. Prerequisite, G. & P. 1. The background and interpretation of recent political events in the Far East and their influence on world politics. (Steinmeyer, McNelly.)

G. & P. 106. American Foreign Relations. (3)

First semester. Prerequisite, G. & P. 1. The principles and machinery of the conduct of American foreign relations, with emphasis on the Department of State and the Foreign Service, and an analysis of the major foreign policies of the United States. (Plischke.)

G. & P. 108. International Organization. (3)

Second semester. Prerequisite, G. & P. 1. A study of the objectives, structure, functions, and procedures of international organizations, including the United Nations and such functional and regional organizations as the Organization of American States. (Plischke.)

G. & P. 110. Principles of Public Administration. (3)

First semester. Prerequisite, G. & P. 1. A study of public administration in the United States, giving special attention to the principles of organization and management and to fiscal, personnel, planning, and public relations practices. (Dillon.)

G. & P. 111. Public Personnel Administration. (3)

First semester. Prerequisite, G. & P. 110 or B. A. 160. A survey of public personnel administration, including the development of merit civil service, the personnel agency, classification, recruitment, examination techniques, promotion, service ratings, training, discipline, employee relations, and retirement. (O'Donnell.)

G. & P. 112. Public Financial Administration. (3)

Second semester. Prerequisite, G. & P. 110 or Econ. 142. A survey of governmental financial procedures, including processes of current and capital budgeting, the administration of public borrowing, the techniques of public purchasing, and the machinery of control through pre-audit and post-audit. (O'Donnell.)

Government and Politics

G. & P. 124. Legislatures and Legislation. (3)

Second semester. Prerequisite, G. & P. 1. A comprehensive study of legislative organization, procedure, and problems. The course includes opportunities for student contact with Congress and with the Legislature of Maryland. (Hathorn.)

G. & P. 131, 132. Constitutional Law. (3, 3)

First and second semesters. Prerequisite, G. & P. 1. A systematic inquiry into the general principles of the American constitutional system, with special reference to the role of the judiciary in the interpretation and enforcement of the federal constitution; the position of the states in the federal system; state and federal powers over commerce; due process of law and other civil rights. (Hathorn.)

G. & P. 133. Administration of Justice. (3)

Second semester. Prerequisite, G. & P. 1. An examination of civil and criminal court structure and procedures in the United States at all levels of government, with special emphasis upon the federal judiciary. (Byrd.)

G. & P. 141. History of Political Theory. (3)

First semester. Prerequisite, G. & P. 1. A survey of the principal political theories set forth in the works of writers from Plato to Bentham. (Anderson.)

G. & P. 142. Recent Political Theory. (3)

Second semester. Prerequisite, G. & P. 1. A study of 19th and 20th century political thought, with special emphasis on recent theories of socialism, communism, and fascism. (Anderson.)

G. & P. 144. American Political Theory. (3)

First semester. Prerequisite, G. & P. 1. A study of the development and growth of American political concepts from the colonial period to the present. (Anderson.)

G. & P. 154. Problems of World Politics. (3)

Second semester. Prerequisite, G. & P. 1. A study of governmental problems of international scope, such as causes of war, problems of neutrality, and propaganda. Students are required to report on readings from current literature. (Steinmeyer.)

G. & P. 174. Political Parties. (3)

First semester. Prerequisite, G. & P. 1. A descriptive and analytical examination of American political parties, nominations, elections, and political leadership. (Burdette, Hathorn.)

G. & P. 178. Public Opinion. (3)

First semester. Prerequisite, G. & P. 1. An examination of public opinion and its effect on political action, with emphasis on opinion formation and measurement, propaganda, and pressure groups. (O'Donnell.)

G. & P. 181. Administrative Law. (3)

Second semester. Prerequisite, G. & P. 1. A study of the discretion exercised by administrative agencies, including analysis of their functions, their powers over persons and property, their procedures, and judicial sanctions and controls. (Dillon.)

G. & P. 191. The Government and Administration of the Soviet Union. (3)

Prerequisite, G. & P. 1. A study of the adoption of the communist philosophy by the Soviet Union, of its governmental structure, and of the administration of government policy in the Soviet Union. (Steinmeyer.)

G. & P. 197. Comparative Governmental Institutions. (3)

Second semester. Prerequisite, G. & P. 1. A study of major political institutions, such as legislatures, executives, courts, administrative systems, and political parties, in selected foreign governments. (McNelly.)

For Graduates

G. & P. 201. Seminar in International Political Organizations. (3)

A study of the forms and functions of various international organizations. (Plischke.)

G. & P. 202. Seminar in International Law. (3)

Reports on selected topics assigned for individual study and reading in substantive and procedural international law. (Harrison.)

G. & P. 205. Seminar in American Political Institutions. (3)

Reports on topics assigned for individual study and reading in the background and development of American government. (Burdette or Hathorn.)

G. & P. 206. Seminar in American Foreign Relations. (3)

Reports on selected topics assigned for individual study and reading in American foreign policy and the conduct of American foreign relations. (Plischke.)

G. & P. 207. Seminar in Comparative Governmental Institutions. (3)

Reports on selected topics assigned for individual study and reading in governmental and political institutions in governments throughout the world. (Steinmeyer.)

G. & P. 211. Seminar in Federal-State Relations. (3)

Reports on topics assigned for individual study and reading in the field of recent federal-state relations. (Dillon.)

G. & P. 213. Problems of Public Administration. (3)

Reports on topics assigned for individual study and reading in the field of public administration. (Dillon.)

G. & P. 214. Problems of Public Personnel Administration. (3)

Reports on topics assigned for individual study and reading in the field of public personnel administration. (O'Donnell.)

G. & P. 215. Problems of State and Local Government in Maryland. (3)

Reports on topics assigned for individual study in the field of Maryland state and local government. (Staff.)

G. & P. 216. Government Administrative Planning and Management. (3)

Reports on topics assigned for individual study and reading in administrative planning and management in government. (Staff.)

G. & P. 217. Government Corporations and Special Purpose Authorities. (3)

Reports on topics assigned for individual study and reading in the use of the corporate form for governmental administration. The topics for study will relate to the use of the corporate form as an administrative technique, as in the cases of the Tennessee Valley Authority, the Port of New York Authority, and local housing authorities. (Staff.)

History

G. & P. 221. Seminar in Public Opinion. (3)

Reports on topics assigned for individual study and reading in the field of public opinion. (Burdette, O'Donnell.)

G. & P. 223. Seminar in Legislatures and Legislation. (3)

Reports on topics assigned for individual study and reading about the composition and organization of legislatures and about the legislative process. (Burdette or Hathorn.)

G. & P. 224. Seminar in Political Parties and Politics. (3)

Reports on topics assigned for individual study and reading in the fields of political organization and action. (Burdette.)

G. & P. 225. Man and the State. (3)

Individual reading and reports on such recurring concepts in political theory as liberty, equality, justice, natural law and natural rights, private property, sovereignty, nationalism, and the organic state. (Anderson.)

G. & P. 231. Seminar in Public Law. (3)

Reports on topics assigned for individual study and reading in the fields of constitutional and administrative law. (Hathorn.)

G. & P. 251. Bibliography of Government and Politics. (3)

Survey of the literature of the various fields of government and politics and instruction in the use of government documents. (Byrd.)

G. & P. 261. Problems of Government and Politics. (3)

An examination of contemporary problems in the various fields of government and politics, with reports on topics assigned for individual study. (Hathorn.)

G. & P. 281. Department Seminar. (No Credit)

Topics as selected by the graduate staff of the Department. Registration for two semesters required of all doctoral candidates. Conducted by the entire departmental staff in full meeting. (Staff.)

G. & P. 399. Thesis Research. (Arranged)

(Staff.)

HISTORY

Professors: LAND, BAUER, CHATELAIN, GEWEHR (EMERITUS), MERRILL AND PRANCE.

Associate Professors: CONKIN, GORDON, JASHEMSKI, SPARKS AND STROMBERG.

Assistant Professors: CALLCOTT, FARQUHAR, FERGUSON, GATELL, PITT AND RIVLIN.

MASTER OF ARTS

A. Course Requirements

1. Course requirements are those set forth under Academic Information in this catalog, with the exception of 2 and 3 below.

2. The course, H. 200—*Historiography*, is required.
3. Fifteen hours of the total required for the Master of Arts degree must be in history, of which at least 9 hours shall be in the field of concentration.

B. Thesis

1. A thesis is required of all candidates for the Master of Arts degree in history.
2. The Department of History expects that the thesis, required of all candidates for the master's degree, shall display a capacity for directed research in a variety of historical sources, the ability to interpret factual detail, and shall constitute a properly documented report of the completed research.

C. Examinations

1. Candidates for the Master of Arts degree must pass a 4 to 6 hour written examination. The primary purpose of this examination is to determine the student's mastery of his major field. The examination will require factual and interpretive material as well as bibliography and historiography.
2. The oral examination will be confined to the thesis and the field in which it lies.

DOCTOR OF PHILOSOPHY

A. Course Requirements

1. Course requirements are those set forth under Academic Information in this catalog, with the exception of 2 and 3 below.
2. The course, H. 200—*Historiography*, is required.
3. In consultation with his adviser, candidates must select four general fields to present for examination.

4. Fields:

Greek History	Russian History
Roman History	Middle Eastern History
Medieval History	Chinese History
European History 1500-1789	Latin American History
European History 1789- Present	U.S. History to 1865
English History	U.S. History Since 1865
British Empire	Minor Outside Department

B. Examinations

1. The Qualifying Examination is normally taken after the student has completed one year's work beyond the M.A. Separate written examinations of 3 to 4 hours each will be given

on two selected fields on successive days. One language examination must be passed before the qualifying examination can be administered.

2. The Comprehensive Examination is taken at the completion of the student's course work. The comprehensive examination covers the two remaining fields and will consist of written examinations of 3 to 4 hours in each field and an oral examination of approximately two hours duration. The second language examination must be passed before the comprehensive examination can be administered. The satisfactory completion of the comprehensive examination shall for departmental purposes constitute admission to candidacy for which the student must make formal application within one month.
3. The Final Examination is conducted by a committee appointed by the Dean of the Graduate School. This examination, of approximately three hours duration, covers the research of the candidate as embodied in his thesis and his attainments in the fields of his major and minor subjects.

C. The following languages are approved for the Ph.D. requirement: French, German, Russian, Spanish, Arabic, Turkish, Hebrew, Chinese, and Japanese. One of the languages must be either French or German. No two languages offered may be in the same language family.

D. The Ph.D. Dissertation

The Department of History expects that the dissertation, required of all candidates for the doctorate, shall display a capacity for independent research in primary and secondary sources. The resulting synthesis must constitute a contribution to historical knowledge and ought to reveal the qualities of insight and sound judgment in the handling of historical materials.

AMERICAN HISTORY

For Graduates and Advanced Undergraduates

H. 5, 6 are prerequisites for courses H. 101 to H. 142, inclusive.

H. 101. American Colonial History. (3)

The settlement and development of colonial America to the middle of the eighteenth century. (Ferguson.)

H. 102. The American Revolution. (3)

The background and course of the American Revolution through the formation of the Constitution. (Ferguson.)

H. 103. The Formative Period in America, 1789-1824. (3)

The evolution of the federal government, the origins of political parties, problems of foreign relations in an era of international conflict, beginnings of the industrial revolution in America, and the birth of sectionalism. (Ferguson.)

H. 105. *Social and Economic History of the United States to 1865.* (3)

A synthesis of American life from independence through the Civil War. (Chatelain.)

H. 106. *Social and Economic History of the United States Since the Civil War.* (3)

The development of American life and institutions, with emphasis upon the period since 1876. (Chatelain.)

H. 114. *The Middle Period of American History 1800-1860.* (3)

An examination of the political history of the United States from Jefferson to Lincoln with particular emphasis on the factors producing Jacksonian democracy, Manifest Destiny, the Whig Party, the anti-slavery movement, the Republican Party, and secession. (Sparks.)

H. 115. *The Old South.* (3)

A study of the institutional and cultural life of the ante-bellum South with particular reference to the background of the Civil War. (Staff.)

H. 116. *The Civil War.* (3)

Military aspects; problems of the Confederacy; political, social, and economic effects of the war upon American society. (Sparks.)

H. 118, 119. *Recent American History.* (3, 3)

Party politics, domestic issues, foreign relations of the United States since 1890. First semester, through World War I. Second semester, since World War I. (Merrill.)

H. 121. *History of the American Frontier.* (3)

Prerequisites, H. 5, 6, or the equivalent. The Trans-Allegheny West. The westward movement into the Mississippi Valley, and the Far West. (Pitt.)

H. 124. *Reconstruction and the New Nation 1865-1896.* (3)

Problems of reconstruction in both South and North. Emergence of big business and industrial combinations. Problems of the farmer and laborer. (Merrill.)

H. 127, 128. *Diplomatic History of the United States.* (3, 3)

First and second semesters. An historical study of the diplomatic negotiations and foreign relations of the United States. First semester: from the Revolution to the Civil War. Second semester: from the Civil War to the present. (Wellborn.)

H. 129. *The United States and World Affairs.* (3)

A consideration of the changed position of the United States with reference to the rest of the world since 1917. (Wellborn.)

H. 133, 134. *The History of Ideas in America.* (3, 3)

An intellectual history of the American people, embracing such topics as liberty, democracy, and social ideas. (Conkin.)

H. 135, 136. *Constitutional History of the United States.* (3, 3)

A study of the historical forces resulting in the formation of the Constitution, and the development of American constitutionalism in theory and practice thereafter. (Gatell.)

H. 141, 142. *History of Maryland.* (3, 3)

First semester: a survey of the political, social and economic history of colonial Maryland. Second semester: Maryland's historical development and role as a state in the American Union. (Chatelain.)

History

H. 145, 146. *Latin-American History.* (3, 3)

A survey of the history of Latin America from colonial origins to the present, covering political, cultural, economic, and social development, with special emphasis upon relations with the United States. First semester: the colonial period. Second semester: the Republics. (Crosman.)

H. 147. *History of Mexico.* (3)

The history of Mexico with special emphasis upon the independence period and upon relations between ourselves and the nearest of our Latin American neighbors. (Crosman.)

H. 148. *History of Canada.* (3)

A history of Canada, with special emphasis on the nineteenth century and upon Canadian relations with Great Britain and the United States. (Gordon.)

EUROPEAN HISTORY

H. 41, 42, H. 51, 52, or H. 53, 54 are prerequisites for courses H. 151 to H. 180 inclusive.

H. 151. *History of the Ancient Orient and Greece.* (3)

A survey of the ancient civilizations of Egypt, the Near East, and Greece, with particular attention to their institutions, life, and culture. (Jashemski.)

H. 153. *History of Rome.* (3)

A study of Roman civilization from the earliest beginnings through the Republic and down to the last centuries of the Empire. (Jashemski.)

H. 155. *Medieval Civilization.* (3)

A survey of medieval life, culture, and institutions from the fall of the Roman Empire to the thirteenth century. (Staff.)

H. 159, 160. *History of European Ideas.* (3, 3)

Beginning with a review of the basic Western intellectual traditions as a heritage from the Ancient World, the course will present selected important currents of thought from the scientific revolution of the 16th and 17th centuries down to the 20th century. First semester: through the 18th century. Second semester: 19th and 20th centuries. (Stromberg.)

H. 161. *The Renaissance and Reformation.* (3)

The culture of the Renaissance, the Protestant revolt and Catholic reaction through the Thirty Years War. (Staff.)

H. 163, 164. *History of the British Empire.* (3, 3)

First semester: the development of England's Mercantilist Empire and its fall in the war for American Independence (1783). Second semester: the rise of the Second British Empire and the solution of the problem of responsible self-government (1783-1867), the evolution of the British Empire into a Commonwealth of Nations, and the development and problems of the dependent Empire. (Gordon.)

H. 165. *Constitutional History of Great Britain.* (3)

A survey of constitutional development in England with emphasis on the real property aspects of feudalism, the growth of the common law, the development of Parliament, and the expansion of liberties of the individual. (Gordon.)

H. 167, 168. History of Russia. (3, 3)

A history of Russia from earliest times to the present day. (Yaney.)

H. 169, 170. Europe in the Nineteenth Century, 1815-1919. (3, 3)

A study of the political, economic, social, and cultural developments of Europe from the Congress of Vienna to the First World War. (Bauer.)

H. 171, 172. Europe in the World Setting of the Twentieth Century. (3, 3)

A study of political, economic, and cultural developments in twentieth century Europe with special emphasis on the factors involved in the two World Wars and their global impacts and significance. (Prange.)

H. 173. The Soviet Union. (3)

A history of the Bolshevik Revolution and the founding of the Soviet Union; the economic and foreign policy of the USSR to the present. (Yaney.)

ASIAN HISTORY

H. 181, 182. The Middle East. (3, 3)

A survey of the historical and institutional developments of the nations of this vital area. The Islamic Empires and their cultures; impact of the west; breakup of the Ottoman Empire and rise of nationalism; present day problems. (Rivlin.)

H. 183. The Contemporary Middle East. (3)

H. 181 or 182 recommended though not required. The development of middle eastern institutions in the 19th and 20th centuries with reference to the emergence of contemporary states and their place in world affairs. (Rivlin.)

H. 187, 188. History of China. (3, 3)

A history of China from earliest times to the present. The emphasis is on the development of Chinese institutions that have molded the life of the nation and its people. (Farquhar.)

H. 199. Proseminar in Historical Writing. (3)

First and second semesters. (Bauer, Callcott, Gatell, Staff.)

For Graduates

H. 200. Historiography: Techniques of Historical Research and Writing. (3)

An introduction to the professional study of history, including an examination of the sources and nature of historical knowledge, historical criticism, and synthesis. Required of all candidates for advanced degrees in history. (Bauer, Sparks, and Staff.)

H. 201. Seminar in American History. (3)

(Staff.)

H. 202. Historical Literature: American. (1-6)

Readings in the standard works and monographic studies to meet the requirements of qualified graduate students who wish intensive concentration in American history. (Staff.)

History

- H. 203. *Seminar in the History of Maryland.* (3)
(Land.)
- H. 205. *Seminar in American Economic History.* (3)
A seminar in the problems of American economic history of selected periods.
(Chatelain.)
- H. 206. *Seminar in American Social History.* (3)
A seminar in the problems of American social history of selected periods. (Pitt.)
- H. 208. *Seminar in Recent American History.* (3)
(Merrill.)
- H. 211. *Seminar in American Colonial History.* (3)
A seminar on selected problems of early American history. (Land.)
- H. 212. *Seminar in the American Revolution.* (3)
A seminar on problems of American history in the revolutionary era. (Ferguson.)
- H. 214. *Seminar in the Middle Period of American History.* (3)
Selected research topics in the period from Jackson to the Civil War. (Sparks.)
- H. 215. *Seminar in the Old South.* (3)
A seminar on problems in the history of the ante-bellum South. (Staff.)
- H. 216. *Seminar in the American Civil War.* (3)
Investigations of the political, military, and economic problems of the North and South during the Civil War. (Sparks.)
- H. 217. *Seminar in Reconstruction America.* (3)
A seminar on problems resulting from the Civil War: political, social, and economic reconstruction. (Merrill.)
- H. 221. *Seminar in Western History.* (3)
A seminar on American frontier history in the trans-Appalachian region and the Great Plains. (Pitt.)
- H. 233. *Seminar in Early American Intellectual History.* (3)
A seminar on selected problems of American intellectual history before 1859. (Conkin.)
- H. 234. *Seminar in Recent American Intellectual History.* (3)
A seminar on problems of American intellectual history since 1859. (Conkin.)
- H. 245. *Topics in Latin American History.* (3)
A seminar on selected topics in Latin American history. (Crosman.)
- H. 251. *Seminar in Greek History.* (3)
A seminar in the sources and problems of Greek history. (1) "Greek Federal Leagues" and "Political Institutions of the Greek City States" are usually offered in alternate years. (Jashemski.)
- H. 253. *Seminar in Roman History.* (3)
A seminar in the sources and problems of Roman history. (1) "Provinces of the

Roman Empire"; (2) "Roman Political Institutions," (3) "Roman Religion," and (4) "Municipal Life and Institutions" are usually offered in successive years.
(Jashemski.)

H. 255. Medieval Culture and Society. (3)

Readings and conferences designed to acquaint the student with the important literature and interpretations on such topics as feudalism, the medieval Church, schools and universities, Latin and vernacular literature, art and architecture. (Staff.)

H. 260. Historical Literature: European. (1-6)

Readings in the standard works and monographic studies to meet the requirements of qualified graduate students who wish intensive concentration in European history. (Staff.)

H. 265. Seminar in Middle Eastern History. (3)

A seminar on selected problems of Middle Eastern history. (Rivlin.)

H. 269. Seminar in Nineteenth Century Europe. (3)

A seminar on problems in the history of western Europe during the nineteenth century. (Bauer.)

H. 281. Problems in the History of World War I. (3)

Investigation of various aspects of the First World War, including military operations, diplomatic phases, and political and economic problems of the war and its aftermath. (Prange.)

H. 282. Problems in the History of World War II. (3)

Investigation of various aspects of the Second World War, including military operations, diplomatic phases, and political and economic problems of the war and its aftermath. (Prange.)

H. 285. Seminar in the History of Britain. (3)

A seminar in selected problems of the history of the United Kingdom. (Gordon.)

H. 286. Seminar in the History of the British Empire. (3)

A seminar on selected problems in the history of the British empire. (Gordon.)

H. 289. Seminar in Chinese History. (3)

A seminar on selected problems in the history of China. (Farquhar.)

H. 290. Historical Literature: Asian. (1-6)

Readings in the standard works and monographic studies to meet the requirements of qualified graduate students who wish intensive concentration in Asian history. (Staff.)

H. 390. The Teaching of History in Institutions of Higher Learning. (1)

Investigation and discussion of professional teaching of history at the college level: course construction, presentation of subject matter, testing, instructional aids, evaluation of instruction. Required of all graduate assistants.

H. 399. Research. (1-6)

Credit apportioned to amount of research. First and second semesters. (Staff.)

HOME ECONOMICS

Professors: LIPPEATT AND MITCHELL.

Associate Professors: BRAUCHER, BROWN AND WILSON.

Assistant Professor: WILBUR.

The College offers three programs of study leading to the degree of Master of Science in the fields of food and nutrition, general home economics, and textiles and clothing.

A candidate for an advanced degree with a major or minor in home economics is expected to have an undergraduate major in home economics or in closely allied fields. The graduate study program will supplement the student's previous training and experience to achieve a well-rounded knowledge of the subject, with due consideration given to the student's purpose in undertaking graduate study. Graduate students may prepare for some specialized phases of home economics, including food, nutrition, textiles and clothing, and home economics education. (See Department of Education.) A student whose preparation is deficient in any area may meet prerequisites during a period of study as a special student or as a provisional candidate. Interdepartmental programs and offerings in the several areas of home economics to give breadth of contact with the field of home economics are available.

FOOD AND NUTRITION

Students with a major or minor in the field of food and nutrition may select from a variety of courses, seminars, and experiences in independent study. Each student plans his program in consultation with his major adviser, after consideration of his background and purpose in graduate study.

A master's degree candidate wishing to major in this field is expected to have had training equivalent to that of an undergraduate major in the Department of Food, Nutrition and Institution Management (basic courses in food and nutrition, organic and biochemistry, microbiology, and physiology).

GENERAL HOME ECONOMICS

This program is oriented toward home economists whose work is centered in home, school and community services, and to home economists returning to employment after a period of absence. It is primarily designed to increase competence in more than one area within the field of home economics. The program utilizes many courses in the University as well as the College to permit a well-integrated study.

TEXTILES AND CLOTHING

For students who wish to major or minor in textiles and clothing a variety of offerings is available as to course work and opportunities for in-

dependent study. Candidates for a Master of Science degree in the field of textiles and clothing are expected to acquire a general knowledge of all phases of the field and an understanding of research methods in it, and to concentrate in one of the various areas of textiles and clothing.

FOOD, NUTRITION AND INSTITUTION MANAGEMENT

For Graduates and Advanced Undergraduates

Foods 100. Food Economics. (2)

First semester. Prerequisite, Foods 1 or 2, 3. One lecture and one laboratory period a week. Laboratory fee, \$7.00. Sources of our food supply; buying of food for the family. (Cornell.)

Foods 101. Meal Management. (3)

First and second semesters. Two laboratory periods a week. Prerequisite, Foods 1, or 2, 3. Laboratory fee, \$10.00. Planning, preparing and serving meals for family groups, considering nutritional needs and management of money, time and labor; includes entertaining. (Cornell.)

Foods 102. Experimental Foods. (3)

First semester. One lecture and two laboratory periods a week. Prerequisites, Foods 2, 3; Organic Chemistry, Chem. 31, 32, 33, 34. Laboratory fee, \$10.00. A study of food preparation processes from the experimental viewpoint. (Brown.)

Foods 104. Advanced Foods. (2-3)

First semester. Prerequisites, Foods 2, 3; Chem. 31, 32, 33, 34. Laboratory fee, \$3.00. The physical and chemical behavior of the basic food constituents in food preparation and processing; study of recent advances in those fields. (Staff.)

Foods 105. Foods of Other Countries. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Foods 1 or 2, 3, or equivalent. Laboratory fee, \$10.00. Food preparation and food customs of the peoples of other countries. (Cornell.)

Nut. 110. Nutrition. (3)

First and second semesters. Prerequisites, Foods 2, 3; Organic Chemistry, Chem. 31, 32, 33, 34 to precede or parallel. Laboratory fee, \$10.00. A scientific study of principles of human nutrition. Animal experimentation. Correction of nutritional deficiencies by dietary studies. (Braucher.)

Nut. 111. Child Nutrition. (2)

First and second semesters. One lecture and one laboratory period a week. Prerequisites, Foods 1 or 2, 3, Nut. 10 or 110. Laboratory fee, \$7.00. Principles of human nutrition applied to growth and development of children. Experience in a nursery school. (Collins.)

Nut. 112. Dietetics. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Nut. 110. A study of food selection for health; planning and calculating dietaries for children, adults and family units; methods of teaching food values and nutrition. Laboratory fee, \$10.00. (Staff.)

Home Economics

Nut. 113. Diet and Disease. (2)

Second semester. Alternate years. Prerequisite, Nut. 110. Modification of the normal adequate diet to meet the nutritional needs in treating certain diseases. Laboratory fee, \$3.00. (Staff.)

Nut. 114. Nutrition for Health Services. (3)

Second semester. Prerequisite, Nut. 10 or the equivalent. Laboratory fee, \$3.00. A scientific study of nutritional status and the effect of food habits and food consumption on family health. Nutritional requirements for individuals in different stages of development. Techniques and procedures for the application of nutrition knowledge with consideration of various economic levels and social backgrounds. For graduate nurses, dietitians, health teachers, and social workers. (Braucher.)

Nut. 120. Advanced Nutrition. (3)

First semester. Prerequisites, Foods 3; Zool. 1; Biochemistry 81, 82 or concurrent. The progress of nutrition as found in the results of current research, with emphasis on interpretation and application. Laboratory fee, \$3.00. (Staff.)

For Graduates

Foods 200. Advanced Experimental Foods. (3-5)

Second semester. Two lectures and three laboratory periods a week. Laboratory fee, \$10.00. Selected readings of literature in experimental foods. Development of individual problem. (Staff.)

Foods 204. Recent Trends in Foods. (2-3)

First semester. Laboratory fee, \$3.00. Recent trends in the preparation, processing and marketing of foods. (Staff.)

Foods 210. Readings in Foods. (3)

Second semester. Prerequisites, Foods 102, 104. A critical survey of literature on recent developments in food research. (Brown.)

Foods 220. Seminar. (1, 1)

First semester. Laboratory fee, \$3.00. Reports and discussions of current research in foods. (Brown.)

Foods 399. Research. (6)

First and second semesters. Laboratory fee, \$10.00. Credit in proportion to work done and results accomplished. Investigation in some phases of food which may form the basis of a thesis. (Brown.)

Nut. 204. Recent Advances in Nutrition. (2-3)

Second semester. Laboratory fee, \$3.00. Factors that affect the nutritive value of food during production, cookery processes, holding practices, processing, packaging and storage. (Braucher.)

Nut. 208. Recent Progress in Human Nutrition. (3)

Second semester. Laboratory fee, \$3.00. The recent developments in the science of nutrition with emphasis upon the interpretations of these findings for application in health and disease. Aids for the dietitian in creating a better understanding of

nutrition among patients, students of graduate status and personnel, such as those of the dental and medical profession. (Braucher.)

Nut. 210. Readings in Nutrition. (3)

First semester. Laboratory fee, \$3.00. Reports and discussion of outstanding nutritional research and investigation. (Braucher.)

Nut. 211. Problems in Nutrition. (3-5)

Second semester. Laboratory fee, \$10.00. Experience in a phase of nutrition research which is of interest to the student. Use of experimental animals, human studies or an extensive and critical survey of the literature. (Braucher.)

Nut. 212. Nutrition for Community Service. (3)

First semester. Laboratory fee, \$3.00. Applications of the principles of nutrition to various community problems. Students may work on problems of their own choosing. (Braucher.)

Nut. 220. Seminar. (1, 1)

First and second semesters. Reports and discussions of current research in nutrition. (Staff.)

Nut. 399. Research. (6)

First and second semesters. Laboratory fee, \$10.00. Credit in proportion to work done and results accomplished. Investigation in some phase of nutrition which may form the basis of a thesis. (Braucher.)

GENERAL HOME ECONOMICS

For Graduates and Advanced Undergraduates

H. E. 190. Special Problems in Home Economics. (1-3)

Junior, senior or graduate standing and consent of instructor. Laboratory fee \$3.00 to \$10.00, depending upon department and credit hours. Problem may be in any area of home economics and will carry the name of the subject matter of the problem.

For Graduates

H. E. 201. Methods of Research in Home Economics. (3)

First and second semesters. Prerequisite, Statistics or Tests and Measurements (Ed. 151, Soc. 183, Agr. 100, or equivalent). Application of scientific methods to problems in the field of home economics with emphasis on needed research of an interdisciplinary nature. (Lippeatt.)

H. E. 202. Integrative Aspects of Home Economics. (2)

First and second semesters. Prerequisite, consent of instructor. Scope and focus of total professional field with emphasis on purposes and functions as related to family and other group living. Impact of the changing social, economic, technological and educational situation upon home economics. (Wilson.)

H. E. 290. Special Topics. (1-6) *Credit as arranged.*

First and second semesters. Summer session. Concentrated study in areas of home economics, such as consumer problems; housing, interior design, and home furnishings; institution administration, and food service. (Staff.)

Home Economics

H. E. 399. *Thesis Research.* (1-6)

First and second semesters, summer session. 1-6 credits according to work accomplished.
(Staff.)

FAMILY LIFE AND MANAGEMENT

For Graduates and Advanced Undergraduates

Home Mgt. 150, 151. Management of the Home. (3, 3)

Two lectures and one laboratory period a week. Prerequisite, Econ. 37. Laboratory fee for Home Mgt. 151, \$3.00. Principles of scientific management applied to the family's use of resources, particularly to use of time, energy and money, pointing up the importance of choice as values and goals change throughout the life cycle. Housing from the sociological aspects of what constitutes good housing, housing legislation, determination of a family's housing needs, ways and means of meeting them. Household equipment, its selection, use and care, as durable and non-durable goods of the family.
(Staff.)

Home Mgt. 152. Experience in Management of the Home. (3)

First and second semesters. Prerequisites, Home Mgt. 150, 151. Laboratory fee, \$10.00. Residence for one third of a semester in the Home Management House. Experience in planning, coordinating and participating in the activities of a household composed of a faculty member and a group of students. A charge of \$40.00 for food and supplies is assessed each student. Students who board at the University may receive a pro-rata refund of the established charge if the Dining Hall Card is turned in during the period of residence in the Home Management House. Students not living in the dormitories are billed at the rate of \$5.00 per week for a room in the Home Management House. (Staff.)

Home Mgt. 155. Money Management. (2)

Two lectures a week. Prerequisite, Home Mgt. 150 or consent of instructor. Integrating the use of money and other available resources to meet both individual and family wants and needs. Emphasis on areas of finance influencing family economic decisions.
(Staff.)

Home Mgt. 156. Household Equipment. (2)

Two laboratory periods a week. Laboratory fee, \$3.00. Problems in selection, use and care of small and large equipment.
(Staff.)

Home Mgt. 158. Special Problems in Management. (3)

Summer session only. Five lectures; one two-hour laboratory. Prerequisites, Home Mgt. 150, 151 or equivalent. Laboratory fee, \$3.00. Analysis of some of the important management problems in the home and in the economics classroom. Financial problems, problems in work simplification, problems related to housing and household equipment.
(Staff.)

Inst. Mgt. 160. Institution Organization and Management. (3)

First semester. Prerequisites, Foods 2, 3; Nut. 110, Home Mgt. 150, 151 to precede or parallel. Vocational opportunities in the field of institution management; organization of food service departments. Planning of functional kitchens and selection of equipment for quantity food services. Field trips.
(Collins.)

Inst. Mgt. 161. Institution Food Purchasing and Cost Control. (3)

Second semester. Prerequisites, Food 2, 3; Nut. 10 or 110 or equivalent. Selection of food, method and units of purchase in large quantities. Budgets, food cost accounting and control. Field trips.
(Collins.)

Inst. Mgt. 162. Institution Foods. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisites, Foods 2, 3; Nut. 10 or 110 or consent of instructor. Laboratory fee, \$10.00. Application of basic principles and procedures of food preparation to quantity food preparation. Standardizing recipes; menu planning for various types of food services; determination of food costs. Field trips. (Collins.)

Inst. Mgt. 164. Food Service Administration and Personnel Management. (2)

Second semester. One lecture and one laboratory period a week. Prerequisites, Inst. Mgt. 160, 161, 162 or the equivalent. Administrative policies, problems, and personnel management. Field trips. (Staff.)

Inst. Mgt. 165. School Food Service. (3)

Two lectures and one morning a week for practical experience in a school food service. Prerequisites, Foods 1 or 2, 3 and Nut. 10 or 110, or consent of instructor. Not open to institution management majors. Study of organization, management, menu planning, food purchasing and preparation, and cost control for serving the noon meal in schools and child care centers. (Collins.)

Inst. Mgt. S166. Nutrition and Meal Planning. (2)

Summer session. One lecture and two laboratory periods. Prerequisites, Inst. Mgt. 160 or equivalent. Special application to group food services; school lunches, restaurants, and hospitals. (Staff.)

Inst. Mgt. S168. Cost Accounting for School Food Service. (2)

Summer session. Food cost accounting systems for school lunch programs; programs and procedures of accumulating, recording, and interpreting data for control. (Staff.)

Inst. Mgt. S169. Food Purchasing for School Food Service. (2)

Summer session. Purchasing procedures; grading, processing, and packing of food; selection of food, specifications, and marketing regulations. (Staff.)

For Graduates

Inst. Mgt. 200. Food Service Administration and Supervision. (3)

Supervision and administrative policies; personnel management with emphasis on human relations, and philosophy underlying management practices. (Brown.)

PRACTICAL ART AND CRAFTS

For Graduates and Advanced Undergraduates

Pr. Art 100, 101. Mural Design. (2, 2)

First semester, alternate years. Three laboratory periods a week. Prerequisites, Pr. Art 1, 21. Fee, \$3.00. Group and individual expression serving two types of objectives; temporary murals for the public schools developed from classroom study and rendered in colored chalk on wrapping paper; murals for permanent architectural decoration considering propriety to setting and rendered in old paint, gouache, fresco, or mosaic. Brief study of civilization's use of murals. Trips to nearby murals having social significance. (Curtiss.)

Home Economics

Pr. Art 120, 121. Costume Illustration. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 20, 21. Fee, \$3.00. Fashion rendering emphasizing clothing structure, representation of materials and development of individual rendering technique. Development of techniques employing transparent water color, India ink, Craftint, Zipatone and Burgess process. Study of styles of contemporary fashion illustrators. (Elliott.)

Pr. Art 124, 125. Individual Problems in Costume. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 20, 21, 120, 121. Fee, \$3.00. Advanced problems in fashion illustration or costume design for students who are capable of independent work. Program developed in consultation with the instructor. (Elliott.)

Pr. Art 132. Advertising Layout. (2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 20, 30, 40. Fee, \$3.00. Designing of rough to finished layouts for advertisements for newspapers, magazines, packaging, brochures and other forms of direct advertising. Included is the study of typography and illustration and their relationship to reproduction. Experience in use of the airbrush. Field trip. (Cuneo.)

Pr. Art 134, 135. Individual Problems in Advertising. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 20, 30, 40, 132. Fee, \$3.00. Advanced problems in advertising layout. Opportunity to build skills in one area or more of advertising design. Readings. Field trip. (Cuneo.)

Pr. Art 136. Display. (2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, 4, 30. Fee, \$3.00. Practice in effective merchandise display in cooperation with retail establishments. Study of other aspects of display through field trips, discussion and research. (Longley.)

Pr. Art 138. Advanced Photography. (2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, 38, 39. Fee, \$3.00. Advanced experimental effects emphasizing design in photography. Each student must have his own camera. (Davis.)

Pr. Art 142, 143. Advanced Interior Design. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 40, 41. Fee, \$3.00. Designs of rooms drawn in perspective and isometrics and rendered in water color. Coordination with fabrics, floor and wall finishes. Study of budgets, costs, and manufacturing techniques. Field trips. (Woodlock.)

Pr. Art 144, 145. Individual Problems in Interior Design. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 40, 41, 142, 143. Fee, \$3.00. Advanced problems in interior design for students who are capable of independent work. Students assume the role of interior decorator serving the needs of theoretical clients. Field trips. (Woodlock.)

Cr. 102. Creative Crafts. (2-4)

Summer session. Daily laboratory periods. Prerequisites, Pr. Art 1 and permission of the instructor. Fee, \$3.00. Interests of the persons enrolled will determine the crafts pursued. Suggested: block printing, wood burning, crayon decoration, paper sculpture, clay modeling, metalry, weaving. Excellent for teachers, directors of recreation centers, and persons who desire an introduction to recreational crafts. (Staff.)

Cr. 120, 121. Advanced Ceramics. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 20, 21. Fee, \$3.00. Advanced techniques in clay sculpture and in building pottery on the potter's wheel. Study of glaze composition and calculation. Experimentation with several clay bodies. (Cox.)

Cr. 124, 125. Individual Problems in Ceramics. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 20, 21, 120, 121. Fee, \$3.00. Individual problems in clay sculpture and pottery making. Use of gas kiln fired in the medium cone range and experimental research in glazes and original textural effects. (Cox.)

Cr. 130, 131. Advanced Metalry. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art. 1, Cr. 30, 31. Fee, \$3.00. Advanced applications of basic techniques in metal working and jewelry making. Introduction of ring making, stone setting, and metal casting. (Longley.)

Cr. 134, 135. Individual Problems in Metalry. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 30, 31, 130, 131. Fee, \$3.00. Advanced problems in metalry and jewelry making. Supervised laboratory for students capable of independent work and research. (Longley.)

Cr. 140, 141. Advanced Weaving. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 40, 41. Fee, \$3.00. Advanced weaving on four and eight harness looms stressing creative weaves in relation to functional use. (Cox.)

Cr. 144, 145. Individual Problems in Weaving. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 40, 41, 141. Fee, \$3.00. Advanced problems in creative weaving. Supervised laboratory for students capable of independent work and research. (Cox.)

TEXTILES AND CLOTHING

For Graduates and Advanced Undergraduates

Tex. 100. Advanced Textiles. (3)

First semester. One lecture and two laboratory periods a week. Prerequisite, Tex. 1. Laboratory fee, \$3.00. The intensive study of textiles from the fiber to the finished fabric, from the producer to the consumer. Analysis of fabric construction and serviceability features. (Crouthamel.)

Tex. 101. Problems in Textiles. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisites, Tex. 100, organic chemistry. Laboratory fee, \$3.00. Individual experimental problems in textiles. (Crouthamel.)

Tex. 102. Textile Testing. (3)

Second semester. Three laboratory periods a week. Prerequisite, Tex. 100. Laboratory fee, \$3.00. The theory of textile testing methods, the repeated use of physical and chemical testing, the interpretation of the data, and the presentation of the findings. (Crouthamel.)

Home Economics

Tex. 105. Consumer Problems in Textiles. (3)

First and second semesters. Three lectures a week. Prerequisite, Tex. 1, or equivalent. Laboratory fee, \$3.00. Study of textiles from the consumer point of view for personal, household and institutional use. Evaluation of such textiles through analysis of comparison shopping, laboratory tests, survey of literature and field trips. (Staff.)

Tex. 108. Decorative Fabrics. (2)

First semester. Two lectures a week. Laboratory fee, \$3.00. Study of historic and contemporary fabrics and laces with analysis of designs and techniques of decorating fabrics. (Wilbur.)

Clo. 120. Draping. (3)

First semester. Three laboratory periods a week. Prerequisites, Clo. 21, Clo. 122. Laboratory fee, \$3.00. Demonstrations and practice in creating costumes in fabrics on individual dress forms; modeling of garments for class criticism. (Wilbur.)

Clo. 122. Tailoring. (2)

First and second semesters. Two laboratory periods a week. Prerequisite, Clo. 21. Laboratory fee, \$3.00. Construction of tailored garments, requiring professional skill. (Mitchell, Heagney.)

Clo. 123. Children's Clothing. (2)

First semester. Two laboratory periods a week. Prerequisite, Clo. 20, or equivalent. Laboratory fee, \$3.00. Children's clothing from the standpoint of age, health, beauty, economy and personality; development of original designs. (Heagney, Wilbur.)

Clo. 124. Projects and Readings in Textiles and Clothing. (2)

First semester. Two lectures a week. Prerequisites, Clo. 120, Tex. 100. Laboratory fee, \$3.00. Analysis of wardrobe planning preparatory to the job situation; grooming as related to the college girl and to the job holder; survey of job opportunities in the field; special projects. (Mitchell.)

Clo. 125. Costume Draping. (3)

Second semester. Three two-hour laboratory periods a week. Prerequisite, Pr. Art 20 or consent of Department. Laboratory fee, \$3.00. By means of draping in fabrics on a form the development of costumes both historic and contemporary for specific needs, purposes and occasions. Consideration of fabric, line and color are integral of the work. (Wilbur.)

Clo. 126. Fundamentals of Fashion. (2, 3)

Second semester. Prerequisite, Clo. 120. Laboratory fee, \$3.00. Fashion history; current fashions, how to interpret and evaluate them; fashion show techniques; fashion promotion. The course includes oral and written reports, group projects, panel discussions and field trips. (Wilbur.)

Clo. 127. Apparel Design. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Clo. 120. Laboratory fee, \$3.00. The art of costuming; trade and custom methods of clothing design and construction; advanced work in draping, pattern design and/or tailoring with study of the interrelationship of these techniques. (Staff.)

Clo. 128. Home Furnishings. (3)

First and second semesters. Three laboratory periods a week. Prerequisite, Tex. 1, Clo. 20, or consent of instructor. Laboratory fee, \$3.00. Selection of fabrics for home

and institutional furnishings; care and repair of such furnishings; custom construction of slip covers, draperies, bedspreads; refinishing and upholstering a chair. (Wilbur.)

For Graduates

- Tex. 200. Special Studies in Textiles.* (2-4)
Second semester. Laboratory fee, \$3.00. (Staff.)
- Clo. 220. Special Studies in Clothing.* (2-4)
First semester. Laboratory fee, \$3.00. (Mitchell, Wilbur.)
- Tex. and Clo. 230. Seminar.* (1)
First and second semesters. Laboratory fee, \$3.00. (Mitchell.)
- Tex. and Clo. 232. Economics of Textiles and Clothing.* (3)
Second semester. Laboratory fee, \$3.00. (Mitchell.)
- Tex. and Clo. 399. Research.* (4-6)
First and second semesters. Laboratory fee, \$3.00. (Staff.)

HORTICULTURE

Professors: HAUT, KRAMER, LINK, SCOTT, SHANKS, STARK AND THOMPSON.

Associate Professors: REYNOLDS AND WILEY.

Assistant Professor: SNYDER.

This Department offers graduate work in the fields of floriculture and ornamental horticulture, processing, olericulture, and pomology leading to the Master of Science or Doctor of Philosophy degrees.

Departmental requirements, supplementary to the material in the Graduate School Announcements have been formulated for the administration and guidance of graduate students. Copies of these requirements may be obtained from the Department.

For Graduates and Advanced Undergraduates

- Hort. 101. Technology of Fruits.* (3)
First semester. (Offered 1962-63.) Prerequisites, Hort. 6, Bot. 101. A critical analysis of research work and applications of the principles of plant physiology, chemistry, and botany to practical problems in commercial production. (Thompson.)
- Hort. 103. Technology of Vegetables.* (3)
Second semester. (Offered 1963-64.) Prerequisites, Hort. 58, Bot. 101. For a description of these courses see the general statement under Hort. 101. (Stark.)
- Hort. 105. Technology of Ornamentals.* (2)
First semester. Prerequisite, Bot. 101. A study of the physiological plant processes as related to the growth, flowering, and storage of floricultural and ornamental plants. (Link.)

Horticulture

Hort. 107, 108. Woody Plant Materials. (3, 3)

First and second semesters. Prerequisites, Bot. 11. A field and laboratory study of trees, shrubs, and vines used in ornamental plantings. (Staff.)

Hort. 114. Systematic Horticulture. (3)

First semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period a week. A study of the origin, taxonomic relationship and horticultural classification of fruits and vegetables. (Staff.)

Hort. 123. Quality Control. (3)

First semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period a week. Principles involved in the evaluation of factors of quality in horticultural products including appearance, kinesthetic flavor and sanitation factors and statistical presentation of results. (Kramer.)

Hort. 124. Quality Control Systems. (3)

Second semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period a week. Prerequisite, Hort. 123. Development of quality control systems designed to maintain specific levels of quality for selected food products. (Kramer.)

Hort. 150, 151. Commercial Floriculture. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisite, Hort. 11. Growing and handling bench crops and potted plants, and the marketing of cut flowers. (Link.)

Hort. 155, 156. Fundamentals of Fruit and Vegetable Processing. (3, 3)

First and second semester, alternate years. (Offered 1962-63.) Two lectures and one laboratory period a week. Prerequisites, Chem. 32, 34, Hort. 61. Laboratory fee, \$5.00 per semester. The fundamentals of canning, freezing and preserving of horticultural crops with emphasis on the chemical, biochemical and microbiological aspects of processing. (Wiley.)

Hort. 159. Nursery Management. (3)

Second semester, alternate years. (Offered 1963-64.) Two lectures and one laboratory period a week. Prerequisites or concurrently, Hort. 62, 107, 108. A study of all phases of commercial nursery management and operations. (Staff.)

Hort. 160. Arboriculture. (3)

Second semester, alternate years. (Offered 1962-63.) Two lectures and one laboratory period a week. Prerequisites or concurrently, Hort. 107 and 108. A study of the planting and maintenance of ornamental shrubs and trees, including basic principles of park, institution and estate maintenance. (Staff.)

Hort. 161. Physiology of Maturation and Storage of Horticultural Crops. (2)

Second semester, alternate years. (Offered 1962-63.) Two lectures a week. Prerequisite, Bot. 101. Factors related to maturation and application of scientific principles to handling and storage of horticultural crops. (Scott.)

Hort. 198. Special Problems. (2, 2)

First and second semesters. Credit arranged according to work done. For major students in horticulture or botany. Four credits maximum per student. (Staff.)

For Graduates

Hort. 200. Experimental Procedures in Plant Sciences. (3)

First semester. Prerequisite, permission of instructor. Organization of research projects and presentation of experimental results in the field of biological science. Topics included will be: Sources of research financing, project outline preparation, formal progress reports, public and industrial supported research programs, and technical and popular presentation of research data. (Haut.)

Hort. 201, 202. Experimental Pomology. (3, 3)

First and second semesters. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in pomology. (Thompson.)

Hort. 203, 204, 205. Experimental Olericulture. (2, 2, 2)

First semester and in sequence. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in olericulture. (Stark.)

Hort. 206. Experimental Floriculture. (3)

First semester. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in floriculture. (Link.)

Hort. 207. Methods of Horticultural Research. (3)

Second semester. One lecture and one four-hour laboratory period a week. A critical study of research methods which are or may be used in horticulture. (Scott.)

Hort. 210. Experimental Processing. (2)

Second semester. Prerequisite, permission of instructor. A systematic review of scientific knowledge and practical observations as applied to commercial practices in processing. (Kramer.)

Hort. 302. Advanced Seminar. (1)

First and second semesters. Oral reports with illustrative material are required on special topics or recent research publications in horticulture. Three credit hours maximum allowed toward the M. S. degree or six credits maximum toward the Ph.D. degree. (Haut, Staff.)

Hort. 399. Advanced Horticultural Research. (2-12)

First and second semesters. Credit granted according to work done. (Staff.)

MATHEMATICS

Professors: COHEN, DIAZ, DOUGLIS, FULLERTON, GOOD, JACKSON, MARTIN*, MAYOR AND STELLMACHER.

Research Professors: PAYNE* AND WEINSTEIN*.

* Member of the Institute for Fluid Dynamics and Applied Mathematics, College of Engineering.

Mathematics

Associate Professors: BRACE, HORVATH, HUMMEL AND ZELEN.

Associate Research Professor: GOLDBABER.

Assistant Professors: CORRELL, EHRLICH, PEARL, PUKANSZKY, REINHART, ROSEN AND ZEDEK.

Assistant Research Professor: SYSKI.

For admission to graduate study in mathematics the Department requires, in addition to the Graduate School requirements, an official transcript of the student's previous work for its files and evidence that the candidate for admission has received sufficient prior training in mathematics to indicate that he will be able successfully to undertake graduate training.

Before being recommended for admission to candidacy for the Master's degree in mathematics, in addition to the Graduate School requirements, the student must demonstrate a reading knowledge of one foreign language of scientific importance and must have completed the major part of the course work required for the degree and must have received an average grade of "B" or better in all graduate courses taken.

A student preparing for the degree of Doctor of Philosophy with a major in mathematics will be offered a choice of two curricula, one with an emphasis on pure mathematics, the other with an emphasis on applied mathematics.

The Department requires successful completion of a preliminary written and oral examination before giving its recommendation for admission to candidacy for the doctorate. Before presenting himself for this examination the student is expected to have acquired a background of mathematical knowledge equivalent to the following group of graduate studies. In the pure mathematics curriculum: algebra, six hours; analysis, twelve hours; geometry and topology, six hours; mathematical methods or mathematical physics or physics or (further) analysis, six hours. In the applied mathematics curriculum: analysis, fifteen hours (including Math. 286, 287, 288, 212); mathematical methods, six hours; mathematical physics, six hours (including Math. 260); algebra or geometry or topology as related to the student's individual work.

A student who intends to present a minor in mathematics should consult with a member of the Graduate Committee in the Department of Mathematics to secure approval, in advance, for his proposed minor program.

The Mathematics Department Colloquium meets frequently throughout the academic year for reports on current research by the resident staff, visiting lecturers, and graduate students. In addition the Institute for Fluid Dynamics and Applied Mathematics Colloquium meets at frequent intervals for reports on research in those fields. All colloquium meetings are open to the public.

Several seminars meet regularly for the discussion of current developments in special fields. Graduate students are invited to participate.

ALGEBRA

For Graduates and Advanced Undergraduates

Math. 100. Vectors and Matrices. (3)

First semester. Prerequisite, Math. 21 or equivalent. The algebra of vector spaces and matrices, with emphasis upon those aspects of interest to students in applied mathematics. (Good.)

Math. 103, 104. Introduction to Modern Algebra. (3, 3)

Prerequisite, Math. 21 or equivalent. For Math. 104, the usual prerequisite of Math. 103 may be waived upon consent of instructor. In Math. 103 are studied the basic concepts of abstract algebra: integral domains, divisibility, congruences; fields, ordered fields; the fields of rational numbers, of real numbers, of complex numbers; polynomial domains over a field, including classical results on the theory of polynomial equations with rational, real, or complex coefficients; unique factorization domains, irreducibility criteria; rings. In Math. 104 are studied groups, vector spaces, linear transformations, matrices. (Hummel.)

Math. 106. Introduction to the Theory of Numbers. (3)

Summer school (2). Prerequisite, Math. 21 or equivalent. Integers, divisibility, Euclid's algorithm, Diophantine equations, prime numbers, Moebius function, congruences, residues. (Pukanszky.)

For Graduates

Math. 200, 201. Modern Algebra. (3, 3)

Prerequisite, Math. 103 or consent of instructor. Groups, rings, fields, vectors and matrices, linear transformations, linear dependence rank, canonical forms. (Ehrlich.)

Math. 202. Linear Algebra. (3)

Prerequisite, Math. 201 or consent of instructor. Linear manifolds, the lattice of subspaces, projectives, dualities, the ring of endomorphisms, the full linear group and its subgroups. (Pearl.)

Math. 203. Galois Theory. (3)

Prerequisite, Math. 201 or consent of instructor. Field extensions, automorphisms of a field, the Galois group of a polynomial equation, solvability by radicals, recent developments in Galois theory. (Good.)

Math. 204, 205. Topological Groups. (3, 3)

Prerequisite, consent of instructor. An introductory course in abstract groups, topological spaces, and the study of collections of elements enjoying both these properties. The concept of a uniform space will be introduced and studied. The representation problem will be considered together with the subject of Lie groups. (Pukanszky.)

Math. 206. Number Theory. (3)

Prerequisite, consent of instructor. Foundations, linear and higher congruences, law of reciprocity, quadratic forms, sieve methods, elements of additive number theory and density, distribution of prime numbers and L-functions, discussion of unsolved problems. (Goldhaber.)

Math. 208. Ring Theory. (3)

Prerequisite, Math. 201 or consent of instructor. According to the needs of the class, emphasis will be placed on one or more of the following: ideal theory, structure theory

Mathematics

of rings with or without minimum condition, division rings, algebras, nonassociative rings. (Ehrlich.)

Math. 209. Group Theory. (3)

Prerequisite, Math. 201 or consent of instructor. According to the needs of the class, emphasis will be placed on one or more of the following aspects of discrete group theory; finite groups, abelian groups, free groups, solvable or nilpotent groups, groups with operators, groups with local properties, groups with clan conditions, extensions. (Ehrlich.)

Math. 271. Selected Topics in Algebra. (3)

(Arranged.) Prerequisite, consent of instructor. (Staff.)

ANALYSIS

For Graduates and Advanced Undergraduates

Math. 110, 111. Advanced Calculus. (4, 4)

Prerequisite, Math. 21 or equivalent. Limits and continuity of real and complex functions, Riemann integration, partial differentiation, line and surface integrals, infinite series, elements of vector analysis, elements of complex variable theory. (Rosen.)

Math. 112. Infinite Processes. (3)

Prerequisite, Math. 21 and consent of instructor. Accumulation points for infinite sets, limits of sequences, special limits; tests for convergence of series of positive terms, conditional convergence, multiplication of series, double and multiple series; uniform convergence, power series; infinite products; asymptotic and summable series; partial fractions.

Math. 114. Differential Equations. (3)

Second semester. Prerequisite, Math. 110 or equivalent. Ordinary differential equations, symbolic methods, successive approximations, solutions in series, orthogonal functions, Bessel functions, Sturm-Liouville theory. (Pukanszky.)

Math. 115. Partial Differential Equations. (3)

Prerequisite, Math. 114 or equivalent. Partial differential equations of first and second order, characteristics, boundary value problems, systems of equations, applications. (Martin.)

Math. 116. Introduction to Complex Variable Theory. (3)

Prerequisite, Math. 21 or equivalent. Not open to students who have passed Math. 154. Graduate students in mathematics should enroll in Math. 286. Fundamental operations in complex numbers, differentiation and integration, sequences and series, power series, analytic functions, conformal mapping, residue theory, special functions. (Fullerton.)

Math. 117. Fourier Series. (3)

Prerequisite, Math. 110 or equivalent. Representation of functions by series of orthogonal functions. Applications to the solution of boundary value problems of some partial differential equations of physics and engineering. (Horvath.)

For Graduates

Math. 212. Special Functions. (3)

Second semester. Prerequisite, Math. 287 or consent of instructor. Gamma function; second order differential equations in the complex domain, regular and irregular sin-

gularities; hypergeometric functions, Riemann's P-functions, Legendre functions, confluent hypergeometric functions, Whittaker functions, Bessel functions. (Diaz.)

Math. 215, 216. Advanced Differential Equations. (3, 3)

Prerequisites, Math. 100, 111 and 114, or consent of instructor. Existence and uniqueness theorems for systems of ordinary differential equations and for partial differential equations, characteristic theory, reduction to normal forms, the methods of finite differences. (Stellmacher.)

Math. 218. Integral Equations. (3)

Prerequisites, Math. 100 and 287, or consent of instructor. Integral equations of the first and second kind, Volterra's equation, Abel's equation and fractional differentiation; the Fredholm theory, the Hilbert-Schmidt theory, Mercer's theorem, expansion in orthonormal series; existence theorems of potential theory and other applications. (Brace.)

Math. 272. Selected Topics in Analysis. (3)

(Arranged.) Prerequisite, consent of instructor. (Staff.)

Math. 278. Advanced Topics in Complex Analysis. (3)

Prerequisite, Math. 288 or consent of instructor. Material selected to suit interests and background of the students. Typical topics: Conformal mapping, algebraic functions, Riemann surfaces, entire functions, Dirichlet series, Taylor's series, geometric function theory. (Hummel.)

Math. 280, 281. Linear Spaces. (3, 3)

Prerequisite, Math. 287 or equivalent. Linear vector spaces and their topologies, linear operations and transformations and their inverses, Banach and Hilbert spaces. (Horvath.)

Math. 286, 287. Theory of Functions. (3, 3)

Prerequisite, Math. 111 or equivalent. Basic topics in real and complex variable theory, real and complex number systems, point sets on the line and in space, continuity, Riemann and Stieltjes integrals, Cauchy integral theorem, residues, power series, analytic functions, introduction to Lebesgue measures and integration. (Brace.)

Math. 288. Theory of Analytic Functions. (3)

Prerequisite, Math. 287 or a course in complex variables. Advanced topics in complex function theory, properties of power series, entire functions, conformal mapping, classification of singularities, harmonic functions. (Zedek.)

Math. 289. Measure and Integration. (3)

Prerequisite, Math. 286 or a course in real variables. Set functions, abstract theory of measure, differentiability properties and absolute continuity of set functions, measurable functions, abstract integration theory, introduction to linear spaces. (Rosen.)

GEOMETRY AND TOPOLOGY

For Graduates and Advanced Undergraduates

Math. 122. Introduction to Point Set Topology. (3)

Prerequisite, Math. 110, or Math. 146, or equivalent. Open and closed sets, connectedness, compactness, transformations, homeomorphisms; application of these concepts to various spaces with particular attention to the Euclidean plane.

Mathematics

Math. 123. Introduction to Algebraic Topology. (3)

Prerequisites, Math. 122 and 103, or equivalent. Chains, cycles homology groups for surfaces, the fundamental group.

Math. 124. Introduction to Projective Geometry. (3)

Prerequisite, Math. 21 or equivalent. Elementary projective geometry largely from the analytic approach, projective transformations, cross ratio, harmonic division, projective coordinates, projective theory of conics, Laguerre's definition of angle.

Math. 125. Introduction to Algebraic Geometry. (3)

Prerequisite, Math. 103 or Math. 124 or equivalent. Plane algebraic curves, algebraic functions, ideals in polynomial rings, theory of elimination, points, multiplicity, dimension, theory of places, algebraic varieties, algebraic correspondences, the theorem of Riemann-Roch.

Math. 126, 127. Introduction to Differential Geometry and Tensor Analysis. (3, 3)

Prerequisite, Math. 21 or equivalent. The differential geometry of curves and surfaces with the use of vector and tensor methods, curvature and torsion, moving frames, curvilinear coordinates, the fundamental differential forms, covariant derivatives, intrinsic geometry, curves on a surface, applications to problems in dynamics, mechanics, electricity, and relativity. (Jackson.)

Math. 128. Euclidean Geometry. (3)

Prerequisite, Math. 21 or equivalent. Recommended for students in the College of Education. Axioms of euclidean geometry; axiomatic method, models, properties of axioms; proofs of some basic theorems from the axioms; modern geometry of the triangle, circle, and sphere.

Math. 129. Non-euclidean Geometry. (3)

Prerequisite, Math. 21 or equivalent. Recommended for students in the College of Education. Axiomatic development of non-euclidean geometry, trigonometry, application of calculus to non-euclidean geometry.

For Graduates

Math. 220, 221. Differential Geometry. (3, 3)

Prerequisite, Math. 111 and 150, or consent of instructor. Curves and surfaces, geometry in the large, the Gauss-Bonnet formula, surfaces of constant curvature. (Jackson.)

Math. 223, 224. Algebraic Topology. (3, 3)

Prerequisites, Math. 103 and 123, or consent of instructor. Homology, cohomology, and homotopy theory of complexes and spaces. (Reinhart.)

Math. 225, 226. Set-theoretic Topology. (3, 3)

Prerequisite, Math. 122 or consent of instructor. Foundations of mathematics based on a set of axioms, metric spaces, convergence and connectivity properties of point sets, continua and continuous curves, the topology of the plane. (Correll.)

Math. 273. Selected Topics in Geometry and Topology. (3)

(Arranged.) Prerequisite, consent of instructor. (Staff.)

PROBABILITY AND STATISTICS

For Graduates and Advanced Undergraduates

Math. 130. Probability. (3)

First semester. Prerequisite, Math. 21 or equivalent. Combinatory analysis, total, compound, and inverse probability, continuous distributions, theorems of Bernoulli and Laplace, theory of errors.

Math. 132. Mathematical Statistics. (3)

Second semester. Prerequisite, Math. 21 or equivalent. Frequency distributions and their parameters, multivariate analysis and correlation, theory of sampling, analysis of variance, statistical inference.

Math. 133. Advanced Statistical Analysis. (3)

Second semester. Prerequisite, Math. 132 or equivalent. Advanced methods in correlation analysis, regression analysis, analysis of variance and sequential analysis, curve fitting, testing of hypotheses, non-parametric testing, machine tabulation in statistics.
(Staff.)

HISTORY, LOGIC, AND FOUNDATIONS

For Graduates and Advanced Undergraduates

Math. 140. History of Mathematics. (3)

Summer session (2). Prerequisite, Math. 21 or consent of instructor. A survey of the historical development of mathematics and of the mathematicians who have contributed to that development.
(Jackson.)

Math. 144. Introduction to Mathematical Logic. (3)

Prerequisite, Math. 146, or consent of instructor. Boolean algebras, Stone's representation theorem, propositional calculus, first-order predicate calculus, Godel completeness theorem, decision procedures, formal arithmetic, Turing machines.

Math. 146. Fundamental Concepts of Mathematics. (3)

Prerequisite, Math. 21 or consent of instructor. Construction of the number system starting with the Peano Axioms for the natural numbers, development of the algebraic structures associated with the integers and rationals, theory of sets, equivalence classes, order relations, finite and infinite cardinals, positions of the various number systems in the hierarchy of order types.
(Ehrlich.)

For Graduates

Math. 244. Mathematical Logic. (3)

Prerequisite, consent of instructor. Propositional calculus, predicate calculus and relations, formal deduction, the deduction theorem and the decision problem.
(Karp.)

MATHEMATICAL METHODS

For Graduates and Advanced Undergraduates

Math. 152. Applied Mathematics I (Vector Analysis). (3)

Prerequisite, Math. 21 or equivalent. Algebra and calculus of vectors and applications.
(Sedgewick.)

Mathematics

Math. 153. Applied Mathematics II (Complex Variable). (3)

Prerequisite, Math. 152 or equivalent. Open to students in engineering and the physical sciences. Graduate students in mathematics should take Math. 286. Undergraduate Mathematics majors should take Math. 116. Sequences and series; power series and Fourier series. Analytic functions, conformal mapping, complex integration, special functions. (Sedgewick.)

Math. 154. Applied Mathematics III (Operational Calculus). (3)

Prerequisite, Math. 154 or equivalent. Operational solutions of ordinary and partial differential equations. Fourier and Laplace transforms. (Sedgewick.)

Math. 155. Applied Mathematics IV (Numerical Analysis). (3)

Prerequisite, Math. 152 or consent of instructor. A brief survey of computing machines, study of errors involved in numerical computations. The use of desk machines and tables. Numerical solutions of polynomial and transcendental equations. Interpolation, numerical differentiation and integration, ordinary differential equations, systems of linear equations. (Stellmacher.)

Math. 156. Programming for High Speed Computers. (3)

Prerequisite, Math. 21 or equivalent. General characteristics of high-speed automatic computers; logic of programming, preparation of flow charts, preliminary and final coding; scaling, use of floating point routines; construction and use of subroutines; use of machine for mathematical operations and for automatic coding. Each student will prepare and, if possible, run a problem in a high speed computer. (Sinkov.)

Math. 158. Games and Linear Relations. (3)

Prerequisite, Math. 21 or consent of instructor. Theory of games, minimax theorem, theory of linear programming, simplex method, systems of linear inequalities and the nature of their solutions, geometrical interpretations. (Good.)

For Graduates

Math. 250. Tensor Analysis. (3)

Prerequisites, Math. 126 or 152, or consent of instructor. Algebra and calculus of tensors, Riemannian geometry and its extensions, differential invariants; applications to physics and engineering, and in particular the theory of relativity. (Stellmacher.)

Math. 251. Hilbert Space. (3)

Prerequisites, Math. 100 and 287, or consent of instructor. The original and general Hilbert space, scalar product, metric strong and weak convergence, linear functionals, symmetric operators, complete continuity, eigenvalues, orthonormal systems, Schwartz-Bessel inequality and Parseval identity, eigenvalues in sub-spaces, spectral theorem. (Weinstein.)

Math. 252. Variational Methods. (3)

Prerequisite, Math. 260 or consent of instructor. The Euler-Lagrange equation, minimal principles in mathematical physics, estimation of capacity, torsional rigidity and other physical quantities; symmetrisation, isoperimetric inequalities, estimation of eigenvalues; the minimax principle. (Payne.)

Math. 253, 254. Special Theory in Hilbert Space. (3, 3)

Prerequisite, Math. 251 or consent of instructor. A detailed treatment of the spectral theory of self-adjoint operators in Hilbert Space, a presentation of the extension theory for symmetric operators, and applications to ordinary and partial differential operators.

Math. 255, 256. Advanced Numerical Analysis. (3, 3)

Prerequisites, Math. 100 and 155, or consent of instructor. Review of numerical differentiation and integration, solution of ordinary differential equations, stability, accuracy, use of high-speed digital machines, properties of elliptic, hyperbolic and parabolic partial differential equations, conversion of partial differential equations to partial difference equations, rates of convergence of relaxation methods, gradient methods, iterative methods, the method of characteristics; general methods of solving problems, existence and unique theorems for difference equations associated with partial differential equations, stability of solutions, perturbation, iterative procedures, steepest descent, eigenvalue problems. (Staff.)

MATHEMATICAL PHYSICS

For Graduates and Advanced Undergraduates

Math. 160, 161. Analytic Mechanics. (3, 3)

Prerequisite, Math. 21 or equivalent. Statics, kinematics, dynamics of a particle, elementary celestial mechanics, Lagrangian equations for dynamical systems of one, two, and three degrees of freedom, Hamilton's principle, the Hamilton-Jacobi partial differential equation. (Martin.)

For Graduates

Math. 260. Foundations of Mathematical Physics. (3)

First semester. Prerequisite, consent of instructor. General survey of mathematical methods and results employed in various branches of mathematical physics. The following are among the general topics to be discussed: vector analysis and integral identities (Green-Gauss, Stokes, etc.), ordinary and partial differential and difference equations, integral equations, formulation of typical boundary and initial value problems and indication of the main methods of solution. (Diaz.)

Math. 261, 262. Fluid Dynamics. (3, 3)

Prerequisite, Math. 260 or consent of instructor. Basic kinematic and dynamic concepts, equation of continuity, velocity, potential and stream function, vorticity, Bernoulli's equation; perfect incompressible fluids, Helmholtz' vorticity theorems, plane hydrodynamics, Kutta-Joukowski theory of lift, conformal mapping, vortices and vortex streets, Prandtl-Munk theory of finite wings; viscous fluids, Navier-Stokes equations, boundary layer theory; perfect gases, method of characteristics, subsonic, transonic, and supersonic flows, hodograph method, theory of shock waves. (Ludford.)

Math. 263, 264. Elasticity. (3, 3)

Prerequisites, Math. 100 and 260, or consent of instructor. Stress and strain, nuclei of strain, compatibility equations, Saint-Venant principle, bending, torsion and flexure of beams, complex variable methods, Airy's stress function, axial symmetry, strain energy and potential energy, buckling, bending, and vibration of plates and shells. (Payne.)

Math. 265. Hyperbolic Differential Equations. (3)

Prerequisite, Math. 260 or consent of instructor. Two variables, Cauchy's problem, characteristics, Riemann's method, properties of the Riemann function, quasi-linear equations and canonical hyperbolic systems, wave equation in n -dimensions, methods of Hadamard and Riesz, Euler-Poisson equation and the singular problems, Huygens' principle. (Stellmacher.)

Mathematics

Math. 266. Elliptic Differential Equations. (3)

Prerequisite, Math. 260 or consent of instructor. The equations of Laplace and Poisson, flux, the theorems of Gauss and Green, potentials of volume and surface distributions, harmonic functions, Green's function and the problems of Dirichlet and Neumann; linear elliptic equations with variable coefficients, in particular the equations of Stokes and Beltrami; fundamental solutions, the principle of the maximum, and boundary value problems; introduction to the theory of non-linear equations. (Stellmacher.)

Math. 274. Selected Topics in Applied Mathematics. (3)

(Arranged.) Prerequisite, consent of instructor. (Staff.)

FOR TEACHERS OF MATHEMATICS AND SCIENCE

For Graduates and Advanced Undergraduates

Math. 181. Foundations of Number Theory. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. Axiomatic development of the real numbers. Elementary number theory. (Jackson.)

Math. 182. Foundations of Algebra. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. Modern ideas in algebra and topics in the theory of equations. (Good.)

Math. 183. Foundations of Geometry. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. A study of the axioms for Euclidean and non-Euclidean geometry. (Lehner.)

Math. 184. Foundations of Analysis. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. A study of the limit concept and the calculus. (Previous knowledge of calculus is not required.) (Good.)

Math. 199. National Science Foundation Summer Institute for Teachers of Science and Mathematics. Seminar. (1-3)

(Staff.)

RESEARCH

For Graduates and Advanced Undergraduates

Math. 190. Honors Seminar.

Prerequisite, permission by the Department to work for honors. Selected topics in mathematics under the guidance of a staff member. Credit according to work done. (Cohen.)

For Graduates

Math. 298. Proseminar in Research. (1)

Prerequisite, one semester of graduate work in mathematics. A seminar devoted to the foundations of mathematics, including mathematical logic, axiom systems, and set theory. (Cohen.)

Math. 399. Research.

(Arranged.)

(Staff.)

MECHANICAL ENGINEERING

Professors: SHREEVE, ALLEN AND JACKSON.

Associate Professors: EYLER, HAYLECK, SAYRE AND WOCKENFUSS.

Assistant Professor: CATHER.

Lecturers: HABERMAN, SEIGEL AND WISE.

Instruction and research facilities are available for the degrees of Master of Science and Doctor of Philosophy in mechanical engineering.

For the Master of Science degree in mechanical engineering, a minimum of six semester hours of course work in mechanical engineering must be taken in classes conducted by members of the resident graduate faculty. For the Doctor of Philosophy degree, the minimum is eighteen semester hours.

Registration for six credits of research (M.E. 399, Research) for the M.S. degree and twelve credits for the Ph.D. degree are required. It is the policy of the Department to require that this research be conducted in the Department laboratories. Arrangements for the research, and for faculty supervision, must be made, and approved by the Department Chairman, well in advance of the registration for the research in order that the funds and equipment may be made available.

For Graduates and Advanced Undergraduates

M. E. 100. Thermodynamics. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, Phys. 20, Math. 21, concurrently. Required of juniors in mechanical and aeronautical engineering. The properties, characteristics, and fundamental equations of gases, and vapors. Application of the first and second laws of thermodynamics in the analysis of basic heat engines, air compression, and vapor cycles. Flow and non-flow processes for gases and vapors. (Eyler, Sayre.)

M. E. 101. Heat Transfer. (3)

Second semester. Three lectures a week. Prerequisites, M.E. 100, M.E. 102 concurrently. Basic principles of heat transfer, including a study of conduction by steady state and variable heat flow; free and forced convection, radiation, evaporation and condensation of vapors, and the application of the principles of heat transfer to design problems. (Eyler, John.)

Mechanical Engineering

M. E. 102. Fluid Mechanics. (3)

Second semester. Two lectures and one laboratory a week. Prerequisite, M.E. 100. Laboratory fee, \$3.00. Fluid statics, Bernoulli's equation, principles of impulse and momentum analysis, measurements of flow and fluid properties, dimensional analysis and dynamic similitude, hydraulic machinery. (John, Sayre.)

M. E. 103. Metallography. (3)

Second semester. Two lectures and one laboratory period a week. Laboratory fee, \$3.00. Prerequisites, M.E. 20, 21, 23. A study of the structure of metals and alloys as related to their properties. Study of crystallation, plastic deformation, constitution diagrams, heat treatment and effect of alloying elements on ferrous and non-ferrous materials. Laboratory work in thermal analysis, microscopy heat treatment and testing of metals. (Jackson, Ward.)

M. E. 104. Kinematics. (2)

Second semester. One lecture and one laboratory period a week. Prerequisites, M.E. 24, Math. 21. A study of velocity, acceleration, and displacement of mechanisms, cam motion, gearing and gear trains. (Hayleck, Oetting.)

M. E. 105. Principles of Mechanical Engineering. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, Phys. 21, Math. 21. Required of juniors in civil engineering. Elementary thermodynamics and the study of heat, fuel and combustion in the production and use of steam for generation of power. Supplemented by laboratory tests and trips to industrial plants. (Cather, Lloyd, Marks.)

M. E. 107. Heat Power—Chemical and Nuclear. (4)

Second semester. Three lectures and one laboratory period a week. Prerequisite, M.E. 100. Required of seniors in electrical engineering. Laboratory fee, \$3.00 per semester. The study of power plant cycles using as heat sources nuclear reactors, solid, liquid and gaseous fuels. Includes analysis and design of such equipment as: reactors, boilers, turbines, regenerators and their accessories. (Cather, Lloyd, Glass.)

M. E. 150, 151. Heat Power—Chemical and Nuclear. (4, 4)

First and second semesters. Three lectures and one laboratory period a week. Prerequisites, M.E. 100, M.E. 102, concurrently. Required of seniors in mechanical engineering. The study of all types of power plants including internal combustion engines, gas turbines, and steam stations; using all types of heat sources including nuclear reactors, solid, liquid and gaseous fuels. Includes the study of such cycles as Otto, Diesel, Brayton, and Rankine. Analysis and design of various components such as: reactors, regenerators, turbines, compressors, boilers and condensers. (Shreeve, Cather, Allen.)

M. E. 152, 153. Mechanical Engineering Design. (4, 3)

First semester. Two lectures and two laboratory periods a week. Second semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 103, M.E. 104. Design of machine elements. Machine design projects. Mechanical vibrations. (Jackson, Hayleck.)

M. E. 154, 155. Mechanical Laboratory. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, senior standing. Laboratory fee, \$3.00 per semester. Required of seniors in mechanical engineering. Experiments on fuel and lubricants, steam engine and turbines, air compressors, gasoline and diesel engines and various other mechanical equipment. Written reports are required on all tests. (Staff.)

M. E. 156. Heating and Air Conditioning. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 100, M.E. 101, concurrently. The fundamentals of heating and cooling load computations. Basic information on heating and air conditioning systems for residential and industrial use. (Eyler, Lloyd.)

M. E. 157. Refrigeration. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 100, M.E. 101, M.E. 102 concurrently. Laboratory fee, \$3.00 per semester. Thermodynamic analysis of air, vapor compression, absorption and water refrigeration systems. Characteristics of refrigerants. Study of refrigeration as applied to cooling and dehumidification in air conditioning. Low temperature refrigeration, the heat pump, and other special topics. (Eyler, Lloyd.)

M. E. 158, 159. Applied Elasticity. (3, 3)

First and second semester. Three lectures a week. Prerequisites, Math. 64, M.E. 23. Advanced strength of materials involving beam problems, curved bars, flat plates, shells, statically indeterminate structures. Methods of work and energy. (Hayleck, Wise.)

M. E. 160, 161. Advanced Dynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 64, M.E. 24. Linear, plane and three dimensional motion, moving axes, Lagrange's equation, Hamilton's principle, balancing, vibration, gyroscope, etc. (Hayleck, Wise.)

M. E. 162, 163. Advanced Thermodynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 100, 102; Math. 64. Advanced problems in thermodynamics on compression of gases and liquids, combustion and equilibrium. Problems in advanced heat transfer. (Eyler, Shreeve.)

M. E. 164. Research. (3)

First and second semesters. Prerequisite, "B" average and senior standing in mechanical engineering. Arrangements must be made in advance of registration. (Staff.)

M. E. 165. Creative Engineering. (3)

First and second semesters. Prerequisite, senior standing in mechanical engineering. Solving design problems in engineering with emphasis on the creative approach. (Cather, Shreeve.)

M. E. 166, 167. Advanced Fluid Mechanics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 102, Math. 64. Hydrodynamic theory, Navier Stokes equations, subsonic and supersonic compressible flow, normal shock theory. Engineering applications. (Sayre, John.)

For Graduates

M. E. 200, 201. Advanced Dynamics. (3, 3)

First and second semesters. Prerequisites, M.E. 24, Math. 64, M.E. 153, M.E. 155. Mechanics of machinery. Dynamic forces. Balancing of rotating parts. Vibrations and vibration damping. Critical speeds. (Wise.)

M. E. 202, 203. Applied Elasticity. (3, 3)

First and second semesters. Prerequisites, M.E. 23, Math. 64, M.E. 153. Advanced methods in structural and experimental stress analysis. Advanced strength of materials

Mechanical Engineering

involving beam problems, curved bars, thin plates and shells, buckling of bars, plates and shells, etc. Advanced work in stress concentrations, plastic deformations, etc., and problems involving instability of structures. (Wise.)

M. E. 204, 205. Advanced Thermodynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 101, M.E. 151, Math. 64. Advanced problems in thermodynamics on compression of gases and liquids, combustion and equilibrium, humidification and refrigeration and availability. Problems in advanced heat transfer covering the effect of radiation, conduction, and convection, steady and unsteady flow, evaporation and condensation. (Shreeve, Allen.)

M. E. 206, 207. Advanced Machine Design. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisites, Math. 64, M.E. 153. Application of advanced methods of stress analysis to design of special stationary and moving machine parts, including rotating disks, bearings, thick wall cylinders, screw fastenings, crankshafts, etc. Application of linear and torsional vibration and balancing in the design of machine members. Complete design of a machine. Study of current design literature. (Jackson.)

M. E. 208, 209. Steam Power Design. (3, 3)

First and second semesters. One lecture and two laboratory periods a week. Prerequisite, M.E. 151. Design and specifications of power plants with special emphasis on central stations heated by conventional fuels and nuclear reactors. Design of all components including turbines, boilers, and reactors. Problems of water treatment and waste disposal (atomic and ash) are considered. (Shreeve.)

M. E. 210, 211. Advanced Fluid Mechanics. (3, 3)

First and second semesters. Prerequisites, M.E. 102, Math. 64 or equivalent. Potential flow theory; three dimensional flow examples; application of complex variables to two-dimensional flow problems; Blasius theorem, circulation and Joukowski hypothesis; engineering applications to cavitation prediction and calculation of pressure distribution; introduction to viscous flow and theory of the boundary layer. (Haberman, Sayre.)

M. E. 212, 213. Advanced Steam Power Laboratory. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, registration in M.E. 204, 205. Research on advanced steam power problems to illustrate and advance steam power theory. Power plant heat balances. (Shreeve.)

M. E. 214, 215. Advanced Applied Mechanics Laboratory. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisites, registration in M.E. 200, 201 and M.E. 202, 203. Illustrative experiments and research on difficult problems in stress analysis. Photoelasticity. Mechanical vibrations. Critical speeds. Dynamic stresses. Fatigue of materials. (Hayleck.)

M. E. 216, 217. Advanced Internal Combustion Engine Design. (3, 3)

First and second semesters. One lecture and two laboratory periods a week. Prerequisites, M.E. 150, 151; M.E. 152, 153 and registration in M.E. 200, 201 and M.E. 204, 205. Each student will carry out complete designs of internal combustion engines. (Shreeve.)

M. E. 218, 219. Advanced Internal Combustion Engine Laboratory. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, registration in M.E. 216, 217. Advanced laboratory tests and problems in the design of internal combustion engines. (Shreeve.)

M. E. 220. Seminar.

Credit in accordance with work outlined by the Staff of the Department of Mechanical Engineering. Prerequisite, graduate standing in mechanical engineering. (Staff.)

M. E. 222. Advanced Metallography. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 103, M.E. 23. Advanced study of the structure and properties of metals and alloys. Study of the latest developments in ferrous and non-ferrous alloys including stainless steels, high temperature steels, tool steels, aluminum, magnesium and copper alloys. Study of inspection of metals by the use of x rays, spectograph, metallograph and magniflux. Review of current literature. (Jackson.)

M. E. 223, 224. Steam and Gas Turbine Design. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 101, M.E. 151, Math. 64. Study of nozzles and blades, with application to all types of turbines and compressors based on detailed heat calculations. Design of regenerators and combustors for gas turbines. Applications to jet propulsion. Fundamentals of rocket, pulse jet and ram jet design. (Shreeve.)

M. E. 225, 226. Advanced Properties of Metals and Alloys. (3, 3)

First and second semesters. Two lectures a week. Prerequisites, M.E. 23, M.E. 103, M.E. 152, M.E. 153. Properties of metals including tensile, impact, fatigue, damping capacity, hardenability, wear, etc. Fabrication problems and selection of metals and alloys. Service failures. Properties required for nuclear engineering applications. Properties of metals at elevated and extremely low temperatures. (Jackson.)

M. E. 227, 228. Theory of Elasticity. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 202, 203. Stress and strain at a point. Relation between stresses and strains, general equations of elasticity, plane strain and plane stress, torsion, bending, axially symmetric distribution of stress, plates, thermal stresses, strain energy and approximate methods. (Staff.)

M. E. 229, 230. Jet Propulsion. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 101, M.E. 150, M.E. 151. Types of thermal jet units. Fluid reaction and propulsive efficiency. Performance of rockets, aerothermodynamics, combustion chemical kinetics, aerodynamics of high speed air flow. Principles and design of solid and liquid propellant rockets. Design of turbojets and aerjets, ramjets and hydroduct units, including combustion chambers, turbines and compressor. (Shreeve.)

M. E. 231, 232. Advanced Heat Transfer. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, M.E. 101. Advanced problems covering effects of radiation, conduction, convection, evaporation and condensation. Study of research literature on heat transfer. (Allen, Shreeve.)

M. E. 233, 234. Compressible Flow. (3, 3)

First and second semesters. Prerequisites, M.E. 100, M.E. 102, Math. 64 or equivalent. One dimensional subsonic and supersonic flow; compressible flow in ducts and nozzles; two and three dimensional subsonic and supersonic flow; similarity rules; normal and oblique shock waves. (Sayre, Haberman.)

M. E. 399. Research.

Credit in accordance with work outlined by the staff of the Department of Mechanical Engineering. Prerequisite, graduate standing in mechanical engineering. Research in any field of mechanical engineering as applied mechanics, heat transfer, thermodynamics, heat, power, etc. (Staff.)

MICROBIOLOGY

Professors: DOETSCH, FABER, HANSEN AND PELCZAR.

Associate Professor: LAFFER.

Lecturer: STADTMAN.

The Department of Microbiology offers the degrees of Master of Science and Doctor of Philosophy.

Graduate students associated with institutions away from College Park campus are required to take a minimum of 12 credit hours, exclusive of research, during one semester at College Park for the degree of Master of Science, and a minimum of 24 credit hours, exclusive of research, during two semesters at College Park for the degree of Doctor of Philosophy.

The research project, the experimental approach employed, and progress made must meet with the approval of the Head of the Department.

Further information concerning graduate work in microbiology may be obtained from the Department.

For Graduates and Advanced Undergraduates

Microb. 101. Pathogenic Microbiology. (4)

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, Microb. 1. Laboratory fee, \$11.00. The role of microorganisms in the diseases of man and animals with emphasis upon the differentiation and culture of microorganisms, type of disease, modes of disease transmission; prophylactic, therapeutic and epidemiological aspects. (Faber.)

Microb. 103. Serology. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, Microb. 101. Laboratory fee, \$11.00. Infection and resistance; principles and types of immunity; hypersensitiveness. Fundamental techniques of major diagnostic immunological reactions and their application. (Faber.)

Microb. 104. History of Microbiology. (1)

First semester. One lecture period a week. Prerequisite, a major or minor in microbiology. History and integration of the fundamental discoveries of the science. The modern aspects of cytology, taxonomy, fermentation, and immunity in relation to early theories. (Doetsch.)

Microb. 105. Clinical Methods. (4)

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, consent of instructor. Laboratory fee, \$11.00. A practical course designed to integrate clinical laboratory procedures in terms of hospital and public health demands. (Faber.)

Microb. 108. Epidemiology and Public Health. (2)

Second semester. Two lecture periods a week. Prerequisite, Microb. 1. History, characteristic features, and epidemiology of the important communicable diseases; public health administration and responsibilities; vital statistics. (Faber.)

Microb. 121. Advanced Methods. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, consent of instructor. Laboratory fee, \$11.00. The application of quantitative techniques for the measurement of enzyme reactions, mutations, fermentation analyses and other physiological processes of microorganisms. (Hansen, Pelczar.)

Microb. 131, 133. Applied Microbiology. (4, 4)

First and second semesters. Two lectures and two two-hour laboratory periods a week. Prerequisite, Microb. 1. Laboratory fee, \$11.00. The application of microorganisms and microbiological principles to milk, dairy products, and foods; industrial processes; soil; water and sanitation operations. (Doetsch, Hansen, Laffer, Pelczar.)

Microb. 150. Microbial Physiology. (2)

Second semester. Two lecture periods a week. Prerequisite, 8 credits in microbiology. Aspects of the growth, death, and energy transactions of microorganisms are considered, as well as the effects of the physical and chemical environment on them. (Doetsch.)

Microb. 161. Systematic Bacteriology. (2)

First semester. Two lecture periods a week. Prerequisite, 8 credits in microbiology. History of bacterial classification; international codes of nomenclature; bacterial variation as it affects classification. (Hansen.)

Microb. 181. Microbiological Problems. (3)

First and second semesters; summer session. Prerequisite, 16 credits in microbiology. Laboratory fee, \$11.00. Registration only upon the consent of the instructor. This course is arranged to provide qualified majors in microbiology and majors in allied fields an opportunity to pursue specific microbiological programs under the supervision of a member of the Department. (Faber.)

For Graduates

Microb. 201. Medical Mycology. (4)

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, 30 credits in microbiology and allied fields. Laboratory fee, \$11.00. Primarily a study of the fungi associated with disease and practice in the methods of isolation and identification. (Laffer.)

Microb. 202. Genetics of Microorganisms. (2)

Second semester. Two lecture periods a week. Prerequisite, consent of instructor. An introduction to genetic principles and methodology applicable to microorganisms. Spontaneous and induced mutations, interaction between clones. (Hansen.)

Microb. 204. Bacterial Metabolism. (2)

First semester. Two lecture periods a week. Prerequisites, 30 credits in microbiology and allied fields, including Chem. 161 and 162. Bacterial nutrition, enzyme formation, metabolic pathways and the dissimilation of carbon and nitrogen substrates. (Pelczar.)

Microb. 206, 208. Special Topics. (1-4, 1-4)

First and second semesters. Prerequisite, 20 credits in microbiology. Presentation and discussion of fundamental problems and special subjects in the field of microbiology. (Staff.)

Music

Microb. 210. Virology and Tissue Culture. (2)

Second semester. Two lecture periods a week. Prerequisite, Microb. 101 or equivalent. Characteristics and general properties of viruses and rickettsiae. Principles of tissue culture.

Microb. 211. Virology and Tissue Culture Laboratory. (2)

Second semester. Two three-hour laboratory periods a week. Prerequisite, Microb. 101 or equivalent. Laboratory fee, \$20.00. Registration only upon consent of instructor. Laboratory methods in virology and tissue culture.

Microb. 214. Advanced Bacterial Metabolism. (1)

Second semester. One lecture period a week. Prerequisite, Microb. 204 and consent of instructor. A discussion of recent advances in the field of bacterial metabolism with emphasis on metabolic pathways of microorganisms. (Pelczar.)

Microb. 280. Seminar—Research Methods. (1)

First semester. Discussions and reports by majors in microbiology engaged in current research; presentations of selected subjects dealing with recent advances in microbiology. (Staff.)

Microb. 282. Seminar—Microbiological Literature. (1)

Second semester. Presentation and discussion of current literature in microbiology. (Staff.)

Microb. 399. Research.

First and second semesters; summer session. Credits according to work done. Laboratory fee, \$11.00. The investigation is outlined in consultation with, and pursued under, the supervision of a senior staff member of the Department. (Staff.)

MUSIC

Professors: ULRICH, GRENTZER AND RANDALL.

Associate Professor: JORDAN.

Assistant Professors: BERMAN, HENDERSON AND MEYER.

Instructors: BERNSTEIN AND GORDON.

The Department of Music offers the degree of Master of Music in three areas of specialization: music history and literature, theory and composition, and performance. Departmental requirements, supplementary to those of the Graduate School, have been formulated in each of the three areas of specialization. Copies may be obtained by applying to the Department.

For information on work leading to the degrees of Master of Arts or Master of Education in Music Education, and on a music-education minor in the degrees of Doctor of Philosophy or Doctor of Education, the student is referred to the section devoted to the Department of Education in this catalogue.

For Graduates and Advanced Undergraduates

Music 120, 121. History of Music. (3, 3)

First and second semesters. Prerequisites, Music 1 or 20 and junior standing. A study of musical styles from their origins in western Europe to their present-day manifestations. The interaction of music and other cultural activities. Music 120, the Greek period to Bach; Music 121, Bach to the present. (Jordan.)

Music 141, 142. Musical Form. (2, 2)

First and second semesters. Prerequisites, Music 70, 71. A study of the organizing principles of musical composition, their interaction in musical forms, and their functions in different styles. Music 141, the phrase to the rondo; Music 142, the larger forms. (Jordan.)

Music 143, 144. Composition. (2, 2)

First and second semesters. Prerequisites, Music 70, 71. The principles of musical composition, and their application to the smaller forms. Original writing in nineteenth- and twentieth-century musical idioms for various media. (Staff.)

Music 145, 146. Counterpoint. (2, 2)

First and second semesters. Prerequisites, Music 70, 71. A course in eighteenth-century contrapuntal techniques. Study of devices of imitation in the invention and the choral prelude. Original writing in the smaller contrapuntal forms. (Bernstein.)

Music 147, 148. Orchestration. (2, 2)

First and second semesters. Prerequisites, Music 70, 71. A study of the ranges, musical functions and technical characteristics of the instruments, and their color possibilities in various combinations. Practical experience in orchestrating for small and large ensembles. (Jordan.)

Music 150. Keyboard Harmony. (2)

First semester. Prerequisites, Music 70, 71. One lecture and two laboratory hours per week. The application to the piano keyboard of the harmonic principles acquired in Music 70 and 71. Harmonization of melodies, improvisation and accompanying playing from dictation, and transposition. (Meyer.)

Music 160, 161. Conducting. (2, 2)

First and second semesters. Music 160 or the equivalent is prerequisite to Music 161. A laboratory course in conducting vocal and instrumental groups. Baton technique, score reading, rehearsal techniques, tone production, style, and interpretation. Music of all periods will be introduced. (Grentzer, Henderson.)

Music 166. Survey of the Opera. (3)

Second semester. Prerequisite, Music 120, 121 or the equivalent. A study of the music, librettos, and composers of the standard operas. (Randall.)

Music 167. Symphonic Music (3)

First semester. Prerequisite, Music 120, 121 or the equivalent. The study of orchestral music from the Baroque period to the present. The concerto, symphony, overture, and other forms are examined. (Jordan.)

Music 168. Chamber Music. (3)

Second semester. Prerequisite, Music 120, 121 or the equivalent. The history and literature of chamber music from the early Baroque period to the present. Music for trio

Music

sonata, string quartet and quintet, and combinations of piano and string instruments is studied. (Ulrich.)

Music 169. Choral Music. (3)

First semester. Prerequisites, Music 120, 121 or the equivalent. The history and literature of choral music from the Renaissance to the present, with discussion of related topics such as Gregorian chant, vocal chamber music, etc. (Jordan.)

Music 175. Canon and Fugue. (3)

Second semester. Prerequisite, Music 146 or the equivalent. Composition and analysis of the canon and fugue in the styles of the eighteenth, nineteenth, and twentieth centuries. (Staff.)

For Graduates

Music 200. Advanced Studies in the History of Music. (3)

First semester. Prerequisites, Music 120, 121, and consent of instructor. A critical study of one style period (Renaissance, Baroque, etc.) will be undertaken. The course may be repeated for credit, since a different period will be chosen each time it is offered. (Jordan.)

Music 201. Seminar in Music. (3)

Second semester. Prerequisites, Music 120, 121, and consent of instructor. The work of one major composer (Bach, Beethoven, etc.) will be studied. The course may be repeated for credit, since a different composer will be chosen each time it is offered. (Jordan.)

Music 202. Pro-Seminar in the History and Literature of Music. (3)

Prerequisites, Music 121 and graduate standing. An introduction to graduate study in the history and literature of music. Bibliography and methodology of systematic and historical musicology. (Jordan.)

Music 203. Seminar in Musicology. (3)

Prerequisites, Music 121 and graduate standing. An intensive course in one of the areas of musicology such as performance practices, history of music theory, history of notation, or ethnomusicology. Since a cycle of subjects will be studied, the course may be repeated for credit. (Bernstein.)

Music 204. American Music. (3)

Prerequisites, Music 121 and graduate standing. A lecture course in the history of American art music from Colonial times to the present. (Staff.)

Music 206. Advanced Modal Counterpoint. (3)

Prerequisites, Music 146 or the equivalent, and graduate standing. An intensive course in the composition of music in the style of the late Renaissance. Analytical studies of the music of Palestrina, Lasso, Byrd, and others. (Bernstein.)

Music 207. The Contemporary Idiom. (3)

Prerequisites, Music 146 or the equivalent, and graduate standing. Composition and analysis in the twentieth century styles, with emphasis on techniques of melody, harmony, and counterpoint. (Staff.)

Music 208. Advanced Orchestration. (3)

Prerequisites, Music 148 or the equivalent, and graduate standing. Orchestration projects in the styles of Debussy, Ravel, Stravinsky, Schoenberg, Bartok, and others. (Staff.)

Music 209. Seminar in Musical Composition. (3)

Prerequisites, Music 144 or the equivalent, and graduate standing. An advanced course in musical composition. (Staff.)

Music 212, 213. Interpretation, Performance, and Analysis of the Standard Repertoire. (4, 4)

Prerequisite, consent of the graduate faculty in the Department. A seminar in analysis and interpretation for the graduate performer, with advanced instruction at the instrument of the works studied. In Music 213 a seminar paper and a full-length recital are required. (Staff.)

Music 218. Teaching the Theory, History, and Literature of Music. (3)

Prerequisite, graduate standing and consent of instructor. A course in teaching methodology, with emphasis on instruction at the college level. (Ulrich.)

Music 399. Thesis Research. (3-6)

Research in theory or history and literature of music, and musical composition. May be repeated for credit. (Staff.)

PHILOSOPHY

Professor: YOLTON.

Associate Professors: LAVINE, PASCH AND SCHLARETZKI.

Assistant Professor: DIAMADOPOULOS.

Instructor: CAPITAN.

The Department of Philosophy offers the degrees of Master of Arts and Doctor of Philosophy.

A statement of departmental requirements for these degrees, supplementary to the requirements of the Graduate School, may be obtained on request from the Department.

Courses numbered below 150 will not be accepted for graduate credit in a philosophy major.

For Graduates and Advanced Undergraduates

Phil. 101. Ancient Philosophy. (3)

First semester. A history of Greek thought from its beginnings to the time of Justinian. The chief figures discussed; the Presocratic philosophers, Socrates, Plato, Aristotle, Epicurus, the Stoic philosophers and Plotinus. (Diamadopoulos.)

Phil. 102. Modern Philosophy. (3)

Second semester. A history of philosophical thought in the West during the 16th, 17th, and 18th centuries. The chief figures discussed: Bacon, Galileo, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume and Kant. (Diamadopoulos.)

Phil. 120. Oriental Philosophy. (3)

Second semester. A brief survey of Indian and Chinese philosophy. Discussion of Indian thought will center about the Rig-Veda, the Upanishads, the Buddhist philos-

Philosophy

ophers, and the chief Hindu systems. Discussions of Chinese thought will center about Confucius, Lao-tse and their disciples, particular attention being given to the development of democratic ideals from Mencius to Sun Yat-sen. (Staff.)

Phil. 123, 124. Philosophies Men Live By. (2, 2)

First and second semesters. Phil. 123, extension (3). Designed as electives for students who wish to acquaint themselves with the field of philosophy. Phil. 123 not necessarily a prerequisite for Phil. 124. An exploration of the fundamental beliefs which determine what men make of their lives and of the world they live in. Each semester classic statements of these beliefs by great philosophers will be chosen for class discussion on the basis of their significance for the problems confronting modern man. (Staff.)

Phil. 125. The Great Philosophers. (3)

Offered in Baltimore only A discussion of the ideas of the great Western Philosophers, based on readings in their works. (Staff.)

Phil. 130. The Conflict of Ideals in Western Civilization. (3)

First semester. A critical and constructive philosophical examination of the assumptions, goals, and methods of contemporary democracy, fascism, socialism, and communism, with special attention to the ideological conflict between the United States and Russia. (Schlaretzki.)

Phil. 140. Philosophical Bases of Educational Theories. (3)

Second semester. A critical study of the foundations of major views regarding the proper ends of education and the implications of these views for educational practice. (Staff.)

Phil. 145. Ethics. (3)

Second semester. A critical study of the problems and theories of human conduct, aimed at developing such principles of ethical criticism as may be applied to contemporary personal and social problems and to the formulation of an ethical philosophy of life. (Schlaretzki.)

Phil. 147. Philosophy of Art. (3)

Second semester. An inquiry into the nature and functions of art. The course will begin with an examination of the relations between art and imitation, art and craft, art and beauty, art and pleasure, art and form, art and expression, art and not-art, and good, bad, and great art, and conclude with a consideration of the uses of art, propagandistic, religious, escapist, and therapeutic. (Capitan.)

Phil. 152. Philosophy of Social and Historical Change. (3)

First semester. A survey and an assessment of the religious, the philosophic, and the scientific approaches to socio-historic change, including the theories of linear progress, evolutionary progress, cyclical repetition, Hegelian-Marxian dialectic, Weberian secularization and bureaucratization. (Lavine.)

Phil. 154. Political and Social Philosophy. (3)

Second semester. An inquiry into the nature and functions of society and of the state. Attention is given to the major classical and contemporary theories, but the course is not primarily historical. The central problems: determination of the ground of political obligation; reconciliation of the claims of personal freedom and social welfare. (Schlaretzki.)

Phil. 155. Logic. (3)

Second semester. A critical exposition of deductive logic. The course includes an examination and appraisal of Aristotelian logic and a systematic presentation of the foundations of modern symbolic logic. Consideration is given to the application of the techniques of logic in the organization of knowledge and in scientific method. (Pasch.)

Phil. 156. Philosophy of Science. (3)

First semester. An inquiry into the relations of the sciences, the nature of observation, hypotheses, verification, experiment, measurement, scientific laws and theories, the basic concepts and presuppositions of science, and the relations of science to society. (Diamadopoulos.)

Phil. 158. Philosophy of Languages. (3)

Second semester. An inquiry into the nature and function of language and other forms of symbolism. (Schlaretzki.)

Phil. 160. Medieval Philosophy. (3)

First semester. A history of philosophical thought in the West from the close of the Classical period to the Renaissance. Based upon readings in the Stoics, early Christian writers, Neoplatonists, later Christian writers and Schoolmen. (Capitan.)

Phil. 162. American Philosophy. (3)

Second semester. A survey of American philosophical thought from the 18th century to the present. Special attention is given to Edwards, Jefferson, Emerson, Royce, Peirce, James, Dewey and Santayana. (Schlaretzki.)

Phil. 163. Nineteenth Century Idealism. (3)

First semester. A survey of idealist thought following Kant: the Romantic Idealists, Hegel, Schopenhauer, Nietzsche, the British School. (Staff.)

Phil. 164. Contemporary Movements in Philosophy. (3)

First semester. A survey of recent and present developments in philosophy. Attention will be given to such thinkers as James, Bergson, Russell, Dewey, and Whitehead and to such movements as Pragmatism, Idealism, Naturalism, Positivism, and Existentialism. Particular consideration will be paid to the bearing of these developments on contemporary problems of science, religion and society. (Staff.)

Phil. 166. The Philosophy of Plato. (3)

First semester. Prerequisite, Phil. 101 or consent of the instructor. A critical study of selected dialogues. (Diamadopoulos.)

Phil. 167. The Philosophy of Aristotle. (3)

Second semester. Prerequisite, Phil. 101 or consent of the instructor. A critical study of selected portions of Aristotle's writings. (Diamadopoulos.)

Phil. 168. The Philosophy of Kant. (3)

First semester. Prerequisite, Phil. 102 or consent of the instructor. A critical study of selected portions of Kant's writings. (Pasch.)

Phil. 170. Metaphysics. (3)

First semester. Prerequisite, 3 hours of philosophy. A critical study of rival metaphysical theories. Analysis of basic metaphysical categories and methods. (Capitan.)

Philosophy

Phil. 171. Epistemology. (3)

Second semester. Prerequisite, 3 hours of philosophy. Systematic analysis of the central problems in the theory of knowledge. Idealism, realism, phenomenism, pragmatism, empiricism, rationalism, positivism, and language analysis will be discussed in the light of contemporary developments. (Pasch.)

Phil. 175. Symbolic Logic. (3)

First semester. Prerequisite, Phil. 41 or 155 or consent of the instructor. A study of the historical development of symbolic logic and a careful analysis of recent systems and techniques. (Pasch.)

Phil. 191, 192, 193, 194. Topical Investigations. (1-3)

Each semester. (Staff.)

For Graduates

Phil. 215. Advanced Philosophy of Religion. (3)

First semester. Prerequisite, consent of instructor. Philosophical consideration of selected problems. (Capitan.)

Phil. 220. Inductive Logic and Scientific Method. (3)

Second semester. Prerequisite, consent of instructor. An examination of the logic of scientific procedure and of the structure and validity of scientific generalization. (Staff.)

Phil. 230. The British Empiricists. (3)

First semester. Prerequisite, consent of instructor. A critical study of selected writings of Locke, Berkeley, and Hume. (Pasch.)

Phil. 232. The Continental Rationalists. (3)

Second semester. Prerequisite, consent of the instructor. A critical study of the systems of some of the major 17th and 18th century rationalists, with special reference to Descartes, Spinoza, and Leibniz. (Staff.)

Phil. 255. Seminar in the History of Philosophy. (1-3)

First semester. Prerequisite, consent of instructor. (Staff.)

Phil. 256. Seminar in the Problems of Philosophy. (1-3)

Second semester. Prerequisite, consent of instructor. (Staff.)

Phil. 260. Seminar in Ethics. (3)

First semester. Prerequisite, consent of instructor. An examination of representative ethical theories. (Staff.)

Phil. 261. Seminar in Aesthetics. (3)

Second semester. Prerequisite, consent of instructor. An examination of representative aesthetic theories. (Capitan.)

Phil. 292. Selected Problems in Philosophy. (1-3)

Each semester. Prerequisite, consent of instructor. (Staff.)

Phil. 399. Research. (1-12)

Each semester. (Staff.)

PHYSICAL EDUCATION, RECREATION AND HEALTH

Professors: FRALEY, DEACH, HUMPHREY, JOHNSON, MASSEY AND MOHR.

Associate Professors: EYLER, HARVEY AND HUSMAN.

The graduate student majoring in physical education, recreation, or health education may pursue any of the following degrees: Master of Arts in physical education, Doctor of Education, and Doctor of Philosophy. Undergraduate requirements or the equivalent to be met by every candidate before admission to candidacy for a graduate degree in physical education are: basic sciences (human anatomy and physiology, physiology of exercise), kinesiology, therapeutics, sport skills, methods, human development, measurement, administration, and student teaching. In the event a student has had successful experience in teaching physical education, the prerequisites of sport skills, methods, and student teaching may be waived. Undergraduate prerequisites in recreation are: psychology, sociology, principles, administration, basic sciences, recreational activities, and practical experience. Undergraduate prerequisites in health education are: biological sciences bacteriology, human anatomy and physiology, nutrition, chemistry, psychology, measurement, administration, principles, and field work.

Every graduate student majoring in physical education, health education and recreation is required to take P.E. 210—Methods and Techniques of Research. In addition, every graduate student must register for and complete P.E. 200—Seminar in Physical Education, Recreation, and Health, at some time during his graduate program.

PHYSICAL EDUCATION

For Graduates and Advanced Undergraduates

P. E. 100. Kinesiology. (4)

First and second semesters; summer session. Three lectures and two laboratory hours a week. Prerequisites, Zool. 1, 14, and 15, or the equivalent. (Massey.)

P. E. 120. Physical Education for the Elementary School. (3)

First and second semesters; summer session. (Humphrey.)

P. E. 155. Physical Fitness of the Individual. (3)

First and second semesters; summer session. (Massey.)

P. E. 160. Theory of Exercise. (3)

First and second semesters; summer session. Prerequisite, P. E. 100. (Massey.)

P. E. 170. Supervision in Elementary School Physical Education. (3)

First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 180. Measurement in Physical Education and Health. (3)

First and second semesters; summer session. Two lectures and two laboratory periods a week. (Eyler, Mohr.)

Physical Education, Recreation and Health

P. E. 182. History of Dance. (3)

First semester. Prerequisites, P. E. 52, 54, 56, 58, or permission of instructor. (Madden.)

P. E. 184. Theory and Philosophy of Dance. (3)

First and second semesters. (Madden.)

P. E. 189. Field Laboratory Projects and Workshop. (1-6)

First and second semesters; summer session. (Staff.)

P. E. 190. Administration and Supervision of Physical Education, Recreation and Health. (3)

First and second semesters; summer session. (Eyler.)

P. E. 191. The Curriculum in Elementary School Physical Education. (3)

First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 195. Organization and Administration of Elementary School Physical Education. (3)

First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 196. Quantitative Methods. (3)

First and second semesters; summer session. (Massey.)

For Graduates

P. E. 200. Seminar in Physical Education, Recreation and Health. (1)

First and second semesters; summer session. (Massey.)

P. E. 201. Foundations in Physical Education, Recreation and Health. (3)

First and second semesters; summer session. (Eyler.)

P. E. 202. Status and Trends in Elementary School Physical Education. (3)

First and second semesters; summer session. (Humphrey.)

P. E. 203. Supervisory Techniques in Physical Education, Recreation and Health. (3)

First and second semesters; summer session. (Mohr.)

P. E. 204. Physical Education and the Development of the Child. (3)

First and second semesters; summer session. Three lectures a week. (Humphrey.)

P. E. 205. Analysis of Contemporary Athletics. (3)

First and second semesters; summer session. (Husman.)

P. E. 210. Methods and Techniques of Research. (3)

First and second semesters; summer session. (Mohr.)

P. E. 215. Principles and Techniques of Evaluation. (3)

First and second semesters; summer session. (Mohr.)

P. E. 230. Source Material Survey. (3)

First and second semesters; summer session. (Eyler.)

Physical Education, Recreation and Health

- P. E. 250. Mental and Emotional Aspects of Sports and Recreation.* (3)
First and second semesters; summer session. (Johnson.)
- P. E. 280. Scientific Bases of Exercise.* (3)
First and second semesters; summer session. (Massey.)
- P. E. 287. Advanced Seminar.* (1-2)
First and second semesters; summer session. (Deach.)
- P. E. 288. Special Problems in Physical Education, Recreation and Health.* (1-6)
First and second semesters; summer session. (Staff.)
- P. E. 290. Administrative Direction of Physical Education, Recreation and Health.* (3)
First and second semesters; summer session. (Deach.)
- P. E. 291. Curriculum Construction in Physical Education and Health.* (3)
First and second semesters; summer session. (Deach, Mohr.)
- P. E. 399. Research.* (1-5)
First and second semesters; summer session. (Staff.)

HEALTH EDUCATION

For Graduates and Advanced Undergraduates

- Hea. 150. Health Problems of Children and Youth.* (3)
First and second semesters; summer session. (Johnson.)
- Hea. 160. Problems in School Health Education in Elementary and Secondary Schools.* (2-6)
First and second semesters; summer session. (Johnson, Staff.)
- Hea. 170. The Health Program in the Elementary School.* (3)
First and second semesters; summer session. Prerequisites, Hea. 2 and 4, or Hea. 40. (Humphrey.)
- Hea. 178. Fundamentals of Sex Education.* (3)
First and second semesters; summer session. (Johnson.)
- Hea. 180. Measurement in Physical Education and Health.* (3)
First and second semesters; summer session. (Eyler, Mohr.)
- Hea. 188. Children's Remedial Fitness Clinic.* (1-4)
First and second semesters; summer session. (Johnson.)
- Hea. 189. Field Laboratory Projects and Workshop.* (1-6)
First and second semesters; summer session. (Staff.)
- Hea. 190. Administration and Supervision of School Health Education.* (3)
First and second semesters; summer session. (Johnson.)

Physical Education, Recreation and Health

For Graduates

- Hea. 200. Seminar in Physical Education, Recreation and Health.* (1)
First and second semesters; summer session. (Massey.)
- Hea. 203. Supervisory Techniques in Physical Education, Recreation and Health.* (3)
First and second semesters; summer session. (Mohr.)
- Hea. 210. Methods and Techniques of Research.* (3)
First and second semesters; summer session. (Mohr.)
- Hea. 220. Scientific Foundations of Health Education.* (3)
First and second semester; summer session. (Johnson.)
- Hea. 230. Source Material Survey.* (3)
First and second semesters; summer session. (Eyler.)
- Hea. 240. Modern Theories of Health.* (3)
First and second semesters; summer session. (Johnson.)
- Hea. 250. Health Problems in Guidance.* (3)
First and second semesters; summer session. (Johnson.)
- Hea. 260. Public Health Education.* (3)
First and second semesters; summer session. (Johnson.)
- Hea. 280. Scientific Bases of Exercise.* (3)
First and second semesters; summer session. (Massey.)
- Hea. 287. Advanced Seminar.* (1-2)
First and second semesters; summer session. (Deach.)
- Hea. 288. Special Problems in Physical Education, Recreation and Health.* (1-6)
First and second semesters; summer session. (Staff.)
- Hea. 290. Administrative Direction of Physical Education, Recreation and Health.* (3)
First and second semesters; summer session. (Deach.)
- Hea. 291. Curriculum Construction in Physical Education and Health.* (3)
First and second semesters; summer session. (Deach, Mohr.)
- Hea. 399. Research.* (1-5)
First and second semesters; summer session. (Staff.)

RECREATION

For Graduates and Advanced Undergraduates

- Rec. 120. Program Planning.* (3)
First and second semesters. Prerequisite, Rec. 30. (Harvey.)
- Rec. 150. Camp Management.* (3)
First and second semesters; summer session. (Harvey.)

Physical Education, Recreation and Health

- Rec. 180. Leadership Techniques and Practices.* (3)
First and second semesters. (Harvey.)
- Rec. S184. Outdoor Education.* (6)
Summer only. (Staff.)
- Rec. 189. Field Laboratory Projects and Workshops.* (1-6)
First and second semesters; summer session. (Staff.)
- Rec. 190. Organization and Administration of Recreation.* (3)
First and second semesters. (Harvey.)

For Graduates

- Rec. 200. Seminar in Physical Education, Recreation and Health.* (1)
First and second semesters; summer session. (Massey.)
- Rec. 201. Foundations in Physical Education, Recreation and Health.* (3)
First and second semesters; summer session. (Eylar.)
- Rec. 202. Philosophy of Recreation.* (2)
First and second semesters; summer session. (Harvey.)
- Rec. 203. Supervisory Techniques in Physical Education, Recreation and Health.* (3)
First and second semesters; summer session. (Mohr.)
- Rec. 204. Modern Trends in Recreation.* (3)
First and second semesters; summer session. (Harvey.)
- Rec. 210. Methods and Techniques of Research.* (3)
First and second semesters; summer session. (Mohr.)
- Rec. 215. Principles and Techniques of Evaluation.* (3)
First and second semesters; summer session. (Mohr.)
- Rec. 230. Source Material Survey.* (3)
First and second semesters; summer session. (Eylar.)
- Rec. 240. Industrial Recreation.* (3)
First and second semesters; summer session. (Harvey.)
- Rec. 260. Hospital Recreation.* (3)
First and second semesters; summer session. (Harvey.)
- Rec. 287. Advanced Seminar.* (1-2)
First and second semesters; summer session. (Deach.)
- Rec. 288. Special Problems in Physical Education, Recreation and Health.* (1-6)
First and second semesters; summer session. (Staff.)
- Rec. 290. Administrative Direction of Physical Education, Recreation and Health.* (3)
First and second semesters; summer session. (Deach.)
- Rec. 399. Research.* (1-5)
First and second semesters; summer session. (Staff.)

PHYSICS

Professors: TOLL, BURGERS*, ESTABROOK, FERRELL, HAMA*, HORNYAK, MORGAN, MYERS, OPIK, SINGER, SNOW, WEBER AND WESKE*.

Part-time Professors: FRIEDMAN, HERZFELD AND F. STERN.

Associate Professors: DAY, GLOVER, GRIEM, HOLMGREN, LASTER, MACDONALD, MARION, E. STERN, SUCHER, WAGGONER AND YODH.

Visiting Assistant Professors: BOYD* AND BURNSTEIN.

Assistant Professors: ARMSTRONG, COUDON, DETENBECK, FALK, GLICK, GREENBURG, NISHIYAMA, PRANGE, RODBERG, STEINBERG, TIDMAN*, WEISS*, WILKERSON* AND ZIPOY.

Research Associates: BETTINGER, BISWAS, FIGUERA, FUJIMOTO, HORSFALL, JASEJA, MAEDA, NAGARAJAN, PRAKASH, PRATS, SATO, SWAMI AND TAKETANI.

Part-time Lecturers: AITKEN, BLEIL, COMPTON, DANOS, DIXON, FREEMAN, GLASSER, GUTSCHE, HENDERSON, KAHN, MARTIN, NEIHOF, OVERTON, PENNER, REISS, SLAWSKY, WADA, WOOLARD AND ZWANZIG.

* Institute for Fluid Dynamics and Applied Mathematics.

It is expected that the following subjects should have been studied preliminary to graduate work. Any deficiencies should be made up at once: A limited amount of graduate credit will be allowed for courses so taken.

General Physics

Heat

Intermediate Mechanics

Optics

Electricity and Magnetism

Modern Physics

Differential and Integral Calculus

Advanced Calculus

Candidates for both the master's and doctor's degrees are required to take Introduction to Theoretical Physics (Phys. 200, 201). The course runs for a full year and carries 12 semester hours credit. The minimum prerequisites in mathematics are differential and integral calculus, but advanced calculus, differential equations, and vector analysis are recommended.

Candidates for the doctor's degree should take both the Introduction to Theoretical Physics and Quantum Mechanics. No other courses are specifically required for students doing experimental thesis research, but Relativistic Quantum Mechanics is required for students doing dissertations in theoretical physics. It is recommended in the selection of further courses that the student avoid overspecialization in any field. In particular, he should take a wide variety of classical courses as well as courses in selected fields of modern physics. Some of the advanced courses are given only every second or third year; the student should check with the Physics Department to confirm when a given course is available.

Candidates for advanced degrees in physics may have a minor in either chemistry, mathematics, engineering, and/or in those fields of physics other than general physics and their field of major specialization.

THESIS (PH.D.)

The student must outline his topic to the graduate staff for approval. This outline must clearly set forth the nature of the problem, proposed method of procedure and the possible results that may be obtained. The completed thesis will also be presented to the graduate staff for approval.

TIME LIMITS

There will be a limit on the time taken to get a graduate degree in physics. For the M.S., this will be five calendar years from the date of first enrolling in the Graduate School for full-time students and six years for part-time students. For the Ph.D., the time limits will be 7 years from the date of first enrolling in the Graduate School for full-time students and 8 years for part-time students.

Graduate Assistants and other students whose employment is part-time and secondary to their studies are to be considered full-time students. Timing begins on September 12, 1960 for those students who were enrolled in the Graduate School before that date.

OFF-CAMPUS COURSES

The Physics Department offers courses at convenient times and places so as to accommodate the greatest number of students. In order to facilitate graduate study in the Washington area, the Department has part-time professors in certain government laboratories where a large number of students are interested in graduate study. All M.S. candidates beginning graduate studies after August, 1960, must take at least 3 credits of their graduate work on the College Park campus. All students who began graduate work in the University of Maryland courses after August, 1960 will be required to complete on the College Park campus at least 18 credits of their graduate work for the Ph.D. degree in physics: these credits must include at least 2 credits of Phys. 230—*Seminar*, and the remainder can be divided among major and minor physics courses and thesis research. Normally, students will complete a much greater proportion of their graduate study on the College Park campus. At government agencies where there is no part-time professor, employees desiring to do graduate work in physics should contact a member of the graduate staff in the Physics Department.

FURTHER INFORMATION

For more information, students should write the Physics Department for the departmental publication entitled "Graduate Study in Physics." In addition, further information about the newly-established program in astronomy may be obtained by writing the Physics Department.

GENERAL PHYSICS

For Graduates and Advanced Undergraduates

Phys. 100. Advanced Experiments. (2 credits per semester)

Four hours of laboratory work per week. Prerequisite, four credits of Phys. 60 or consent of instructor. Laboratory fee, \$10.00 per semester. Selected fundamental experiments in electricity and magnetism, elementary electronics, and optics. (Marion, E. Stern.)

Physics

Phys. 102. Optics. (3)

Second semester. Three lectures a week. Prerequisites, Phys. 11 or 21; Math. 21. It is suggested, but not required, that Phys. 60 or Phys. 100 be taken concurrently with this course. Geometrical optics, optical instruments, wave motion, interference and diffraction, and other phenomena in physical optics. (Zipoy.)

Phys. 103. Applied Optics. (3)

First semester. Three lectures a week. Prerequisite, Phys. 102. A detailed study of physical optics and its applications. (Morgan.)

Phys. 104, 105. Electricity and Magnetism. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Phys. 11 or 21; Math. 21. Electrostatics, direct current and alternating current circuitry, electromagnetic effects of steady currents, electromagnetic induction, radiation, development of Maxwell's equations, Poynting vector, wave equations, and electronics. (Armstrong.)

Phys. 106, 107. Theoretical Mechanics. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, Phys. 51 or consent of instructor. A detailed study of Newtonian mechanics. Dynamics, the motion of rigid bodies, oscillation problems, etc., are studied. Lagrange's equation of the first kind and the Hamilton-Jacobi equation are introduced. (Marion.)

Phys. 108. Physics of Electron Tubes. (3)

First semester. Three lectures a week. Prerequisite, Phys. 104 must be taken previously or concurrently. A study of the electromagnetic principles relevant to electron tubes and of their applications. (Steinberg.)

Phys. 109. Electronic Circuits. (4)

Second semester. Four lectures a week. Prerequisite, Phys. 105 must be taken previously or concurrently. Theory of physics detectors and pulse circuits. Application in circuit design. (Detenbeck.)

Phys. 110. Special Laboratory Projects in Physics. (1, 2, or 3)

Two hours laboratory work a week for each credit hour. One to three credits may be taken concurrently, each semester. Prerequisite, Phys. 100 and consent of adviser. Laboratory fee, \$10.00 per credit hour. Selected advanced experiments. (Staff.)

Phys. 111. Physics Shop Techniques. (1)

First semester. One three-hour laboratory per week. Prerequisite, Phys. 100 or consent of instructor. Laboratory fee, \$10.00. Machine tools, design and construction of laboratory equipment. (Horn.)

Phys. 114, 115. Introduction to Biophysics. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, intermediate physics and Math. 21. A study of the physical principles involved in biological processes, with particular emphasis on current research in biophysics. (Mullins.)

Phys. 118. Introduction to Modern Physics. (3)

First semester. Three lectures a week. Prerequisites, general physics and integral calculus, with some knowledge of differential equations and a degree of maturity as evidenced by having taken one or more of the courses Phys. 50 through Phys. 110. Introductory discussion of special relativity, origin of quantum theory, Bohr atom, wave mechanics, atomic structure, and optical spectra. (Singer.)

Phys. 119. Modern Physics. (3)

Second semester. Three lectures a week. Prerequisite, Phys. 118. A survey of nuclear physics, x-rays, radioactivity, wave mechanics, and cosmic radiation. (Rodberg.)

Phys. 130, 131. Basic Concepts of Physics. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, junior standing. Lecture demonstration fee, \$2.00 per semester. A primarily descriptive course intended mainly for those students in the liberal arts who have not had any other course in physics. This course does not satisfy the requirements of professional schools nor serve as a prerequisite or substitute for other physics courses. The main emphasis in the course will be on the concepts of physics, their evolution and their relation to other branches of human endeavor. (Laster.)

Phys. 140, 141. Atomic and Nuclear Physics Laboratory. (3, 3)

One lecture and four hours of laboratory a week. Laboratory fee, \$10.00. Prerequisites, two credits of Phys. 100 and consent of instructor. Classical experiments in atomic physics and more sophisticated experiments in current techniques in nuclear physics. Enrollment is limited to ten students. (Detenbeck, D. Stern.)

For Graduates

Phys. 200, 201. Introduction to Theoretical Physics. (6, 6)

First and second semesters. Six lecture hours per week. Prerequisite, Phys. 106 or consent of instructor. This basic course for graduate study in physics covers advanced classical mechanics, electrodynamics, relativity, thermodynamics, and statistical mechanics. (Myers.)

Phys. 202, 203. Advanced Dynamics. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, Phys. 200. A detailed study of advanced classical mechanics. (Myers.)

Phys. 204. Electrodynamics. (4)

Four lectures a week. Prerequisite, Phys. 201. A detailed study of advanced classical electrodynamics. (Griem.)

Phys. 208. Thermodynamics. (3)

First semester. Three lectures per week. Prerequisite, Phys. 201. The first and second laws of thermodynamics are examined and applied to homogeneous and non-homogeneous systems, calculations of properties of matter, the derivation of equilibrium conditions and phase transitions, the theory of irreversible processes. (Schamp.)

Phys. 212, 213. Introduction to Quantum Mechanics. (4, 4)

First and second semesters. Four lectures per week. Prerequisite, Phys. 200 or an outstanding undergraduate background in physics. A study of the Schrodinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory, etc., and applications to solid state, atomic, and nuclear physics. (Day, Rodberg, Snow.)

Phys. 222, 223. Boundary-Value Problems of Theoretical Physics. (2, 2)

Prerequisite, Phys. 201.

(Prats.)

Physics

Phys. 236. Theory of Relativity. (3)

Three lectures a week. Prerequisite, Phys. 200. A study of Einstein's special theory of relativity and some consequences, and a brief survey of the foundations of general relativity. (Weber.)

Phys. 240, 241. Theory of Sound and Vibrations. (3, 3)

Three lectures a week. Prerequisite, Phys. 201. A detailed study of acoustics and the theory of vibrations. (Hama.)

ATOMIC AND MOLECULAR PHYSICS

For Graduates and Advanced Undergraduates

Phys. 126. Kinetic Theory of Gases. (3)

Three lectures a week. Prerequisites, Phys. 107 and Math. 21. Dynamics of gas particles, Maxwell-Boltzmann distribution, diffusion, Brownian motion, etc. (Mason.)

For Graduates

Phys. 210. Statistical Mechanics. (3)

Second semester. Three lectures a week. Prerequisites, Phys. 119, and Phys. 201. A study of the determination of microscopic behavior of matter from microscopic models. Microcanonical, canonical, and grand canonical models. Applications of solid state physics and the study of gases. (Weiss.)

Phys. 214. Theory of Atomic Spectra. (3)

First semester. Three lectures a week. Prerequisite, Phys. 213. A study of atomic spectra and structure—one and two electron spectra, fine and hyper-fine structure, line strengths, line widths, etc. (Boyd.)

Phys. 215. Theory of Molecular Spectra. (3)

Second semester. Three lectures a week. Prerequisite, Phys. 214. The structure and properties of molecules as revealed by rotational, vibrational, and electronic spectra. (Boyd.)

Phys. 216, 217. Molecular Physics. (2, 2)

Two lectures a week. Prerequisites, Phys. 213. Molecular theory of gases and liquids, ensemble theory, analysis of empirical models for molecular interactions, theory of Coulomb interactions between charge distributions. (Mason.)

SOLID STATE PHYSICS

For Graduates and Advanced Undergraduates

Phys. 122. Properties of Matter. (4)

First semester. Four lectures a week. Prerequisite, Phys. 118 or equivalent. Thermal, elastic and electromagnetic properties of solids. Characteristics of fluids, and high polymer physics. (Glover.)

For Graduates

Phys. 218, 219. X-Rays and Crystal Structure. (3, 3)

Three lectures per week. Prerequisite, Phys. 201. A detailed study of crystal structure of solids and of x-rays. (Morgan.)

Phys. 220. Application of X-Ray and Electron Diffraction Methods. (2)

Two laboratory periods a week. Prerequisite, concurrent enrollment in Phys. 218. The investigation of crystal structure, using x-rays and electron diffraction. (Morgan.)

Phys. 242, 243. Theory of Solids. (3, 3)

First and second semesters. Two lectures a week. Prerequisite, Phys. 213. Properties of metals, lattice vibrations and specific heats, Boltzmann, Fermi-Dirac, and Bose-Einstein statistics, free electron gas theories, band theory of metals. (Ferrell, Myers.)

NUCLEAR PHYSICS

For Graduates and Advanced Undergraduates

Phys. 120. Nuclear Physics. (4)

Second semester. Four lectures a week. Prerequisite, Phys. 118 or equivalent. Shell model, liquid drop model, statistical model of nuclei, interaction of radiation and charged particles with matter, nuclear reactors, conservation laws, beta decay and other selected topics. (Detenbeck, Hornyak.)

Phys. 121. Neutron Physics and Fission Reactors. (4)

Second semester. Four lectures a week. Prerequisite, Phys. 120. Neutron diffusion and reactor physics. (Shapiro.)

For Graduates

Phys. 234, 235. Theoretical Nuclear Physics. (3, 3)

Three lectures a week. Prerequisites, Phys. 120 and Phys. 213. Nuclear properties and reactions, nuclear forces, two, three, and four body problems, nuclear spectroscopy, beta-decay, and related topics. (Ferrell, MacDonald.)

ELEMENTARY PARTICLE PHYSICS

Phys. 237. Relativistic Quantum Mechanics. (3)

First semester. Three lectures a week. Prerequisite, Phys. 213. Classical field theory, Klein-Gordon and Dirac equations, invariance properties, second quantization, renormalization, and related topics. (Sucher.)

Phys. 239. Elementary Particles. (3)

Three lectures a week. Prerequisite, Phys. 237. Survey of elementary particles and their properties, quantum field theory, meson theory, weak interactions, possible extensions of elementary particle theory. (Day, Snow.)

Phys. 258. Quantum Field Theory. (3)

Second semester. Three lectures a week. Prerequisite, Phys. 237. S-matrix, Feynman diagrams, scattering theory, renormalization, conservation laws, dispersion relations, and recent non-perturbation approaches to field theory. (Toll.)

Phys. 260. High Energy Physics. (3)

Three lectures a week. Prerequisite, Phys. 237. Nuclear forces are studied by examining interactions at high energies. Meson physics, scattering processes, and detailed analysis of high energy experiments. (Snow.)

Physics

ASTROPHYSICS AND GEOPHYSICS

A new program in astronomy is being established. Additional courses will be introduced in the near future. For further information, write the Department of Physics.

For Graduates and Advanced Undergraduates

Phys. 124. Introduction to Astrophysics and Geophysics. (3)

First semester. Three lectures a week. Prerequisite, Phys. 118 or consent of instructor. Celestial mechanics, orbit theory, upper atmosphere physics, astronomical spectroscopy, motions of charged particles in the earth's magnetic field. (Opik.)

For Graduates

Phys. 221. Upper Atmosphere and Cosmic Ray Physics. (2)

Second semester. Two lectures a week. Prerequisite, Phys. 200 or consent of instructor. Structure of the atmosphere, rocket and satellite experiments, primary and secondary cosmic rays, origins of cosmic rays, geomagnetic theory. (Singer.)

FLUID DYNAMICS

For Graduates and Advanced Undergraduates

Phys. 116, 117. Fundamental Hydrodynamics. (3, 3)

Three lectures a week. Prerequisites, Phys. 106 and Math. 21. Kinematics of fluid flow, properties of incompressible fluids, complex variable methods of analysis, wave motions. (Hama.)

For Graduates

Phys. 224, 225. Supersonic Aerodynamics and Compressible Flow. (2, 2)

Two lectures a week. Prerequisite, Phys. 201. (Pai.)

Phys. 226, 227. Theoretical Hydrodynamics. (3, 3)

Three lectures a week. Prerequisite, Phys. 201. A detailed study of advanced fluid dynamics. (Burgers.)

Phys. 232, 233. Hydromechanics Seminar. (1, 1)

First and second semesters. One meeting a week. (Staff.)

Phys. 246, 247. Special Topics in Fluid Dynamics. (2, 2)

Prerequisites, advanced graduate standing and consent of the instructor. (Burgers.)

Phys. 262, 263. Aerophysics. (3, 3)

Three lectures. Prerequisite, consent of the instructor. (Pai.)

RESEARCH, SEMINARS AND SPECIAL TOPICS

For Graduates and Advanced Undergraduates

Phys. 150. Special Problems in Physics.

Research or special study. Credit according to work done. Laboratory fee, \$10.00 per credit hour when appropriate. Given each semester. Prerequisite, major in physics and consent of adviser. (Staff.)

Phys. 190. Independent Studies Seminar. (Credit according to work done)

First and second semesters. Enrollment is limited to students admitted to the Independent Studies Program in physics.

Phys. 230. Seminar.

Seminars on various topics in advanced physics are held each semester, with the contents varied each year. One credit for each seminar each semester. (Staff.)

Phys. 231. Applied Physics Seminar.

One credit for each semester. (Staff.)

Phys. 238. Quantum Theory—Selected Topics. (3)

Three lectures a week. Prerequisite, Phys. 237. (Staff.)

Phys. 245. Special Topics in Applied Physics.

Two credits each semester. Two lectures a week. (Staff.)

Phys. 248, 249. Special Topics in Modern Physics. (2, 2)

Two lectures a week. Prerequisites, calculus and consent of instructor. (Staff.)

Phys. 399. Research.

Credit according to work done, each semester. Laboratory fee, \$10.00 per credit hour. Prerequisite: an approved application for admission to candidacy or special permission of the Physics Department. (Staff.)

SPECIAL PHYSICS COURSES FOR HIGH SCHOOL SCIENCE TEACHERS

The courses in this section were especially designed for high school teachers and are not applicable to B.S., M.S., or Ph.D. degrees in physics without special permission of the Physics Department. However, these courses can be included as part of a physics minor or as electives. No prerequisites are required.

Phys. 118A. Atoms, Nuclei, and Stars. (3)

Three lectures per week. An introduction to basic ideas of the constitution and properties of atomic and subatomic systems and of the overall structure of the universe.

Phys. 122A. Properties of Materials. (3)

Three lectures per week. An introduction to the study of solid state physics and the properties of fluids. (E. Stern.)

Phys. 160A. Physics Problems. (1, 2, 3)

Lectures and discussion sessions arranged. (Laster.)

Phys. 170A. Applied Physics. (3)

Three lectures per week. (Hornyak.)

Phys. 199. National Science Foundation Summer Institute for Teachers of Science and Mathematics Seminar. (1)

Arranged during summer school. Enrollment limited to participants in the N.S.F. Summer Institute. Laboratory fee, \$5.00. (Detenbeck, Staff.)

POULTRY HUSBANDRY

Professors: SHAFFNER AND COMBS.

Research Professor: SHORB.

Assistant Professors: CREEK, HELBACKA AND WILCOX.

Course work and research leading to the Master of Science and the Doctor of Philosophy degrees are offered. The student may pursue work with the major emphasis either in nutrition, physiology, physiological genetics, or the technology of eggs and poultry.

Department requirements, supplementary to the Graduate School, have been formulated for the guidance of candidates for graduate degrees. Copies of these requirements may be obtained from the Department of Poultry Husbandry.

For Graduates and Advanced Undergraduates

P. H. 104. Technology of Market Eggs and Poultry. (3)

First semester, alternate years. (Not offered 1963-64.) Two lectures and one laboratory per week. A study of the technological factors concerned with the processing, storage, and marketing of eggs and poultry, also factors affecting their quality and grading. (Helbacka.)

A. E. 117. Economics of Marketing Eggs and Poultry. (3)

Second semester. Three lectures per week. (See Agricultural Economics A. E. 117.)

Poultry Hygiene, see Veterinary Science, V. S. 107. (Staff.)

Avian Anatomy, see Veterinary Science, V. S. 108.

P. H. 105. Poultry Genetics. (3)

Second semester, alternate years. (Not offered 1963-64.) Two lectures and one laboratory period per week. Prerequisites, P.H. 1 and Zool. 104. Inheritance of factors related to egg and meat production and quality are stressed. An experiment utilizing procedures of pedigreed matings will be performed in the laboratory. (Wilcox.)

P. H. 109. Avian Physiology. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, Zool. 1 and V.S. 108 or equivalent. (V.S. 108 may be taken simultaneously with P.H. 109.) The basic physiology of the bird is discussed, excluding the reproductive system. Special emphasis is given to physiological differences between birds and other vertebrates. (Wilcox.)

P. H. S111. Poultry Breeding and Feeding. (1)

Summer session only. This course is designed primarily for teachers of vocational agriculture and extension service workers. The first half will be devoted to problems concerning breeding and the development of breeding stock. The second half will be devoted to nutrition. (Combs, Wilcox.)

P. H. S112. Poultry Products and Marketing. (1)

Summer session only. This course is designed primarily for teachers of vocational agriculture and county agents. It deals with the factors affecting the quality of poultry

products and with hatchery management problems, egg and poultry grading, preservation problems and market outlets for Maryland poultry. (Helbacka.)

P. H. 198. Special Poultry Problems. (1-2)

First and second semesters. For senior poultry students. No more than three credits may be applied towards a graduate degree. The student will be assigned special problems in the field of poultry for individual study and report. The poultry staff should be consulted before any student registers for this course. (Staff.)

For Graduates

P. H. 202. Advanced Poultry Nutrition. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, P. H. 101, Chem. 31, 32, 33 and 34 or permission of instructor. A fundamental study of the dietary role of proteins, minerals, vitamins, antibiotics, and carbohydrates is given as well as a study of the digestion and metabolism of these substances. Deficiency diseases as produced by the use of synthetic diets are considered. (Combs.)

P. H. 203. Physiology of Reproduction of Poultry. (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, P. H. 102 or its equivalent. The role of the endocrines in avian reproduction is considered. Fertility, sexual maturity, broodiness, egg formation, ovulation, and the physiology of oviposition are studied. Comparative mammalian functions are discussed. (Shaffner.)

P. H. 205. Poultry Literature. (1-4)

First and second semesters. Readings on individual topics are assigned. Written reports required. Methods of analysis and presentation of scientific material are discussed. (Staff.)

P. H. 207. Poultry Nutrition Laboratory. (2)

First semester, alternate years. (Not offered 1963-64.) One lecture and one laboratory period a week. To acquaint graduate students with common basic nutrition research techniques useful in conducting experiments with poultry. Actual feeding trials with chicks as well as bacteriological and chemical assays will be performed. (Creek.)

P. H. 302. Poultry Seminar. (1)

First and second semesters. No more than two credits in Seminar may be applied towards a graduate degree. Oral reports of current researches by staff members, graduate students, and guest speakers are presented. (Staff.)

P. H. 399. Research. (1-6)

First and second semesters. Credit in accordance with work done. Practical and fundamental research with poultry may be conducted under the supervision of staff members toward the requirements for the degrees of M.S. and Ph.D. (Staff.)

PSYCHOLOGY

Professors: ANDREWS, MC GINNIES AND VERPLANCK.

Associate Professors: MAGOON AND ROSEN.

Assistant Professors: ANDERSON, CLINE, GOLLUB, HEERMAN, PUMROY AND YARCZOWER.

Lecturers: BRADY AND METCALF.

Psychology

For the master's degree a minimum of 30 hours are required. The *major*, composed of 21 hours, will be identified as *General Psychology* and will consist of Psych. 211-212 (6), Psch. 252-253 (6), the master's thesis research (6), and one elective course (3). The *minor*, composed of a minimum of 9 hours, will ordinarily be taken in a field of specialization which the student proposes for the major in his doctoral program.

For the doctoral degree a minimum of 72 hours is required. The *majors*, composed of 48 hours, will consist of at least 30 hours in courses chosen from two specialized fields, and 18 hours of research for thesis, the last including 6 hours for the master's thesis. The *minor* will be in *General Psychology* and will consist of a total of 24 hours including Psych. 205-206 (6), Psych. 211-212 (6), Psych. 252-253 (6), and two elective courses (6).

For Graduates and Advanced Undergraduates

Graduate credit will be assigned only for students certified by the Department of Psychology as qualified for graduate standing.

Psych. 110. Educational Psychology. (3)

Second semester. Prerequisite, Psych. 1. Researches on fundamental psychological problems encountered in education. Measurement and significance of individual differences; learning, motivation, transfer of training, and the educational implications of theories of intelligence. (Maxwell.)

Psych. 122. Advanced Social Psychology. (3)

Second semester. Prerequisites, Psych. 21, and Psych. 90 or consent of instructor. A systematic review of researches and points of view in regard to major problems in the field of social psychology. (McGinnies, Cline.)

Psych. 123. Language and Social Communication. (3)

Second semester. Prerequisite, Psych. 21, senior standing and consent of instructor. The nature and significance of verbal and non-verbal communication in social psychological processes, including examination of relevant theoretical approaches to symbolic behavior. (McGinnies, Cline.)

Psych. 131. Abnormal Psychology. (3)

First and second semesters. Prerequisite, 3 courses in psychology including Psych. 5. The nature, diagnosis, etiology, and treatment of mental disorders. (Magoon, Pumroy, Rosen.)

Psych. 136. Applied Experimental Psychology. (3)

Second semester. Prerequisite, Psych. 1. A study of basic human factors involved in the design and operation of machinery and equipment. Organized for students in engineering, industrial psychology, and the biological sciences. (Anderson)

Psych. 145. Experimental Psychology: Sensory Processes. (4)

First and second semesters. Two lectures and two two-hour laboratory periods per week. Prerequisite, Psych. 90. Laboratory fee per semester, \$4.00. Primarily for students who major or minor in psychology. A systematic survey of the laboratory methods and techniques applied to sensory and perceptual processes. (Yarczower, Gollub.)

Psych. 146. Experimental Psychology: Learning, Motivation, and Problem Solving. (4)

First and second semesters. Two lectures and two two-hour laboratory periods per week. Prerequisite, Psych. 90. Laboratory fee per semester, \$4.00. Primarily for students who major or minor in psychology. The experimental analysis of learning and motivational processes. (Yarczower, Gollub.)

Psych. 147. Experimental Psychology: Social Behavior. (3)

First and second semesters. Two lectures and one two-hour laboratory period per week. Laboratory fee, \$4.00. Prerequisites, Psych. 21 and Psych. 90 or equivalent. A laboratory course dealing with methods of studying behavior in the social context. Topics will include social perception and motivation, small groups, communication and persuasion. Consideration will be given to the techniques involved in laboratory experimentation, field studies, attitude scale construction, and opinion surveys. (McGinnies, Cline.)

Psych. 148. Psychology of Learning. (3)

First semester. Prerequisites, Psych. 146, or Psych. 145 and permission. Review and analysis of the major phenomena and theories of human and animal learning, including an introduction to the fields of problem solving, thinking and reasoning behavior. (Verplanck, Yarczower, Gollub.)

Psych. 150. Tests and Measurements. (3)

First and second semesters. Prerequisite, Psych. 90. Laboratory fee, \$4.00. Critical survey of measuring devices used in counseling, educational and industrial practice with an emphasis on the theory, development and standardization. Laboratory work will incorporate training in methodology of test development together with appropriate practice in the use of selected tests. (Waldrop, Heermann.)

Psych. 151. Psychology of Individual Differences. (3)

First and second semesters. Prerequisites, Psych. 5 and 90. Problems, theories, and researches related to psychological differences among individuals and groups. (Rosen, Heermann.)

Psych. 161. Industrial Psychology. (3)

Second semester. Prerequisite, 6 hours in psychology. A course designed to aid in the understanding of the problems of people in a variety of work situations; serving as an introduction to such technical problems as personnel selection, interviewing, morale, supervision and management, and human relations in industry. Lecture, discussion and laboratory. (Heermann, Anderson.)

Psych. 180. Physiological Psychology. (3)

Prerequisite, Psych. 145 or 146. An introduction to research on the physiological basis of human behavior, including considerations of sensory phenomena, motor coordination, emotion, drives, and the neurological basis of learning. (Brady, Gollub.)

Psych. 181. Animal Behavior. (3)

(Same as Zool. 181.) Second semester. Prerequisite, consent of instructor. A study of animal behavior, including considerations of social interactions, learning, sensory processes, motivations, and experimental methods, with a major emphasis on mammals. (Verplanck.)

Psych. 191. Senior Seminar. (3)

First semester. Prerequisites, senior standing and consent of the instructor. The historical and theoretical roots of the science of psychology. Analysis of current psychological theories and their related research. (Staff.)

Psychology

Psych. 194. Independent Study in Psychology. (1-6)

First and second semesters. Prerequisite, written consent of individual faculty supervisor. Integrated reading under direction, leading to the preparation of an adequately documented report on a special topic. (Staff.)

Psych. 195. Minor Problems in Psychology. (1-6)

First and second semesters. Prerequisite, written consent of individual faculty supervisor. An individualized course designed to allow the student to pursue a specialized topic or research project under supervision. (Staff.)

For Graduates

(All the following courses require consent of the instructor.)

Psych. 200. Proseminar: Professional Aspects of Psychological Science. (2)

Second semester. Prerequisite, consent of faculty advisor. Survey of professional problems in psychology, including considerations of contemporary developments, professional ethics, literature resources, formulation of critical research problems, and discussion of the major institutions requiring psychological services. (Staff.)

Psych. 201. Sensory Processes. (3)

Second semester. Prerequisites, Psych. 180 and 211. A detailed analysis of sensory systems, emphasizing human processes and including anatomical, physiological and psychological considerations. (Anderson, Gollub.)

Psych. 202. Perception. (3)

First semester. Prerequisite, Psych. 211. Review of modern methods and results in the research areas of form and brightness perception, meaning and constancy phenomena, movement and depth, and the influences of attitudes and motivation on human perception. (Andrews.)

Psych. 203, 204. Graduate Seminar. (2, 2)

First and second semesters. Surveys of contemporary American and foreign research literature in specialized fields in psychology. (Staff.)

Psych. 205, 206. Historical Viewpoints and Current Theories in Psychology. (3, 3)

First and second semesters. Prerequisite, Psych. 212. A study of the philosophical and scientific background of modern psychology, together with a review of its major systematic viewpoints and issues. (Verplanck.)

Psych. 207. Learning Theory. (3)

Second semester. Prerequisite, Psych. 212. Systematic survey of modern theories of learning, including those of Hull, Skinner, Tolman, and Spence, with emphasis on modern behavioral concepts. (Verplanck, Yarczower.)

Psych. 208. Language and Thought. (3)

First semester. Prerequisite, Psych. 212. A study of thinking and language processes, as they have been investigated descriptively and experimentally in both normal and abnormal individuals. (Verplanck.)

Psych. 211, 212. Advanced General Psychology. (3, 3)

First and second semesters. Prerequisite, Psych. 145 or 146. A systematic review of the more fundamental investigations upon which modern psychology is based. (Yarczower, Gollub.)

Psych. 220. Psychological Concepts in Mental Health. (3)

Second semester. Introduction to the problem of mental health and potential contributions of psychology to its solution. Examination of a variety of psychological principles and techniques with respect to their utility. Development of a conceptual framework for approaching mental health problem. (Magoon, Rosen.)

Psych. 221. Seminar in Counseling Psychology. (3)

The seminar focuses attention upon the historical antecedents, definitional considerations, various theoretical orientations and their implications for training, service and research. The treatment process is treated in terms of client-expectations, relationship problems and in terms of observation, inference, hypothesis making, and hypothesis testing. Considerable attention is devoted to past and current research, investigations of the treatment process, its outcomes, and to needed research evidence.

Psych. 222. Seminar in Clinical Psychology. (3)

Prerequisites, Psych. 150, 220. This seminar deals more intensively with the theoretical orientation of various treatments and the research evidence regarding the evaluation of the treatment process and its outcome. (Rosen, Pumroy.)

Psych. 223. Diagnosis and Correction of Reading Difficulties. (3)

Second semester. Prerequisites, Psych. 150, 220. Consideration of the range of reading difficulties, their etiology, manifestations and the various methods of corrective treatment employed in removing or alleviating the conditions. Opportunity for observation and limited field work will be provided as available to demonstrate the variations resulting from differences in ability, age, and educational level. (Staff.)

Psych. 224. Advanced Procedures in Clinical and Counseling Psychology. (3)

Analysis of diagnostic and therapeutic procedures, both group and individual, employed in remediation of normal and abnormal problems. Consideration of experimental and evaluative literature bearing on these. Examination of a variety of systematic approaches to remediation of mental health problems. (Staff.)

Psych. 225, 226. Practicum in Counseling and Clinical Procedures. (1-3, 1-3)

First and second semesters. Psych. 225 gives the student limited experience in contact with campus and community mental health facilities, with current research in mental health through fieldwork, role playing, and observed demonstrations. Psych. 226 initiates a continuing counseling relationship with both individual supervision and group consultation focused on the understanding of clients and the progress of the student's work. The students will engage in individual or group research projects in the general mental health area. (It is to be noted that a maximum of 6 credit hours may be used toward a graduate degree from any combination of Psych. 225, 226, 268 and 269.) (Magoon, Pumroy.)

Psych. 227. Occupational Development and Choice. (3)

Alternate years. Prerequisites, Psych. 220 and permission of instructor. Analysis of theoretical and research literature on occupational behavior, development of occupational skills and attitudes, theories of career choice and vocational adjustment.

Psych. 228. Seminar in Student Personnel. (2)

(Same as Ed. 228.) First semester. Prerequisite, permission of instructor. The seminar is designed to acquaint the student with student personnel functions at the collegiate level. Attention is devoted to the historical antecedents of student personnel activities, the range of services, their functions, responsibilities, interrelationships and projected

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future status. Resource personnel presently engaged in student personnel services will participate as needed. (Byrne, Magoon.)

Psych. 229. Advanced Industrial Psychology. (3)

First semester. Prerequisite, Psych. 161 or equivalent. A review of certain fundamental problems in industry and the psychological techniques for studying them. Included will be analyses of motivation and morale, personnel selection and evaluation, management problem solving, and situational behavior controls. (Heermann.)

Psych. 230. Determinants of Human Performance. (3)

Second semester. An advanced seminar dealing with the analysis of factors and variables which affect human performance and efficiency. (Anderson, Yarczower.)

Psych. 231. Training Procedures in Industry. (3)

Second semester. Prerequisite, Psych. 148 or equivalent. A consideration of psychological principles and methods for improving job performance; skill development laboratory in application of methods and techniques is provided. (Staff.)

Psych. 232. Personnel Selection and Job Analysis. (3)

Second semester. Prerequisite, Psych. 161 or equivalent. Psychological measurement as applied to the analysis of job requirements and the development and use of performance criteria and predictors. (Heermann.)

Psych. 233. Social Organization in Industry. (3)

First semester. Prerequisite, Psych. 229 or equivalent. Analysis of management organizations as social structures, and the application of concepts and methods of social psychology to problems of conflict, cooperation, and leader-group relations. (Staff.)

Psych. 240. Interview and Questionnaire Techniques. (3)

Second semester. Psychological concepts and methods in the use of interview, questionnaire, and inventory procedures for the measurement, prediction and alteration of behavior. (Anderson, Cline.)

Psych. 241. Mass Communication and Persuasion. (3)

Second semester. Consideration of the communication process and the various media of mass communication. Factors related to the effectiveness of communications are analyzed in the light of experimental evidence, and various strategies and techniques of persuasion are reviewed. (McGinnies.)

Psych. 242. Seminar in Social Psychology. (3)

Second semester. Analysis and discussion of contemporary systematic positions in social psychology. Review of research methods in the area as well as theories and problems of current importance. (McGinnies.)

Psych. 250. Mental Test Theory. (3)

First semester. Prerequisite, Psych. 253. Development of test theory from psychophysics and measurement theory. Consideration of formal and applied problems involved in developing and utilizing psychological tests and measurements. Special attention is given to problems of reliability, validity, and prediction. (Heermann.)

Psych. 251. Development of Predictors. (3)

First semester. Prerequisite, Psych. 253. Review of statistical theory and practices in the design, development and analysis of techniques of prediction in the behavioral sciences, with special attention to the formal and practical problem of criteria for prediction. (Andrews.)

Psych. 252, 253. Advanced Statistics. (3, 3)

First and second semesters. Prerequisite, Psych. 90. Detailed study of the fundamentals of statistical inference, experimental design, and the analysis of regression and correlation concepts and techniques; a basic course for research students in the behavioral sciences. (Andrews, Anderson, Heermann.)

Psych. 254. Factor Analysis. (3)

First semester. Prerequisite, Psych. 253. Analysis of major developments in factor theory as applicable to the behavioral sciences, including computational methods and research implications. (Andrews.)

Psych. 255. Seminar in Psychometric Theory. (3)

Prerequisite, Psych. 253. Study of psychophysical methods, scaling techniques, and the statistical methods of pattern analysis. (Andrews.)

Psych. 260. Individual Tests. (3)

Prerequisite, Psych. 150. Laboratory fee, \$4.00. Analysis of the various theories of intelligence and current research in the area; practical experience in the administration, scoring and interpretation of currently used intelligence tests. (Pumroy.)

Psych. 262. Appraisal of Personality. (3)

Prerequisite, Psych. 150. Evaluation of the normal individual by use of a variety of psychological tests and techniques, the objective being a broader and deeper understanding of the individual along as many dimensions as possible. (Rosen.)

Psych. 263. Research Methods in Psychodynamics. (3)

Alternate years. Prerequisite, Psych. 222 and permission of instructor. Systematic evaluation and discussion of the theoretical and research literature dealing with psychodynamics and personality theory. Particular attention will be paid to research methods applicable to these concepts. (Rosen.)

Psych. 264. Projective Tests. (3)

Second semester. Prerequisite, Psych. 260. Laboratory fee, \$4.00. A familiarization with currently used projective tests, including the theory, historical background, and research in the area. The student receives experience in administration, scoring and interpreting currently used projective tests, as well as some experience in writing psychological reports. (Pumroy.)

Psych. 265. Advanced Development Psychology. (3)

Detailed examination of empirical, experimental, and theoretical literature related to developmental processes from birth throughout life. Included are discussion of physical, social, intellectual, and emotional development at various life stages. Emphasis on developmental approach to understanding of personality. (Rosen, Pumroy.)

Psych. 266, 267. Theories of Personality and Motivation. (3, 3)

First and second semesters. Prerequisite, Psych. 128. A review of the experimental analyses and conceptual aspects of biological and acquired drives and motives, and a study of the use of motivational and other concepts in personality theories. (Verplanck, Rosen.)

Psych. 268, 269. Advanced Practicum in Counseling and Clinical Procedures. (1-3, 1-3)

First and second semesters. Prerequisites, Psych. 226 and consent of instructor. In Psych. 268 emphasis is placed upon direct individual supervision of casework, analysis

Sociology

of selected typical and atypical problems, and individual or group research projects in the general mental health area. Psych. 269 provides extensive practical experience through varied assignments to such community mental health facilities as child guidance clinics, employment and rehabilitation service, mental health research agencies, outpatient clinics, and hospitals. (It is to be noted that a maximum of 6 credit hours may be used toward a graduate degree from any combination of Psych. 225, 226, 268, and 269.) (Magoon, Pumroy.)

Psych. 270. Advanced Abnormal Psychology. (3)

Prerequisite, Psych. 131. Extensive and intensive analyses of deviant human behavior, with emphasis on the theoretical concepts proposed by Freud, Jung, Adler, Rank, Horney, French and Alexander, Meyer, and Sullivan, as well as upon the contribution of the self-concept and neo-behavioral theorists. (Rosen.)

Psych. 271. Special Testing of Disabilities. (3)

Second semester. Prerequisite, Psych. 260. Study of a variety of the lesser known psychological tests and techniques useful in evaluating individuals with certain disabilities, including cerebral palsy, speech problems, brain damage. (Magoon.)

Psych. 272, 273. Individual Clinical Diagnosis. (3, 3)

Prerequisite, Psych. 264. Study of emotionally disturbed individuals with a variety of psychological tests and techniques, including the use of intensive case study methodology; the aim being to understand the individual as thoroughly as possible, as well as the evaluation for the implications for treatment. (Metcalf.)

Psych. 280. Advanced Psychophysiology. (3)

First semester. An advanced seminar dealing with special selected topics in the area of psychophysiology. (Brady.)

Psych. 281. Seminar in Psychopharmacology. (3)

Alternate years. Prerequisite, one year of graduate study in psychology or consent of the instructor. A critical review and detailed analysis of the literature and problems related to the effects of drugs on animal and human behavior. Designed for advanced graduate students in experimental psychology and mental health psychology. (Brady.)

Psych. 288, 289. Special Research Problems. (1-3)

First and second semesters. Supervised research on problems selected from the areas of experimental, industrial, social, quantitative, or mental health psychology. (Staff.)

Psych. 399. Research. (credit arranged).

First and second semesters. (Staff.)

SOCIOLOGY

Professors: HOFFSOMMER, LEJINS AND MELVIN.

Associate Professor: SHANKWEILER.

Assistant Professors: ANDERSON, COATES, CUSSLER, FRANZ, HIRZEL AND MOTZ.

The Department of Sociology grants the degrees of Master of Arts and Doctor of Philosophy. Fields of specialization include anthropology, crimi-

nology, rural and urban sociology, mental health, the family, industrial and occupational sociology, social theory, social psychology, intercultural sociology and research methods.

Prerequisites for graduate study leading to an advanced degree with a major in sociology consist of either (1) an undergraduate major (totalling at least 24 semester hours) in sociology or (2) 12 semester hours of sociology (including 6 semester hours of advanced courses) and 12 additional hours of comparable work in economics, political science, or psychology. Reasonable substitutes for these prerequisites may be accepted in the case of students majoring in other departments who desire a graduate minor or several courses in sociology.

For Graduates and Advanced Undergraduates

Soc. 102. Intercultural Sociology. (3)

First semester. Prerequisite, Soc. 2. On the basis of a comparative study of customs, individual and group behavior patterns and institutions, this course studies the ideologies of America and other modern societies. The analysis focuses on the nature of the social processes and group behavior of various peoples having or not having a written language. (Melvin.)

Soc. 105. Cultural Anthropology. (3)

Second semester. A survey of the simpler cultures of the world, with attention to historical processes and the application of anthropological theory to the modern situation. (Anderson.)

Soc. 106. Archeology. (3)

Second semester. A survey of human cultural developments as revealed by archeological methods, with materials to be drawn from selected areas of both Old and New Worlds. (Anderson.)

Soc. 111. Sociology of Occupations and Careers. (3)

First semester. The sociology of work and occupational life in modern society. Changing occupational ideologies, values and choices. Occupational status systems and occupational mobility. The social psychology of career success. (Coates.)

Soc. 112. Rural-Urban Relations. (3)

First semester. The ecology of population and the forces making for change in rural and urban life; migration, decentralization and regionalism as methods of studying individual and national issues. Applied field problems. (Cussler.)

Soc. 113. The Rural Community. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. A detailed study of rural life with emphasis on levels of living, the family, school, and church and organizational activities in the fields of health, recreation, welfare, and planning. (Hoffsommer, Hirzel.)

Soc. 114. The City. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. The rise of urban civilization and metropolitan regions; ecological process and structure; the city as a center of dominance; social problems, control and planning. (Staff.)

Sociology

Soc. 115. Industrial Sociology. (3)

First and second semesters. The sociology of human relations in American industry and business. Complex industrial and business organizations as social systems. Social relationships within and between industry, business, community and society. (Coates.)

Soc. 116. Military Sociology. (3)

First and second semesters. The sociology of military life. Social change and the growth of military institutions. Complex formal military organizations. Military organizations as social systems. Military service as an occupation or profession. Career patterns, problems and satisfactions. Relations between military institutions, civilian communities and society. (Coates.)

Soc. 118. Community Organization. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Community organization and its relation to social welfare; analysis of community needs and resources; health, housing, recreation; community centers; neighborhood projects. (DiBella, McElhenie.)

Soc. 121. Population. (3)

First semester. Prerequisite, Soc. 1 or its equivalent. Population distribution and growth in the United States and the world; population characteristics of the U. S.; resulting population problems and policies. (Hirzel.)

Soc. 122. Population. (3)

Second semester. Prerequisite, Soc. 1 or its equivalent. Trends in fertility and mortality, migrations, population estimates and the resulting problems and policies. (Hirzel.)

Soc. 123. Ethnic Minorities. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Basic social processes in the relations of ethnic groups within the State; immigration groups and the Negro in the United States; ethnic minorities in Europe. (Lejins.)

Soc. 124. The Culture of the American Indian. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. A study of type cultures; cultural processes; and the effects of acculturation on selected tribes of Indians in the Americas. (Anderson.)

Soc. 125. Cultural History of the Negro. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. The cultures of Africa south of the Sahara and the cultural adjustments of the Negro in North and South America. (Anderson.)

Soc. 131. Introduction to Social Service. (3)

First and second semesters. General survey of the field of social-welfare activities; historical development; growth, functions, and specialization of agencies and services, private and public. (DiBella, McElhenie.)

Soc. 136. Sociology of Religion. (3)

First semester. Prerequisite, Soc. 1, or equivalent. Varieties and sources of religious experience. Religious institutions and the role of religion in social life. (Anderson.)

Soc. 141. Sociology of Personality. (3)

First semester. Prerequisite, Soc. 1, or equivalent. Development of human nature and personality in contemporary social life; processes of socialization; attitudes, individual differences, and social behavior. (Motz, Cussler, Schmidt.)

Soc. 144. Collective Behavior. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. Social interaction in mass behavior; communication processes; structure and functioning of crowds, strikes, audiences, mass movements, and the public. (Cussler.)

Soc. 145. Social Control. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Forms, mechanisms, and techniques of group influence on human behavior; problems of social control in contemporary society. (Motz.)

Soc. 147. Sociology of Law. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Law as a form of social control; interrelation between legal and other conduct norms as to their content, sanctions, and methods of securing conformity; law as an integral part of the culture of the group; factors and processes operative in the formation of legal norms as determinants of human behavior. (Lejins.)

Soc. 153. Juvenile Delinquency. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Juvenile delinquency in relation to the general problem of crime; analysis of factors underlying juvenile delinquency; treatment and prevention. (Lejins.)

Soc. 154. Crime and Delinquency Prevention. (3)

Second semester. Prerequisites, Soc. 1 or its equivalent; Soc. 52, Soc. 153, or consent of instructor. Methods and programs in prevention of crime and delinquency. (Lejins.)

Soc. 156. Institutional Treatment of Criminals and Delinquents. (3)

First semester. Prerequisites, Soc. 1, or is equivalent; Soc. 52, Soc. 153, or consent of instructor. History, organization and functions of penal and correctional institutions for adults and juveniles. (Lejins.)

Soc. 161. The Sociology of War. (3)

Second semester. The origin and development of armed forces as institutions; the social causes, operations and results of war as social conflict; the relations of peace and war and revolution in contemporary civilization. (Coates.)

Soc. 162. Basic Principles and Current Practice in Public Welfare. (3)

Summer session only. (DiBella, McElhenie.)

Soc. 164. The Family and Society. (3)

Second semester. Prerequisites, Soc. 1 and Soc. 64 or equivalent. Study of the family as a social institution; its biological and cultural foundations, historic development, changing structure and function; the interactions of marriage and parenthood, disorganizing and reorganizing factors in present day trends. (Shankweiler, Motz.)

Soc. 166. Interviewing and Problem Solving in Social Work. (3)

Prerequisite, Soc. 131, or concurrent registration. The principles of interviewing and other diagnostic techniques as applied to social problems with particular reference to family and child behavior.

Soc. 171. Family and Child Welfare. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Programs of family and child welfare agencies; social services to families and children; child placement; foster families. (DiBella.)

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Soc. 173. Social Security. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. The social security program in the United States; public assistance; social insurance. (DiBella.)

Soc. 174. Public Welfare. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. Development and organization of the public welfare movement in the United States, social legislation interrelations of federal, state, and local agencies and institutions. (DiBella.)

Soc. 180. Small Group Analysis. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Analysis of small group structure and dynamics. Review of research on small groups in factories, military service, schools and communities. Presentation of techniques used in the study of small groups. (Franz.)

Soc. 183. Social Statistics. (3)

First and second semester. Prerequisite, Soc. 1, or its equivalent. Measures of central tendency and dispersion, use of statistical inference in simple testing of null hypotheses, chi square, and labor saving computational devices for correlation. (Staff.)

Soc. 185. Advanced Social Statistics. (3)

Second semester. Prerequisite, Soc. 183, or equivalent. Provides refined statistical research methods for advanced students in the social sciences. Sampling theory, specialized correlation technique, advanced tests of significance, and other procedures. (Staff.)

Soc. 186. Sociological Theory. (3)

First and second semesters. Prerequisite, Soc. 1, or its equivalent. Development of the science of sociology; historical backgrounds; recent theories of society. (Melvin, Hirzel.)

Soc. 191. Social Field Training. (1-3)

First and second semesters. Prerequisites: For social work field training, Soc. 131; for crime control field training, Soc. 52 and 153. Enrollment restricted to available placements. Supervised field training in public and private social agencies. The student will select his particular area of interest and be responsible to an agency for a definite program of in-service training. Group meetings, individual conferences and written program reports will be a required part of the course. (Staff.)

Soc. 196. Senior Seminar. (3)

Second semester. Required of and open only to senior majors in sociology. Scope, fields, and research methods of sociology; practical applications of sociological knowledge. Individual study and reports. (Hoffsommer.)

For Graduates

Soc. 201. Methods of Social Research. (3)

First semester. Selection and formulation of research projects; methods and techniques of sociological investigation and analysis. Required of graduate majors in sociology. (Hoffsommer.)

Soc. 215. Community Studies. (3)

First semester. Intensive study of the factors affecting community development and growth, social structure, social stratification, social mobility and social institutions; analysis of particular communities. (Staff.)

Soc. 216. Sociology of Occupations and Professions. (3)

Second semester. An analysis of the occupational and professional structure of American society, with special emphasis on changing roles, functions, ideologies and community-relationships. (Coates.)

Soc. 221. Population and Society. (3)

Second semester. Selected problems in the field of population; quantitative and qualitative aspects; American and world problems. (Hirzel.)

Soc. 224. Race and Culture. (3)

Second semester. Race and culture in contemporary society; mobility and the social effects of race and culture contacts and intermixture. (Anderson.)

Soc. 230. Comparative Sociology. (3)

Second semester. Comparison of the social institutions, organizations, patterns of collective behavior, and art manifestations of societal values of various countries. (Melvin.)

Soc. 241. Personality and Social Structure. (3)

First semester. Comparative analysis of the development of human nature, personality, and social traits in select social structures. (Cussler.)

Soc. 246. Public Opinion and Propaganda. (3)

Second semester. Process involved in the formation of mass attitudes; agencies and techniques of communication; quantitative measurement of public opinion. (Motz.)

Soc. 253. Advanced Criminology. (3)

First semester. Survey of the principal issues in contemporary criminological theory and research. (Lejins.)

Soc. 254. Seminar: Criminology. (3)

Second semester. Selected problems in criminology. (Lejins.)

Soc. 255. Seminar: Juvenile Delinquency. (3)

First semester. Selected problems in the field of juvenile delinquency. (Lejins.)

Soc. 256. Crime and Delinquency as a Community Problem. (3)

Second semester. An intensive study of selected problems in adult crime and juvenile delinquency in Maryland. (Lejins.)

Soc. 257. Social Change and Social Policy. (3)

First semester. Emergence and development of social policy as related to social change; policy-making factors in social welfare and social legislation. (Melvin.)

Soc. 262. Family Studies. (3)

Second semester. Case studies of family situations; statistical studies of family trends, methods of investigation and analysis. (Shankweiler.)

Soc. 263. Marriage and Family Counseling. (3)

Second semester. Prerequisites, Soc. 64 or Soc. 164 or consent of instructor. A sociological analysis of an emerging, family-centered profession: its interdisciplinary development and professional organization; its basic methods of coordinating art and science in solving family problems. Designed for advanced sociology majors or allied

Speech and Dramatic Art

fields for use in vocations such as teaching, medicine, the ministry and others embodying the role of guidance. (Shankweiler.)

Soc. 264. The Sociology of Mental Health. (3)

First semester. A study of the sociological factors that condition mental health together with an appraisal of the group dynamics of its preservation. (Melvin.)

Soc. 282. Sociological Methodology. (3)

Second semester. Logic and method of sociology in relation to the general theory of scientific method; principal issues and points of view. (Staff.)

Soc. 285. Seminar: Sociological Theory. (3)

First semester. Critical and comparative study of contemporary European and American theories of society. Required of graduate majors in sociology. (Melvin.)

Soc. 291. Special Social Problems. (Credit to be determined)

First and second semesters. Individual research on selected problems. (Staff.)

Soc. 399. Thesis Research. (Credit to be determined)

First and second semesters. (Staff.)

SPEECH AND DRAMATIC ART

Professor: STRAUSBAUGH.

Associate Professors: BATKA, HENDRICKS AND NIEMEYER.

Assistant Professors: AYLWARD, DEW, LINKOW AND PUGLIESE.

Lecturers: CAUSEY, SHUTTS AND WILLIAMS.

The Department offers a graduate course of study leading to the degree of Master of Arts. The student may take work with the major emphasis either in dramatics, general speech, radio-television, or in speech and hearing.

Department requirements, supplementary to the Graduate School requirements, have been formulated in each of the fields for the guidance of students. Copies may be obtained from the Department.

For Graduates and Advanced Undergraduates

Speech 102. Radio Production. (3)

Second semester. Prerequisite, Speech 22. Laboratory fee, \$2.00. A study of the multiple problems facing the producer. Special emphasis is given to acoustic setup, casting, "miking," timing, cutting, and the coordination of personnel factors involved in the production of radio programs. (Batka.)

Speech 103, 104. Speech Composition and Rhetoric. (3, 3)

First and second semesters. A study of rhetorical principles and models of speech composition in conjunction with the preparation and presentation of specific forms of public address. (Staff.)

Speech 105. Speech—Handicapped School Children. (3)

Second semester. Prerequisite, Speech 3 for undergraduates. The occurrence, identification and treatment of speech handicaps in the classroom. An introduction to speech pathology. (Craven, Staff.)

Speech 106. Clinical Practice. (1 to 5 credits, up to 9)

Each semester; summer session. Prerequisite, Speech 105. Laboratory fee, \$1.00 per hour. Clinical practice in various methods of corrective procedures with various types of speech cases in the University Clinic, veterans hospitals, and the public schools. May be taken for 1-5 credit hours per semester. May be repeated for a total of 9 semester hours credit. (Conlon.)

Speech 107. Advanced Oral Interpretation. (3)

Second semester. Prerequisite, Speech 13. Emphasis upon the longer reading. Program planning. (Provensen.)

Speech 109. Speech and Language Development of Children. (3)

Second semester. Admission by consent of instructor. An analysis of normal and abnormal processes of speech and language development in children. (Hendricks.)

Speech 110. Advanced Group Discussion. (3)

First and second semesters. Prerequisite, Speech 10. Required in speech curriculum and elective in other curricula. An examination of current research and techniques in the discussion and conference including extensive practice in this area. (Linkow.)

Speech 111. Seminar. (3)

First and second semesters. Prerequisites, senior standing and consent of instructor. Required of speech majors. Present-day speech research. (Strausbaugh.)

Speech 112. Phonetics. (3)

First semester. Prerequisite, Speech 3 or consent of instructor. Laboratory fee, \$3.00. Training in the recognition and production of the sounds of spoken English, with an analysis of their formation. Practice in transcription. Mastery of the International Phonetic Alphabet. (Conlon.)

Speech 113. Play Production. (3)

Second semester. Prerequisite, Speech 16 or consent of instructor. Development of procedure followed by the director in preparing plays for public performance. (Pugliese.)

Speech 114. The Film as an Art Form. (3)

First and second semesters. Laboratory fee, \$7.50. A study of the motion picture as a developing form of entertainment, communication, and artistic expression. A series of significant American and foreign films are viewed to illustrate the artistic, historical and sociological trends of the twentieth century. (Niemeyer.)

Speech 115. Radio in Retailing. (3)

First semester. Limited to students in the College of Home Economics. Prerequisite, Speech 1 or 7. Laboratory fee, \$2.00. Writing and production of promotional programs for the merchandising of wearing apparel and house furnishings. Collaboration with Washington and Baltimore radio stations and retail stores. (Batka.)

Speech and Dramatic Art

Speech 116. Radio Announcing. (3)

Second semester. Prerequisites, Speech 4 and 22 or consent of instructor. Laboratory fee, \$2.00. The theory and application of all types of announcing. (Batka.)

Speech 117. Radio and Television Continuity Writing. (3)

First semester. Prerequisite, Speech 22 or consent of instructor. A study of the principles, methods and limitations of writing for radio and television. Application will be made in the writing of general types of continuities and commercials. (Aylward.)

Speech 120. Speech Pathology. (3)

First semester. Prerequisite, Speech 105. Laboratory fee, \$3.00. A continuation of Speech 105, with emphasis on the causes and treatment of organic speech disorders. (Hendricks.)

Speech 122. Radio Workshop. (3)

First semester. Prerequisite, Speech 102 or 116. Laboratory fee, \$2.00. A laboratory course dealing with all phases of producing a radio program. (Batka.)

Speech 126. Semantic Aspects of Speech in Human Relations. (3)

Second semester. Prerequisite, one course in public speaking. An analysis of speech and language habits from the standpoint of general semantics. (Hendricks.)

Speech 129, 130. Play Directing. (3, 3)

Admission by consent of instructor. A lecture-laboratory course dealing with the fundamentals of script cutting, pacing, movement, blocking, and rehearsal routine as applied to the directing of plays. (Pugliese, Niemeyer.)

Speech 131. History of the Theatre. (3)

First semester. A survey of dramatic production from early origins to 1800. (Niemeyer.)

Speech 132. History of the Theatre. (3)

Second semester. A survey of dramatic production from 1800 to present. (Niemeyer.)

Speech 133. Communication Processes in Conferences. (3)

Second semester. Prerequisite, Speech 103 and 104 or the equivalent. Limited to students in the military studies curriculum. Group participation in conferences, methods of problem solving, semantic aspects of language and the function of conferences in industry and government. (Linkow.)

Speech 135. Instrumentation in Speech and Hearing Science. (2)

First semester. Prerequisite, Speech 3. Laboratory fee, \$2.00. The use of electronic equipment in the measurement of speech and hearing. (Linkow.)

Speech 136. Principles of Speech Therapy. (3)

Prerequisite, Speech 120. Laboratory fee, \$3.00. Differential diagnosis of speech and language handicaps and the application of psychological principles of learning, motivation and adjustment in the treatment of speech disorders. (Hendricks.)

Speech 138. Methods and Materials in Speech Correction. (3)

Prerequisite, Speech 120 or the equivalent. Laboratory fee, \$3.00. The design and use of methods and materials for diagnosis, measurement, and retaining of the speech-handicapped. (Craven.)

Speech 139. Theatre Workshop. (3)

First and second semesters. Prerequisite, Speech 8 or Speech 14. A laboratory course designed to provide the student with practical experience in all phases of theatre production. (Strausbaugh.)

Speech 140. Principles of Television Production. (3)

First semester. Prerequisite, Speech 22. A study of the theory, methods, techniques and problems of television production and direction. Units of study covering television cameras and lenses, lighting theory and practices, scenery and properties, costumes and makeup, graphic arts and special effects, are included. Observation of production procedures at nearby television stations. Application will be made through crew assignments for University-produced television programs. (Aylward.)

Speech 141. Introduction to Audiometry. (2)

First semester. Prerequisite, Speech 3. Required for students whose concentration is in speech and hearing therapy. Laboratory fee, \$2.00. Analysis of various methods and procedures in evaluating hearing losses. (Craven.)

Speech 142. Speech Reading and Auditory Training. (2)

Second semester. Prerequisite, Speech 3. Required for students whose concentration is in speech and hearing therapy. Laboratory fee, \$2.00. Methods of training individuals with hearing loss to recognize, interpret, and understand spoken language. (Conlon.)

Speech 146. Television News and Public Affairs. (3)

Second semester. Prerequisite, Speech 117 or Journ. 101. Training in presentation of television news, interviews, discussions and forums. (Batka.)

Speech 147. Analysis of Broadcasting Processes and Results. (2)

First semester. Prerequisite, Speech 22 or consent of instructor. Survey of the more common analytic approaches, methods, and results in the field of radio and television. (Aylward.)

Speech 148. Television Direction. (3)

First semester. Two hour lecture, three hour laboratory. Prerequisite, Speech 22 or Speech 140. Laboratory fee, \$10.00. Principles of television direction including analysis of script, casting, rehearsing, production, and video control. (Aylward.)

Speech 149. Television Workshop. (3)

Second semester. Two hour lecture, four hour laboratory. Prerequisites, Speech 22, 140 or 148, or consent of instructor. Laboratory fee, \$10.00. Advanced laboratory course dealing with all phases of producing a complete television program. (Batka.)

Speech 150. Radio and Television Station Management. (2)

Second semester. Prerequisite, Speech 22 or consent of instructor. Broadcasting regulations, licenses, personnel functions, sales, advertising, and program and station promotion. (Batka.)

Speech 161. Ancient Rhetoric. (3)

Second semester. Prerequisite, Speech 5 or 11. The theories of speechmaking and speech composition as propounded by the classical rhetoricians. Special attention is given to Plato, Aristotle, Isocrates, Cicero, Quintillian and St. Augustine. (Staff.)

Speech and Dramatic Art

Speech 164. Persuasion in Speech. (3)

Second semester. Prerequisite, Speech 5 or 11. A study of the bases of persuasion with emphasis on recent experimental developments in persuasion. (Staff.)

Speech 171. Styles and Theories of Acting. (3)

Second semester. Prerequisite, Speech 8 or consent of instructor. The study and application of historical styles and theories of acting. (Niemeyer.)

Speech 175. Stage Design and Lighting. (3)

Second semester. Prerequisite, Speech 14 or consent of instructor. The theory of stage design and lighting. Making of plans and lighting plots as coordinate elements of scenic art. (Schmitt.)

For Graduates

(All the following courses require consent of instructor)

The Department maintains a reciprocal agreement with Walter Reed General Hospital whereby clinical practice may be obtained at the Army Audiology and Speech Correction Center, Forest Glen, Maryland, under the direction of James P. Albrite, M.D., Director.

Speech 201. Special Problems Seminar. (A through K) (1-3)

(6 hours applicable toward M.A. degree.) Prerequisites, 6 hours of speech pathology and consent of instructor. A. stuttering; B. cleft palate; C. delayed speech; D. articulation; E. cerebral palsy; F. voice; G. special problems of the deaf; H. foreign dialect; I. speech intelligibility; J. neurophysiology of hearing; K. minor research problems. (Hendricks, Staff.)

Speech 202. Techniques of Research in Speech and Hearing. (3)

First semester. Prerequisite, 12 hours of speech pathology and audiology. Required of candidates for master's degree in speech and hearing therapy. Analysis of research methodology including experimental techniques, statistical analysis and preparation of reports for scientific investigations in speech and hearing science. (Williams.)

Speech 203. Experimental Phonetics. (3)

Prerequisite, Speech 112. Laboratory fee, \$3.00. The application of experimental methods in the quantitative analysis of the phonetic elements of speech. (Hendricks.)

Speech 210. Anatomy and Physiology of Speech and Hearing. (3)

Prerequisites, 6 hours of speech pathology and audiology and consent of instructor. Laboratory fee, \$3.00. A study of the anatomy and physiology of the auditory and speech mechanisms. (Carter.)

Speech 211. A, B, C, D. Advanced Clinical Practice. (1-3 up to 12)

(6 hours applicable toward M.A. degree.) Prerequisite, 12 hours of speech pathology and audiology. Laboratory fee, \$1.00 per hour. Supervised training in the application of clinical methods in the diagnosis and treatment of speech and hearing disorders. (Craven.)

Speech 212. Advanced Speech Pathology. (3)

Second semester. Prerequisites, 6 hours in speech pathology and consent of instructor. Laboratory fee, \$3.00. Etiology and therapy for organic and functional speech disorders. (Dew.)

Speech 214. Clinical Audiometry. (3)

First semester. Prerequisites, 3 hours in audiology and consent of instructor. Laboratory fee, \$3.00. Testing of auditory acuity with pure tones and speech. (Shutts.)

Speech 216. Communications Skills for the Hard-of-Hearing. (3)

First semester. Prerequisites, 3 hours in audiology and consent of instructor. Speech reading, auditory training, and speech conservation problems in the rehabilitation of the hard-of-hearing. (Causey.)

Speech 217. Selection of Prosthetic Appliances for the Acoustically Handicapped. (3)

Second semester. Prerequisite, Speech 214. Laboratory fee, \$3.00. A laboratory course in modern methods of utilizing electronic hearing aids. (Shutts.)

Speech 218. Speech and Hearing in Medical Rehabilitation and Special Education Programs. (3)

Second semester. Prerequisites, 6 hours in speech pathology and audiology and consent of instructor. Administrative problems involved in the organization and operation of speech and hearing therapy under different types of programs. (Hendricks.)

Speech 219. Speech Disorders of the Brain-Injured. (3)

Prerequisites, 6 hours in pathology and audiology and consent of instructor. Laboratory fee, \$3.00. Methods of evaluation and treatment of children and adults who have suffered injury to brain tissue, with subsequent damage to speech and language processes. (Hendricks.)

Speech 220. Experimental Audiology. (3)

Second semester. Prerequisite, 6 hours in audiology. Laboratory fee, \$3.00. A study of experimental techniques in the investigation of problems in audiology and psycho-acoustics. (Hendricks, Staff.)

Speech 221. Communication Theory and Speech and Hearing Problems. (3)

Second semester. Prerequisites, 6 hours in speech pathology and audiology and consent of instructor. Analysis of current theories of communication as they apply to research and therapy in speech and hearing. (Hendricks.)

Speech 240. Seminar in Broadcasting. (3)

First semester. Studies of various aspects of broadcasting. (Aylward.)

Speech 241. Special Problems in Broadcasting. (3)

Second semester. An experimental laboratory course for the development of new ideas in broadcasting. (Batka.)

Speech 260. Speech and Drama Programs in Higher Education. (3)

First semester. A study of current theories and practices in speech and drama. (Strausbaugh & Staff.)

Speech 261. Introduction to Graduate Study in Speech. (3)

First semester. (Aylward.)

Speech 262. Special Problems in General Speech. (3)

First semester. (Linkow.)

Speech 270. Seminar: Studies in Theatre. (3)

First semester. Research projects adapted to individual backgrounds and special work. (Staff.)

Veterinary Science

Speech 271. The Theory of Pre-Modern Dramatic Production. (3)

Second semester. An historical survey of production styles.

(Pugliese.)

Speech 272. Special Problems in Drama. (3)

Second semester. The preparation of adaptations and other projects in dramaturgy.

(Niemeier.)

Speech 399. Research. (1-6)

Credit in proportion to work done and results accomplished.

(Staff.)

VETERINARY SCIENCE

Professors: BRUECKNER AND DE VOLT.

Associate Professors: BYRNE, COTTON AND PLUMER.

Assistant Professor: WIERSIG.

No advanced degrees are given in the Department of Veterinary Science. Graduate students in other departments are accepted for problems in the Department of Veterinary Science upon approval of the Department in which the graduate degree may be given.

For Graduates and Advanced Undergraduates

V. S. 101. Anatomy and Physiology. (3)

First semester. Two lectures and one laboratory period a week. Normal structure of the domesticated animals; normal physiological activities; interrelationship of structure and function.

(Wiersig.)

V. S. 102. Animal Hygiene. (3)

Second semester. Two lectures and one laboratory period a week. Nature of disease; immunity; prevention and control; common diseases of farm animals.

(Wiersig.)

V. S. 107. Poultry Hygiene. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, one year of zoology and one year of chemistry.

(De Volt.)

V. S. 108. Avian Anatomy. (3)

First semester. Two lectures and one laboratory a week. Prerequisite, Zool. 1. Gross and microscopic structure, dissection and demonstration.

(De Volt.)

For Graduates

V. S. 203. Electron Microscopy. (2)

First semester. One lecture and one laboratory period a week. Theory of the electron microscope, preparation of specimens, manipulations, photography.

(Byrne.)

V. S. 399. Animal Disease Research. (2-6)

First and second semesters. Credit in accordance with work done. Prerequisite, veterinary degree or consent of staff. Studies of practical disease phases.

(Brueckner, Byrne, Cotton, DeVolt, Plumer, Wiersig.)

ZOOLOGY

Professors: ANASTOS AND SCHOENBORN.

Associate Professors: BROWN, GROLLMAN, HALEY, RAMM AND WINN.

Assistant Professor: HIGHTON.

The Department of Zoology offers work leading to the Master of Science and the Doctor of Philosophy degrees. The general academic requirements which must be fulfilled for these degrees are described earlier in the catalog.

The special fields which graduate students may emphasize in working toward these degrees are behavior, cytology, ecology, embryology, fisheries, parasitology, physiology, and systematics. Information concerning the specific requirements in each of these fields may be obtained from the Department.

Alternate year courses will be offered according to the following schedule: (a) courses not offered in 1962-63; (b) courses offered in 1962-63.

All zoology courses with laboratory have a laboratory fee of \$8.00 per course per semester.

For Graduates and Advanced Undergraduates

Zool. 102. General Animal Physiology. (4)

Second semester. Occasional summer session. Two lectures and two three-hour laboratory periods a week. Prerequisites, one year of zoology and one year of chemistry.

(Schoenborn.)

Zool. 104. Genetics. (3)

First semester. Summer session. Two lectures and one discussion period a week. Prerequisite, one course of zoology or botany.

(Highton.)

Zool. 108. Animal Histology. (4)

Second semester. Occasional summer session. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of zoology.

(Brown.)

Zool. 110. Parasitology. (4)

First semester. Occasional summer session. Two lectures and two two-hour laboratory periods a week. Prerequisites, Zool. 1 and 2 or permission of the instructor.

(Haley.)

Zool. 111. Animal Parasitology. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, Zool. 110 or equivalent. Alternate years (a).

(Haley.)

Zoology

Zool. 118. Invertebrate Zoology. (4)

First semester. Occasional summer session. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of zoology. (Linder.)

Zool. 121. Principles of Animal Ecology. (3)

Second semester. Occasional summer session. Two lectures and one three-hour laboratory period a week. Prerequisites, one year of zoology and one year of chemistry. (Stross.)

Zool. 127. Ichthyology. (4)

First semester. Two lectures, one two-hour and one three-hour laboratory period a week. Prerequisites, Zool. 5 and 20. Alternate years (b). (Winn.)

Zool. 128. Zoogeography. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, one year of zoology, botany, or geology. Alternate years (a). (Staff.)

Zool. 129. Vertebrate Zoology. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Prerequisites, Zool. 1, 2, 5, and 20 or permission of the instructor. (Winn.)

Zool. 130. Hydrobiology. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Prerequisites, one year of zoology and one year of chemistry or permission of the instructor. (Stross.)

Zool. 181. Animal Behavior. (3)

(Same as Psych. 181.) Second semester. Three lectures a week. Prerequisite, permission of the instructor. (Verplanck, Brady.)

Zool. 199S. National Science Foundation Summer Institute for Teachers of Science and Mathematics. Seminar. (1)

Summer session. Seminar fee, \$5.00. (Brown, Staff.)

For Graduates

Zool. 202. Animal Cytology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Zool. 108. Alternate years (b). (Brown.)

Zool. 203. Advanced Embryology. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Zool. 20. Alternate years (a). (Ramm.)

Zool. 204. Advanced Physiology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, Zool. 102 and one year of organic chemistry. (Schoenborn.)

Zool. 207. Zoology Seminar. (Credit to be arranged)

First and second semesters. Summer session. One lecture a week for each credit hour. 1. cytology; 2. embryology (general embryology, experimental embryology, invertebrate embryology, transplantation and regeneration, endocrines and development); 3. fisheries; 4. genetics (population genetics); 5. parasitology (general parasitology, helminthology,

fish diseases); 6. physiology (physiology of protozoa, invertebrate physiology, physiology of fishes, physiology of development); 7. systematics (evolution, herpetology, ichthyology, zoogeography); 8. ecology (experimental ecology, marine ecology, radioisotopes in ecology, population dynamics, limnology); 9. behavior (comparative behavior, fish behavior, electronic instrumentation); 10. recent advances (microtechnique and histochemistry, Russian parasitology). (Staff.)

Zool. 208. Special Problems in Zoology. (Credit to be arranged)

First and second semester. Summer session. 1. cytology; 2. embryology; 3. fisheries; 5. parasitology; 6. physiology; 7. systematics; 8. ecology; 9. behavior; and 10. general. (Staff.)

Zool. 209. Advanced Parasitology. (4)

Second semester. Three lectures and one three-hour laboratory period a week. Prerequisite, Zool. 110 or permission of the instructor. Alternate years (b). (Haley.)

Zool. 210. Systematic Zoology. (4)

Second semester. Three lectures and one three-hour laboratory period a week. Alternate years (b). (Highton.)

Zool. 211, 212. Lectures in Zoology. (3, 3)

First and second semesters. Three lectures a week. (Visiting Lecturers.)

Zool. 215S. Fisheries Technology. (4)

To be offered as needed during the summer session at the Sea Food Processing Laboratory, Crisfield, Maryland. Two lectures and two three-hour laboratory periods a week. (Dunker.)

Zool. 216. Physiological Cytology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, Chem. 161, 162, Phys. 11, and Zool. 102, or permission of the instructor. Alternate years (a). (Brown.)

Zool. 220. Advanced Genetics. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Zool. 104. Alternate years (a). (Highton.)

Zool. 223. Analysis of Animal Structure. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Alternate years (b). (Ramm.)

Zool. 231S. Acarology. (3)

Summer session. Lecture and laboratory. (Camin.)

Zool. 232S. Medical and Veterinary Acarology. (3)

Summer session. Lecture and laboratory. (Camin.)

Zool. 233S. Agricultural Acarology. (3)

Summer session. Lecture and laboratory. (Baker.)

Zool. 234. Experimental Mammalian Physiology. (4)

First semester. Two four-hour laboratory periods a week. Prerequisites, Zool. 102 and one year of chemistry above general chemistry. (Grollman.)

Dentistry

Zool. 235. *Comparative Behavior.* (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, Zool. 121 and 181, or permission of the instructor. Alternate years (a). (Winn.)

Zool. 399. *Research.* (Credit to be arranged)

First and second semesters. Summer session. Work on thesis project only. 1. cytology; 2. embryology; 3. fisheries; 5. parasitology; 6. physiology; 7. systematics; 8. ecology; and 9. behavior. (Staff.)

SCHOOL OF DENTISTRY

ANATOMY

Professor: HAHN.

Associate Professor: PIAVIS.

Lecturer: LINDENBERG.

For Graduates and Advanced Undergraduates

Anat. 111. Human Gross Anatomy. (8)

First semester. Two lectures and three laboratories a week. Second semester. Two lectures and two laboratory periods for eight weeks. This course consists of dissections and lectures supplemented by frequent conferences and practical demonstrations. The entire human body is dissected. The subject is taught with the purpose of emphasizing the principles of the body structure, the knowledge of which is derived from a study of its development, its organs and tissues and the action of its parts.

(Hahn, Piavis, Staff.)

Anat. 112. Human Neuroanatomy. (2)

Second semester. Two lectures and two laboratory periods for eight weeks. Prerequisite, Anat. 111 or equivalent. The work consists of a study of the brain and spinal cord by gross dissections and microscopic methods. Correlation is made, whenever possible, with the student's work in the histology and physiology of the central nervous system.

(Hahn, Piavis, Lindenberg, Staff.)

For Graduates

Anat. 211. Human Gross Anatomy. (8)

Same as Anat. 111 but with additional work on a more advanced level.

(Hahn, Piavis, Staff.)

Anat. 212. Human Neuroanatomy. (2)

Same as Anat. 112 but with additional instruction of a more advanced nature.

(Hahn, Piavis, Lindenberg, Staff.)

Anat. 214. The Anatomy of the Head and Neck. (3)

One conference and two laboratory periods per week for one semester. This course is designed to provide the student with a detailed study of the basic anatomy of the region and to correlate this knowledge with the various aspects of clinical practice.

(Hahn, Piavis.)

Anat. 399. Research.

(Credit determined by amount and quality of work performed.)

(Staff.)

BIOCHEMISTRY

Professor: VANDEN BOSCHE.

For Graduates and Advanced Undergraduates

Biochem. 111. Principles of Biochemistry. (6)

First year. Prerequisites, inorganic and organic chemistry, with additional training in quantitative and physical chemistry desirable. Two lecture and one laboratory period throughout the year. (Vanden Bosche.)

For Graduates

Biochem. 211. Advanced Biochemistry. (6)

Prerequisite, Biochem. 111. Two lectures, one conference and one laboratory period throughout the year. (Vanden Bosche.)

Biochem. 399. Research.

(Number of hours and credit by arrangement.)

(Vanden Bosche.)

HISTOLOGY

Professor: PROVENZA.

Instructor: SEIPP.

Hist. 111. Mammalian Histology and Embryology. (8)

First year. The course embraces the thorough study of the cells, tissues and organs of the various systems of the human body. Although certain aspects of the dental histology phase of the course are given strictly as special entities, many are included in the instruction in general histology, since the two areas are so intimately related when functional and clinical applications are considered. The instruction in embryology is correlated with that in histology. It covers the fundamentals of development of the human body, particular emphasis being given to the head and facial regions, the oral cavity, and the teeth and their adnexa. Specific correlations are also made with the other courses in the dental curriculum.

For Graduates

Hist. 212. Mammalian Histology and Embryology. (4-2)

This course is the same as Hist. 111, except that it does not include the dental phases of Hist. 111, but does include additional instruction and collateral reading of an advanced nature. (Provenza, Seipp.)

Hist. 213. Mammalian Oral Histology and Embryology. (2)

Prerequisite, Hist. 111 or 212, or an equivalent course. This course covers the dental aspects of Hist. 111, and includes additional instruction in the relations of histologic structure and embryologic development of the teeth, their adnexa, and the head and facial regions of the human body. (Provenza, Seipp.)

Dentistry

Hist. 216. Inheritance and Development Biology. (6)

This course is concerned with the study of the embryogeny and fetal developments of vertebrate animals with special emphasis on mammalian embryology. In addition to tracing the development pattern, lectures are devoted to the discussion of inheritance mechanisms, gametogenesis and fertilization. (Provenza.)

Hist. 217. Comparative Animal Histology. (6)

Prerequisite, Hist. 111, 212-213, or an equivalent course. This course is concerned with a comparative study of the morphology, structure and function of the cells, tissues and organs as found in representative members of the animal kingdom. Special emphasis is placed on techniques and research methods. (Staff.)

Hist. 218. Experimental Embryology. (4)

Second semester of every year. Prerequisite, Hist. 216, or an equivalent course. This course is concerned with the historical and recent aspects of experimental embryology from both the applied and theoretical standpoint. Each student will be assigned a special problem in addition to the scheduled lectures. (Staff.)

Hist. 219. Radiation Biology. (4)

First semester of odd numbered years. The primary aim of this course is to familiarize the student with the techniques of handling radioactive isotopes as applied in biological research. The topics covered in the course are: the physics of radioactivity from the standpoint of the biological researcher; the selection of isotopes for specific investigations; the effects of radioactivity on cells, tissues and systems; the effect of radioactivity on inheritance; the role of environment on the effectiveness of radioactivity; and certain phases of laboratory health physics. The laboratory will be concerned with the use and location as well as recording and interpreting data of isotopes as applied to biological research. (Provenza.)

Hist. 320. Seminar. (2)

(Staff.)

Hist. 399. Research.

(Number of hours and credit by arrangement.)

(Staff.)

MICROBIOLOGY

Professor: SHAY.

For Graduates and Advanced Undergraduates

Microb. 115. Serology and Immunology. (4)

Second semester. Two lectures and two laboratory periods a week. Protective reactions of the animal body against pathogenic microorganisms and their products; cellular and humoral immunity; anaphylaxis and allergies. (Shay.)

Microb. 121. Dental Microbiology and Immunology. (4)

First semester. Consideration is given to pathogenic bacteria, viruses, yeasts and molds. Special attention is given to those organisms which produce lesions of the oral cavity. Immunological principles are studied with emphasis on hypersensitivity resulting from antibiotics, antigens and vaccines. Laboratory teaching includes cultural characteristics, disinfection, sterilization, asepsis, animal inoculation, antibiotics assay and virus techniques. In all phases of the course emphasis is placed on dental applications. (Shay.)

For Graduates

Microb. 200, 201. Chemotherapy. (1, 1)

Offered in alternate years. Prerequisites, Microb. 121 or equivalent, Biochem. 111 or equivalent. Lectures which deal with the chemistry, toxicity, pharmacology and therapeutic value of drugs employed in the treatment of disease. (Shay.)

Microb. 202, 203. Reagents and Media. (1, 1)

Offered in alternate years. Consideration of media for special procedures, such as, antibiotic assays, blood cultures, spinal fluid, exudates and other materials. Anaerobiosis, differential media, biochemical reactions, sensitivity and sterility testing are considered in detail. Emphasis is placed on growth requirements of specific groups of microorganisms. (Shay.)

Microb. 210. Special Problems in Microbiology.

(Credit determined by amount and quality of work performed.) Laboratory course. Special studies in the various divisions of microbiology. (Shay.)

Microb. 211. Public Health. (2)

Prerequisite, Microb. 121 or equivalent. A demonstration of public health facilities in the community and their relation to the practices of the health sciences carried on through lectures and discussion groups. The application of statistical and epidemiological methods to health problems is illustrated through lectures and demonstration. (Shay.)

Microb. 399. Thesis Research.

(Credit determined by amount and quality of work performed.) Open only to candidates for advanced degrees in microbiology. (Shay.)

ORAL SURGERY

Professor: DORSEY.

For Graduates

Surg. 201. Clinical Anesthesiology. (6)

Forty hours a week for thirteen weeks. (Heldrich, Staff.)

Surg. 220. General Dental Oral Surgery. (4)

Two lectures and two laboratory periods a week for one semester. (Dorsey, Staff.)

Surg. 221. Advanced Oral Surgery. (4)

Two lectures and two laboratory periods a week for one semester. (Dorsey, Staff.)

Surg. 399. Research.

Time and credit by arrangement. (Staff.)

PATHOLOGY

Professor: M. AISENBERG.

Associate Professor: A. GARDNER.

Dentistry

For Graduates and Advanced Undergraduates

Path. 121. General Pathology. (4)

Two lectures and two laboratory periods per week for one semester.

(Aisenberg, Gardner.)

For Graduates

Path. 211. Advanced Oral Pathology. (8)

Two lectures and two laboratory periods throughout the year. This course is presented with the objective of correlating a knowledge of histopathology with the various aspects of clinical practice. Studies of surgical and biopsy specimens are stressed.

(Aisenberg, Gardner.)

Path. 339. Research.

Time and credit by arrangement.

(Aisenberg, Gardner.)

PHYSIOLOGY

Professor: WHITE.

Associate Professors: SHIPLEY AND POLLACK.

For Graduates and Advanced Undergraduates

Physiology 121. Principles of Physiology. (6)

Second year. 132 hours. Three lectures and one laboratory period in first semester, two lectures in second semester. The study of the functions of major mammalian organ systems is coordinated with basic cellular neural and hormonal physiology in relation to the integrated activity of the human body.

(Oster, Shipley, Pollack, Staling.)

Physiology 211. Principles of Mammalian Physiology. (6)

Prerequisite, permission from the Department. Same as Physiology 121 but with collateral reading and additional instruction. Each student is required to write a review paper on some special phase of physiology.

(Staff.)

Physiology 212. Advanced Physiology.

Hours and credit arrangement. Prerequisite, Physiology 121 or its equivalent. Lectures and seminars on special problems and recent advances in physiology during the second semester.

(Staff.)

Physiology 213. Research.

By arrangement with the Head of the Department.

(Staff.)

Physiology 399. Thesis Research.

By arrangement with the Head of the Department.

(Staff.)

SCHOOL OF MEDICINE

ANATOMY

Professors: FIGGE AND NAUTA.

Associate Professors: KRAHL, KUYPERS AND LEVEQUE.

The graduate degrees offered by the Department of Anatomy are the Master of Science and the Doctor of Philosophy.

For Graduates and Advanced Undergraduates

Anat. 101. Human Gross Anatomy. (8)

Four conferences or lectures, 12 laboratory hours per week throughout the first semester. Laboratory fee, \$25.00. This course gives the student an opportunity to develop a basic concept of the morphology of the human body. It is closely interwoven with the study of neuroanatomy, histology and embryology, and some time is devoted to roentgen anatomy. The entire human body is dissected.

(Figge, Krahl, Leveque, Mech, Saunders, Crispens.)

Anat. 103. Clinical Anatomy. (4)

Second semester. Laboratory fee, \$20.00. Two lectures and two two-hour laboratories per week for 16 weeks. This course is designed to bridge the gap between abstract anatomy and clinical anatomy as applied to the study and practice of medicine and surgery. It will be required of all majors in anatomy. The study of surface anatomy will be correlated with physical diagnosis.

(Atkins, Brantigan, Martin, Walker, Bowie, Settle, Staff.)

For Graduates

Anat. 201. General Anatomy of the Human Body. (8)

Same course as Anat. 101, but on a more advanced level. It can be taken by graduate as well as post-graduate students. Laboratory fee, \$25.00.

(Figge, Staff.)

Anat. 203. Clinical Anatomy. (4)

Same course as Anat. 103 but on a more advanced level. Laboratory fee, \$25.00.

(Figge, Brantigan, Staff.)

Anat. 204. Fetal and Infant Anatomy. (2)

Second semester. Laboratory fee, \$10.00. Fifteen periods of three hours each, every Thursday from 2 to 5 p.m. for 15 weeks. This course is open to graduate students and post-graduates interested in pediatrics.

(Krahl.)

Anat. 399. Research in Anatomy.

Maximum credits, 12 per semester. Research work may be taken in any one of the branches of anatomy.

(Figge, Staff.)

NEURO-ANATOMY

For Graduates and Advanced Undergraduates

Neuroanat. 201. Human Neuro-Anatomy. (4)

First semester. Two lectures and four laboratory hours per week for 16 weeks. Laboratory fee, \$15.00. The study of the detailed anatomy of the central nervous system is co-

Interdepartmental Courses

ordinated with structure and function of the entire nervous system. The dissection of the human brain and the examination of stained microscopic sections of various levels of the brain stem are required. (Figge, Nauta, Kuypers.)

For Graduates

Neuroanat. 201. Human Neuro-Anatomy. (4)

Same course as Neuroanat. 101, but with additional work of a more advanced nature. Laboratory fee, \$15.00. (Figge, Nauta, Kuypers.)

Neuroanat. 399. Research in Neuro-Anatomy.

Maximum credits, 12. Research work involving the central or peripheral nervous system. (Figge, Nauta, Kuypers, Leveque.)

MICRO-ANATOMY

For Graduates and Advanced Undergraduates

Microanat. 101. Mammalian Histology. (6)

First semester. Three lectures and six laboratory hours a week for 16 weeks. Laboratory fee, \$15.00. This course presents an integrated study of the histology and embryology of the human body. An attempt is made to correlate this with gross anatomy as well as other subjects in the medical curriculum. Special emphasis is placed on the dynamic and functional aspects of the subject. (Figge, Leveque.)

For Graduates

Microanat. 201. Mammalian Histology. (6)

Same course as Microanat. 101, but with additional work of a more advanced nature. Laboratory fee, \$15.00. (Figge, Leveque and Crispens.)

Microanat. 202. Normal and Atypical Growth. (2)

Lectures in problems of growth. Two hours per week, time to be arranged. Sixteen weeks. (Figge.)

Microanat. 399. Research.

Maximum credits, 12. Research work may be taken in any one of the branches which form the subject of micro-anatomy (including cancer research). (Figge, Leveque and Crispens.)

INTERDEPARTMENTAL COURSES

ID. 101. Man and His Environment. (2)

One-hour lecture and one-hour panel discussion Saturday mornings from 9 to 11 a.m. throughout the year. Distinguished leaders in American medicine participate in the presentation of these weekly sessions. The course is broad in scope, stressing the cultural aspects of anthropology with emphasis directed toward the sociological, psychological, physiological, and geneological relationships of man and his surroundings. All departments of the School of Medicine participate.

P.M. 101. Biostatistics. (1)

(Staff.)

BIOLOGICAL CHEMISTRY

Professor: HERBST.

Associate Professors: EMERY AND BESSMAN.

Instructors: DUDA AND LAYNE.

Graduate degrees offered by the Department of Biological Chemistry are the Master of Science and Doctor of Philosophy.

For Graduates

Biochem. 201. Principles of Biochemistry. (8)

Second semester. Five lectures and two four and one-half hour laboratory periods a week. Prerequisites, inorganic, organic and quantitative or physical chemistry. Laboratory fee, \$20.00. Studies of the composition of living organisms and the chemical and physical processes which occur during health and in disease. (Staff.)

Biochem. 202. Special Topics in Biochemistry. (1, 1)

Prerequisite, Biochem. 101 or 201. Reading assignments and written summaries of the classical research literature in biochemistry. (Herbst.)

Biochem. 204, 205. Seminar. (1, 1)

First and second semesters. Reports on the current literature or on research in progress. (Herbst.)

Biochem. 206. Enzymes and Metabolism. (3)

First semester. Three lectures per week on enzyme kinetics and intermediary metabolism. Prerequisite, Biochem. 201. (Herbst, Duda, Layne.)

Biochem. 207. Enzymes and Metabolism Laboratory. (3)

First semester. Three three-hour laboratory periods per week on radioactive tracer methods, cell fractionation, enzyme preparation and assay procedures. To be taken concurrently with Biochem. 206. (Herbst, Emery, Duda.)

Biochem. 208. Biochemical Preparations. (1-4)

Credit according to work assigned. The preparation of biochemicals by methods illustrating useful techniques for the isolation and purification of natural products. (Herbst, Duda, Emery.)

Biochem. 399. Research.

Maximum credits, 12 hours per semester. (Herbst, Duda, Emery, Bessman, Layne.)

BIOPHYSICS

Professor: MULLINS.

Associate Professor: SJODIN.

The Department of Biophysics offers graduate courses of study leading to the degrees of Master of Science and Doctor of Philosophy. The study

Interdepartmental Courses

programs are flexible and depend on the preparation and interests of the student. Detailed requirements are available from the Department of Biophysics.

It is recommended that students studying for the degree of Doctor of Philosophy select a minor in either physics, chemistry, or mathematics.

For Graduates and Advanced Undergraduates

Biophys. 100. Introduction to Biophysics. (3)

First semester. Three lectures a week. Prerequisites, Chem. 1, 3, Phys. 10, 11, Math. 18, 19. An introduction to the study of living systems applying the methods of physics and chemistry. The cell as a physical-chemical system and experimental methods for investigation, nerve impulse conduction and excitation, muscle contraction, the interaction of radiation with living material. (Mullins, Sjodin.)

Biophys. 101. Physical Chemistry of Membranes. (2)

Second semester. Two lectures a week. Prerequisites, Chem. 1, 3, Phys. 10, 11, Math. 18, 19. Diffusion in and through membranes developed from first principles with special reference to problems of ion transport in biological membranes. (Sjodin.)

Biophys. 102. Biophysics of Radiation. (2)

Second semester. Two lectures a week. Prerequisites, Chem. 1, 3, Phys. 10, 11. An advanced study of the interaction of radiation with living matter and with molecules of biological interest. (Mullins.)

Biophys. 103. Laboratory Techniques in Membrane Biophysics. (3)

First semester. One lecture and one laboratory period a week. Prerequisites, Biophys. 100, or Biophys. 101, or consent of the staff. Training in the use of radioactive isotopes, radioactive counting equipment, and bio-electric measuring instruments applied to the study of membranes. (Mullins, Sjodin.)

Biophys. 104. Seminar in Biophysics. (1)

Second semester. Prerequisites, Biophys. 100, Biophys. 101, or consent of the staff. Seminars on various biophysical topics given by the staff, graduate students, and guest speakers.

For Graduates

Biophys. 200. Advanced and Theoretical Biophysics. (3)

First semester. Three lectures a week. Prerequisites, Biophys. 100 or consent of staff. An advanced and critical analysis of experimental findings in terms of biophysical theory. (Mullins, Sjodin.)

Biophys. 201. Advanced Membrane Physics. (2)

Second semester. Two lectures a week. Prerequisites, Chem. 1, 3, Phys. 10, 11, Math. 20, 21. The subject matter of Biophys. 101 at an advanced level for students planning research on biological membranes. (Sjodin.)

Biophys. 202. Research in Biophysics. (3-6)

First and second semesters. Required of students planning to take the Master of Science degree or the Doctor of Philosophy degree in Biophysics. (Staff.)

MICROBIOLOGY

Professor: WISSEMAN.

Associate Professor: SMITH.

Assistant Professors: SNYDER AND EYLAR.

Instructor: MYERS, ROSENZWEIG AND JORDAN.

The Department of Microbiology offers the degree of Doctor of Philosophy. While the degree of Master of Science may be offered in special instances, priority for research facilities will be given aspirants to the Ph.D. degree. This Department encourages students who wish to enroll in the combined M.D.-Ph.D. program.

Emphasis is placed upon medical aspects of microbiology. Research programs are available in virology, rickettsiology, medical bacteriology and mycology, microbial physiology and bacterial cytology. Opportunities are open for experience in teaching and in diagnostic bacteriology and serology.

For Graduates and Advanced Undergraduates

Microb. 101. Medical Microbiology and Immunology. (8)

First semester. Four lecture hours and eight hours in laboratory and group conferences per week. Laboratory fee, \$10.00. This course begins with an introduction to basic principles of microbiology and immunology and then proceeds to consider the major groups of bacteria, spirochetes, fungi, rickettsiae and viruses that cause human disease. Emphasis is placed upon an analysis of the properties of microorganisms thought to be important in disease production, pathogenesis of infection and interaction with host defense mechanisms, epidemiology and control measures. (Wiseman, Staff.)

For Graduates

Microb. 201. Medical Microbiology and Immunology. (8)

First semester. Four lecture hours and eight hours in laboratory and group conferences per week. Laboratory fee, \$10.00. This course, intended for the serious advanced student of medical microbiology, is built upon the framework of Microb. 101 supplemented with advanced readings and laboratory work. (Wiseman, Staff.)

Microb. 203. Microbial Physiology. (3)

Second semester, alternate years. Three lectures per week supplemented with demonstrations. By consent of instructor. This course surveys the metabolic processes of bacteria, fungi, rickettsiae, viruses and parasitic protozoa. (Myers, Wiseman.)

Microb. 205. Cytology and Genetics of Microorganisms. (2)

Second semester, alternate years. One lecture and one laboratory per week. Laboratory fee, \$10.00. Registration by consent of instructor. The structure of microorganisms will be studied by various means, including the electron microscope, in a sequence leading to the ultimate analysis of the nucleus, which, in turn, will be related to the genetics of the cell and its capabilities for mutation. The recognition, origin and importance of bacterial, viral and fungal mutants will be considered. (Smith, Staff.)

Microb. 206, 207. Seminar. (1, 1)

First and second semesters. One session per week. Graduate students, staff and guests participate in comprehensive and critical reviews of subjects of special interest or pertinent to graduate training program. (Wiseman, Staff.)

Microb. 208. Medical Mycology. (2)

Second semester, alternate years. One lecture and one laboratory per week. Laboratory fee, \$10.00. Registration by consent of instructor. Consists of a review of the funda-

Interdepartmental Courses

mentals of elementary mycology; a consideration of methods for the isolation, cultivation and identification of actinomycetes, yeasts and fungi; and a study of the etiological agents and of the immunology, epidemiology, prognosis and treatment of the medical mycoses. (Smith.)

Microb. 209. Special Topics.

(Permission and credit arranged individually.) This course provides the opportunity for the graduate student to pursue under supervision subjects of special interest not offered in other formal courses. A study program is worked out with the instructor prior to registration and may consist of special readings, conferences, reports and, on occasion, laboratory experience. (Wisseman, Staff.)

Microb. 210. Advanced Virology and Rickettsiology Lecture. (3)

This course considers the general properties of viruses and rickettsiae, methods for studying them and finally concentrates on agents of medical importance. Special emphasis is placed on the host-parasite relationship, characterization of the various viral and rickettsial agents and on biological and ecological factors. Registration is by permission of instructor only. The course will be given as the average on alternate years in the Spring semester. There are two weekly sessions of 90 minutes each. Prerequisites: Microb. 201 or equivalent. (Eylar, Wisseman, Staff.)

Microb. 211. Virology and Rickettsiology Laboratory. (1)

This course is the laboratory counterpart of Microbiology 210. It is designed to familiarize the student with the major techniques for the study of virus and rickettsial agents and to give him first hand experience with a variety of the more common agents. Registration is by permission of instructor only. Because of the limited facilities and the nature of the work, it may be necessary to restrict registration in this course according to the following priority: students majoring in medical microbiology, then students minoring in microbiology and, finally, others. The laboratory consists of one formal session per week; however, the nature of the work frequently requires additional participation throughout the week. (Eylar, Wisseman, Staff.)

Microb. 399. Research.

Maximum credits, 12 hours per semester.

(Wisseman, Staff.)

LEGAL MEDICINE

Professor: FISHER.

Associate Professors: FREIMUTH AND LOVITT.

Leg. Med. 201. Legal Medicine. (1)

One hour of lecture for twelve weeks, 4 hours assigned reading. This course embraces a summary of medical jurisprudence including the laws governing the practice of medicine, industrial compensation and malpractice, proceedings in criminal and civil prosecution, medical evidence and testimony, including medicolegal toxicology. (12 hours). (Fisher, Lovitt, Freimuth.)

Leg. Med. 202. Toxicology. (10)

Two hours lecture, 8 laboratory hours per week for 1 year. There is also included some discussion of industrial toxicology relating industrial exposures to toxic substances to effects produced in the worker using these materials. The lectures include discussion of mechanism of action of poisons, lethal doses, antidotes and methods of detection and quantitation of poisons in tissues and body fluids. The laboratory work embraces practical application of analytical procedures for the detection and estimation of poisons in post mortem tissue samples. (Freimuth, Fisher.)

Interdepartmental Courses

Leg. Med. 203. Gross Pathologic Anatomy as Related to Toxicology. (2)

Two hours per week for one year. This course includes elementary anatomy with normal histology and selected histopathology as it will be seen by the toxicologist. It is a correlated course embracing anatomy, basic physiology and the alterations in function as well as structure brought about by disease and poisoning. (Fisher, Lovitt.)

Leg. Med. 399. Research in Toxicology.

(Number of hours and credit arranged.)

(Freimuth, Fisher.)

This Department offers schedules leading to the degrees of Master of Science and Doctor of Philosophy in toxicology. Candidates are expected to have completed undergraduate work as follows: Eight semester hours each in general chemistry, organic chemistry, analytical chemistry (qualitative and quantitative), physical chemistry, physics, biology and four semester hours in organic qualitative analysis.

Candidates for the Master's degree must complete the following or equivalent courses:

Leg. Med. 201, 202, 203 and 399.

Pharm. 101 f. s., and Chem. 258.

Candidates for the doctorate must complete the following or equivalent courses:

Leg. Med. 201, 202, 203, 399.

Pharm. 100 f. s., Physiol. 102, Bact. 101, Bact. 102, Biochem. 206,

Chem. 206, 208, Chem. 221, 223, Chem. 258, Chem. 150, Pharm.

Chem. 111, 113, Pharm. Chem. 112, 114.

Part of the above work is offered at College Park with the remainder to be done at the Baltimore Schools. Some of the course work in legal medicine and toxicology will be given at the laboratories of the Division of Legal Medicine located at the Office of the Chief Medical Examiner, 700 Fleet Street, Baltimore, Maryland.

PHARMACOLOGY

Professor: KRANTZ.

Associate Professors: BURGISON AND TRUITT.

All students majoring in the Department of Pharmacology with a view to obtaining the degree of Master of Science or Doctor of Philosophy should secure special training in anatomy, mammalian physiology, organic chemistry, and physical chemistry.

For Graduates and Advanced Undergraduates

Pharmacol. 101, f.s. General Pharmacology. (8)

Three lectures and one laboratory. This course consists of 96 lectures and 32 laboratory periods of three hours each, offered each year. Laboratory fee, \$20.00.

(Krantz, Truitt, Burgison, Musser, O'Niell.)

Interdepartmental Courses

For Graduates

Pharmacol. 201, f.s. General Pharmacology. (8)

Same as Pharmacol. 101, for students majoring in pharmacology. Additional instruction and collateral reading are required. Laboratory fee, \$20.00.

(Krantz, Truitt, Burgison, O'Niell.)

Pharmacol. 206, f.s. Pharmacologic Methodology. (4)

Prerequisite, Pharmacol. 201, f.s.

(Truitt.)

Pharmacol. 207, 208. Chemical Aspects of Pharmacodynamics. (2, 2)

(Burgison.)

Pharmacol. 209. Biochemical Pharmacology. (2)

(O'Niell.)

Pharmacol. 399. Research.

Maximum credits, 12. Credit in accordance with the amount of work accomplished.

(Krantz, Truitt, Burgison, O'Niell.)

PHYSIOLOGY

Professors: BLAKE AND SMITH.

Associate Professors: BERNSTEIN AND MERLIS.

Assistant Professors: GREISMAN AND KARPELES.

The graduate program in physiology is designed primarily for students oriented toward an academic career in the field of mammalian physiology, basic or applied. Some background in mathematics, physics and/or physical chemistry is considered essential and ordinarily only those wishing to complete the requirements for the Ph.D. degree will be considered.

In the usual case a student majoring in physiology will be expected to take Physiol. courses 201 to 208 below. Such a student will extend his program by taking courses in other departments of this University.

For Graduates and Advanced Undergraduates

Physiol. 101. The Principles of Physiology. (9)

Second semester. Five lectures, two conferences and two 4-hour laboratory periods per week for 16 weeks. Laboratory fee, \$15.00. The lectures cover the major fields of physiology, including the following areas: central and peripheral nervous systems, neuromuscular apparatus, heart and circulation, respiration, kidney and body fluids, gastrointestinal tract, endocrines and reproduction. The laboratory includes experiments with frog and turtle heart and nerve-muscle preparations, mammalian operative work and observations on the human subject.

(Staff.)

For Graduates

Physiol. 201. Principles of Physiology. (9)

Same as Physiol. 101, for graduate students taking physiology. Additional reading will be required. Laboratory fee \$15.00.

(Staff.)

Physiol. 202. Cardio-vascular Physiology. (2)

Two hours a week for 15 weeks. Reading assignments, seminars, conferences on current research in the cardio-vascular field. (Karpeles.)

Physiol. 203. Pulmonary Physiology. (2)

Two hours a week for 15 weeks. Reading assignments, lectures, seminars on current research in pulmonary physiology. (Bernstein.)

Physiol. 204. Physiological Techniques.

Time and credit by arrangement. The various technical procedures currently operating in the Department will be demonstrated and opportunity will be given for acquiring experience with them. (Staff.)

Physiol. 205. Physiology of Kidney and Body Fluids. (2)

Two hours a week, lectures, seminars and conferences, for 15 weeks. Consideration will be given to the current status of knowledge of renal function and body fluids in vertebrates, with particular reference to mammals. (Blake.)

Physiol. 206. Seminar

Credit according to work done. Weekly meetings are held to discuss recent literature and results of departmental research. (Staff.)

Physiol. 207. Physiology of the Central Nervous System. (2)

Two hours a week for 15 weeks. Lectures, seminars and reading assignments on current knowledge of central nervous system function. (Merlis.)

Physiol. 208. Physiology of the Autonomic Nervous System. (2)

Two hours a week for 15 weeks. Lectures, seminars and reading assignments on current knowledge of autonomic nervous system function. (Blake.)

Physiol. 399. Research.

By arrangement with Head of the Department. (Staff.)

SCHOOL OF NURSING

NURSING ADMINISTRATION

PSYCHIATRIC NURSING, MATERNAL AND CHILD HEALTH,

MEDICAL-SURGICAL NURSING.

Professors: GIPE, CARL AND GRESELL.

MAJOR OBJECTIVES OF THE GRADUATE PROGRAM

The major objective of the graduate programs in nursing is to prepare selected students as nursing administrators, instructors in a special clinical area, and supervisors in nursing service.

ADMISSION REQUIREMENTS

Admission to the graduate program in nursing requires the applicant to be a registered nurse who has completed an undergraduate degree with aca-

Nursing

demic standing which is recognized by the Graduate School of the University of Maryland. In addition, the applicant must have clinical experience in medical and surgical nursing, psychiatric nursing, maternal and child nursing, and public health nursing, comparable to the requirements in the basic undergraduate nursing program at the University of Maryland.

CURRICULUM REQUIREMENTS

Requirements for the Master of Science Degree for Administration in Nursing include the satisfactory completion of forty semester hours of graduate work. The forty semester hours of study and work extends through three college semesters, and includes clinical nursing and directed field experience either in University of Maryland Hospital or an associated hospital in Baltimore. The forty semester hour program includes thirty-four semester hours of course work and six semester hours for the thesis. Twenty-two semester hours must be taken in the major field, and a minimum of twelve semester hours in the minor field. It is required that at least twenty-two semester hours of course work will be taken in courses numbered in the catalog as 200 or above.

Other programs in nursing such as Psychiatric Nursing, Medical and Surgical Nursing, Maternal and Child Health Nursing require the satisfactory completion of thirty semester hours of graduate work. The thirty semester hour program includes twenty-four semester hours of course work and six semester hours for the thesis. Twelve semester hours must be taken in the major field, and at least eight semester hours must be taken in the minor field. It is required that twelve semester hours of course work will be taken in courses numbered in the catalog as 200 or above.

THESIS

A thesis representing research in the major field must be approved by the adviser of the student and presented to the Dean of the Graduate School as partial requirement for the Master of Science degree. Final approval of the thesis is given by the examination committee appointed by the Dean of the Graduate School.

LEARNING EXPERIENCES

Through graduate study the student broadens and deepens understandings built first upon knowledge and then greater understanding of a particular specialty of study and work. Having the privilege of studying with graduate students in other disciplines, the graduate student in nursing has opportunities to transfer knowledge from other areas to enrich her understandings in her own field of specialty. The graduate student is given opportunity to learn to pursue, evaluate and apply results of research in nursing in order to find better ways of improving patient care.

The extensive clinical facilities of the University of Maryland provide an excellent climate where this dynamic learning can occur. Seminars, workshops, and institutes also provide opportunities for extending the scope of

understanding of the graduate student. Depending upon the functional interest, the student receives practice in teaching or supervision under guidance.

For Graduates

Nurs. 201. Trends of Higher Education in Nursing. (2)

First semester. One lecture and two hour conferences a week. The central objective of this course is to bring to the student in nursing education a knowledge and an understanding of the current status of nursing in institutions of higher learning and what nursing must have as a goal before it can become a universally accepted profession.

(Gipe, Staff.)

Nurs. 202. Interpersonal Interaction. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is primarily concerned with the application of psychodynamics and psychoanalytic understanding to the nurse's relationships with patients.

(Huffer, Carl.)

Nurs. 203. Nursing in the Somatic Therapies. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is planned to assist the graduate student to broaden her ability to apply biological physiological and somatic therapies of behavior to the care of psychiatric patients. Through this course the student may become aware of current research determining the causative factors of behavior, therefore, she may have an opportunity to formulate the effects of newer somatic methods of treatment upon her care of psychiatric patients.

(Carl, Staff.)

Nurs. 204, 205. Psychiatric Nursing. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. The course includes dynamics of human behavior, including formation of personality, the techniques of problem solving and the skills of communication as preparation for administering expert therapeutic nursing care of psychiatric patients.

(Cohelan, Anderson.)

Nurs. 206. Philosophical Concepts in Health. (2)

Second semester. Two hour lecture a week. The course is planned with a contemporary approach to the problem of philosophical concepts in health. The discussions begin with general considerations and progress to the application of the concepts to more specific situations. (Required of all Graduate Students.)

(Beard.)

Nurs. 207, 208. Nursing in Child Health Services. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. The course is concerned with deeper knowledge of the place of nursing in the society's total program of child health services and increased skill in the nursing of children.

(Reed.)

Nurs. 209, 210. Nursing in Maternal and Newborn Services. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. The course is concerned with knowledge of obstetrics and the opportunity to apply this knowledge in varying nursing situations as it relates to the patient, to the family and to the community.

(Hydorn.)

Nurs. 211. Seminar in Maternal and Child Health Services. (2)

Second semester. One two-hour period a week. The course is concerned with understanding and purposeful application of maternal and child health nursing as it normally

Pharmacy

exists within the family. The influence of the nurse on maternal and child health is traced through the many institutions and agencies where she contacts the mother and child, or the family as a whole. (Hydorn, Reed, Staff.)

Nurs. 212, 213. Medical-Surgical Nursing. (2, 2)

First and second semester. One lecture and two four-hour laboratory periods a week. The course is designed to meet the needs of students who are interested in developing the broader and deeper aspects of nursing care as it relates to the analyzing of those elements in the art and science of nursing which take the learner beyond the realm of general practice of nursing. (Hosfeld, DeHaven.)

Nurs. 214. Application of Principles of Physical and Social Sciences in Nursing. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is designed to apply physical and social science principles in a life situation in such a way that similar situations will be recognized by the learners in their day to day application. (Zitkus, Staff.)

Nurse. 286. Research Methods and Materials in Nursing. (2)

First semester. One two-hour lecture or conference period a week. The course deals with basic understandings of philosophical aspects as they relate to research, including the nature of scientific thinking; with the basic methodologies of research; with participation in research activities; and understanding of research literature in nursing. (Carl, Gipe.)

Nurs. 287. Seminar in Nursing. (2)

Second semester. One two-hour lecture or conference period a week. (Staff.)

Nurs. 288. Special Problems in Nursing. (1-6)

The major objective of this course is to develop further clinical and research competencies in selected students who have completed a graduate core of clinical nursing. (Staff.)

Nurs. 290. Administration in Nursing. (1-6)

The purpose of this course is to provide opportunities for professional nurses, with experience in teaching in schools of nursing and/or nursing services, to gain further competence, through planned study and experience, in the area of nursing administration. (Gipe and Staff.)

SCHOOL OF PHARMACY

Professors: FOSS, ESTABROOK, ICHNIOWSKI, PURDUM, SHAY AND SLAMA.

Associate Professors: ALLEN, MILLER, DOORENBOS AND COSTELLO.

Assistant Professor: SHANGRAW AND ZENKER.

BIOCHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 143. Biochemistry. (5)

First semester. Four lectures and conferences and one four-hour laboratory period a week. Prerequisites, Chem. 32, 35, 36, 37, 38. Composition of living organisms and the chemical and physical processes which occur during health and in disease. (Zenker.)

PHARMACOGNOSY

For Graduates and Advanced Undergraduates

Pharmacognosy 101, 102. Taxonomy of the Higher Plants. (2, 2)

Given in alternate years. One lecture and one laboratory. Prerequisite, Pharmacognosy 51, 52. A study of the kinds of seed plants and ferns, their classification, and field work on local flora. Instruction will be given in the preparation of an herbarium. (Slama.)

Pharmacognosy 111, 112. Plant Anatomy. (4, 4)

Two lectures and two laboratories. Prerequisites, Pharmacognosy 51, 52. Lectures and laboratory work covering advanced plant anatomy with special emphasis placed on the structure of roots, stems and leaves of vascular plants. (Slama.)

For Graduates

Pharmacognosy 201, 202. Advanced Study of Vegetable Powders. (4, 4)

Given in alternate years. Two lectures and two laboratories. Prerequisites, Pharmacognosy 111, 112. A study of powdered vegetable drugs and spices from the structural and microchemical standpoints, including practice in identification and detection of adulterants. (Slama.)

Pharmacognosy 211, 212. Advanced Pharmacognosy. (4, 4)

Two lectures and two laboratories. Prerequisites, Pharmacognosy 111, 112. A study of many crude drugs not ordinarily studied in other pharmacognosy courses. Special attention will be given to practical problems and to the identification and detection of adulterants. (Slama.)

Pharmacognosy 399. Research in Pharmacognosy.

Credit according to the amount and quality of work performed. (Slama.)

MATHEMATICS

For Graduates and Advanced Undergraduates

Math. 130. Probability. (3)

First semester. Prerequisite, Math. 21 or equivalent. Combinatory analysis, total, compound, and inverse probability, continuous distributions, theorems of Bernoulli and Laplace, theory of errors. (Staff.)

Math. 132. Mathematical Statistics. (3)

Second semester. Prerequisite, Math. 21 or equivalent. Frequency distributions and their parameters, multivariate analysis and correlation, theory of sampling, analysis of variance, statistical inference. (Staff.)

MICROBIOLOGY

For Graduates and Advanced Undergraduates

Microb. 146. Serology, Immunology, Public Health and Parasitology. (4)

Prerequisite, Microbiology 41 or its equivalent.

Two lectures and two laboratories.

Pharmacy

A study of the principles of immunity, including the preparation and use of biological products employed in the prevention and treatment of infectious diseases. Attention is given to hypersensitivity of humans and animals. Part of the course is devoted to the study of Public Health. Time is given to the study of medical parasitology, pathology and parasitic infections. (Shay.)

For Graduates

Microb. 200, 201. Chemotherapy. (1, 1)

Alternate years. Prerequisites, Microbiology 121 or equivalent, Biochemistry 111 or equivalent. Lectures which deal with the chemistry, toxicity, pharmacology and therapeutic value of drugs in the treatment of disease. (Shay.)

Microb. 202, 203. Reagents and Media. (1, 1)

Offered in alternate years. Consideration of media for special procedures such as antibiotic assays, blood cultures, spinal fluid, exudates and other materials. Anaerobiosis, differential media, biochemical reactions, sensitivity and sterility testing are considered in detail. Emphasis is placed on growth requirements of specific groups of micro-organisms. (Shay.)

Microb. 210. Special Problems in Microbiology.

Laboratory course. Special studies in the various divisions of microbiology. Credit determined by amount and quality of work performed. (Shay.)

Microb. 211. Public Health. (2)

Prerequisite, Microb. 121 or equivalent. A demonstration of public health facilities in the community and their relation to the practices of the health sciences carried on through lectures and discussion groups. The application of statistical and epidemiological methods to health problems is illustrated through lectures and demonstration. (Shay.)

Microb. 221. Research in Microbiology.

Credit determined by amount and quality of work performed. Open only to candidates for advanced degrees in microbiology. (Shay.)

Microb. 399. Thesis Research.

(Shay.)

PHARMACEUTICAL CHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 101. Advanced Inorganic Chemistry. (2)

The principles of inorganic chemistry at an advanced level—nuclear and atomic structure, bonding, complexions and coordination compounds, oxidation and reduction, acids and bases; the descriptive chemistry of the elements. (Miller, Doorenbos.)

Pharm. Chem. 111, 113. Chemistry of Medicinal Products. (3, 3)

A study of the synthesis, the structural relationships, and the physical and chemical properties of medicinal products. (Doorenbos.)

Chem. 141, 143. Advanced Organic Chemistry. (2, 2)

An advanced study of the compounds of carbon. (Miller.)

Chem. 142, 144. Advanced Organic Laboratory. (2, 2)

The more difficult preparations of organic compounds. (Doorenbos, Miller.)

Chem. 146, 148. Identification of Organic Compounds. (2, 2)

The systematic identification of organic compounds, both individual and mixtures.
(Miller, Doorenbos.)

For Graduates

Chemistry 141, 143 or the equivalent is a prerequisite for any of the following courses, except Chemistry 230.

Pharm. Chem. 230. Seminar. (1)

Each semester. Required of students majoring in pharmaceutical chemistry. Reports of progress and survey of recent developments in chemistry. (Doorenbos, Miller, Zenker.)

Pharm. Chem. 240. Stereochemistry. (2)

Two lectures. A study of the principles of stereochemistry of organic compounds.
(Miller.)

Pharm. Chem. 242. Heterocyclics. (2)

Two lectures. A study of the chemistry and synthesis of heterocyclic compounds.
(Doorenbos.)

Pharm. Chem. 250. Steroids. (2)

Two lectures. A study of the synthesis and structure determination of steroids and the application of modern chemical concepts to the chemistry of steroids. (Doorenbos.)

Pharm. Chem. 252. Alkaloids. (2)

Two lectures. A study of the principles involved in structure determination, chemistry and synthesis of the major alkaloid classes. (Miller.)

Pharm. Chem. 255. Instrumental Analysis. (2)

Either semester. Two laboratories. Prerequisite Chem. 187, 188, 189, 190 or equivalent. Applications of physical methods to the analysis of organic compounds.
(Doorenbos, Miller, Zenker.)

Pharm. Chem. 399. Research in Pharmaceutical Chemistry

Credit determined by the amount and quality of work performed.
(Doorenbos, Miller, Zenker.)

PHARMACOLOGY

For Graduates and Advanced Undergraduates

Pharmacology 111. Official Methods of Biological Assay. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisite, Pharmacology 81, 82. A study of the official methods of biological assay of the United States Pharmacopoeia and the National Formulary. (Ichniowski.)

For Graduates

Pharmacology 201, 202. Methods of Biological Assay. (4, 4)

First and second semesters. Laboratory and conferences. Prerequisite, Pharmacology 111. A study of the more important unofficial methods used in the quantitative evaluation of therapeutic substances. (Ichniowski.)

Pharmacy

Pharmacology 211, 212. Special Studies in Pharmacodynamics. (4, 4)

First and second semesters. Laboratory and conferences. Prerequisites, Pharmacology 81, 82 and the approval of the instructor. Offered in alternate years. A study of the methods used in the evaluation of drug action. (Ichniowski.)

Pharmacology 221, 222. Special Studies in Biological Assay Methods. (2-4, 2-4)

Credit according to the amount of work undertaken after consultation with the instructor. First and second semester. Laboratory and conferences. Prerequisite, Pharmacology 111, 201, 202. Special problems in the development of biological assay methods. (Ichniowski.)

Pharmacology 399. Research in Pharmacology.

Properly qualified students may arrange with the instructor for credit and hours. (Ichniowski.)

PHARMACY

For Graduates and Advanced Undergraduates

Pharmacy 101, 102. Advanced Dispensing Pharmacy. (3, 3)

Senior year, two lectures and one laboratory. Prerequisites, Pharmacy 21, 22, 51, 52. A study of the compounding of new medicinal ingredients and dispensing aids used in modern professional pharmacy, including the preparation of some important classes of pharmaceuticals on a commercial scale. (Allen.)

Pharmacy 121. Hospital Pharmacy Administration. (2)

First semester. Senior year. Two lectures. A study of hospital pharmacy practice and administration. (Purdum.)

Pharmacy 132. Cosmetics. (3)

Second semester. Senior year. Two lectures and one laboratory. Prerequisites, Pharmacy 21, 22, 51, 52, and 101. A study of the composition and manufacture of cosmetic preparations including laboratory work in the formulation of these products. (Allen.)

For Graduates

Pharmacy 201, 202. Manufacturing Pharmacy. (3, 3)

Given in alternate years. Two lectures. Prerequisites, Pharmacy 101, 102. A study of manufacturing processes, control procedure and equipment employed in the manufacture of pharmaceuticals on a commercial scale, including new drug applications and the Federal Food, Drug and Cosmetic Act. (Shangraw.)

Pharmacy 203, 204. Manufacturing Pharmacy. (2, 2)

Two laboratories. Prerequisites, Pharmacy 201, 202, or may be taken simultaneously with Pharmacy 201, 202. Laboratory work dealing with the preparation of useful and important pharmaceuticals in large quantities. (Shangraw.)

Pharmacy 207, 208. Physical Pharmacy. (2, 2)

Two lectures a week. Prerequisite, consent of the instructor; Physical Chemistry 187, 188, 189, 190 recommended. A study of pharmaceutical systems utilizing the fundamentals of physical chemistry. (Shangraw.)

Pharmacy 211, 212. Survey of Pharmaceutical Literature. (1 1,)

Given in alternate years. One lecture. Lectures and topics on the literature pertaining to pharmacy, with special reference to the origin and development of the works of drug standards and the pharmaceutical periodicals. (Allen.)

Pharmacy 215, 216. Product Development. (2, 2)

Two laboratories. Prerequisites, Pharmacy 132, 201, 202, 203, 204. A study of the development of new pharmaceutical preparations and cosmetics suitable for marketing. (Allen.)

Pharmacy 221, 222. History of Pharmacy. (2, 2)

Given in alternate years. Two lectures. Lectures and assignments on the development of pharmacy in America and the principal countries of Europe. (Purdum.)

Pharmacy 230. Pharmaceutical Seminar. (1)

Each semester. Required of students majoring in pharmacy. Reports of progress in research and surveys of recent developments in pharmacy. (Allen.)

Pharmacy 231, 232. Special Problems in Pharmaceutical Technology. (2, 2)

Two laboratories. A study of technical problems in the stabilization and preservation of pharmaceuticals and the various methods of compounding special prescriptions. (Allen.)

Pharmacy 399. Research in Pharmacy.

Credit and hours to be arranged. (Foss, Purdum, Allen, Shangraw.)

PHYSICS AND PHYSICAL CHEMISTRY

For Graduates and Advanced Undergraduates.

Chem. 187, 189. Physical Chemistry. (3, 3)

First and second semesters. Given in alternate years. Three lectures per week. Prerequisites, Phys. 11, Chem. 15, 37, Math. 21. A study of the laws of chemistry, including the gas laws, kinetic theory, liquids, solutions, elementary thermodynamics, thermochemistry, equilibrium, chemical kinetics, and electro-chemistry. (Estabrook.)

Chem. 188, 190. Physical Chemistry. (2, 2)

First and second semesters. Two laboratory periods per week. Prerequisites, Chem. 187, 189, or may be taken simultaneously with these courses. Quantitative experiments are performed which demonstrate physical chemical principles, and acquaint the student with precision apparatus. (Estabrook.)

Phys. 104, 105. Electricity and Magnetism. (3, 3)

First and second semesters. Two lectures and one laboratory period per week. Given according to demand. Prerequisites, Phys. 11 and Math. 21. A study of the fundamental laws of magnetism, electrostatics, and current electricity. Selected experiments are performed illustrating these principles. (Estabrook.)

Phys. 118, 119. Modern Physics. (2, 2)

First and second semesters. Two lectures per week. Prerequisites, Chem. 189, 190, Phys. 10, 11. Given according to demand. A descriptive study of the nature of matter and radiation. Conduction of electricity, and ionization in gases, thermionics, x-rays, radioactivity, nuclear physics, and cosmic rays will be considered. (Estabrook.)

Social Work

Phys. 126. Thermodynamics and Kinetic Theory of Gases. (2)

First semester. Given in alternate years. Two lectures per week. Prerequisite, Phys. Chem. 188, 190. A study of the laws of thermodynamics from a mathematical standpoint. Numerous problems are solved. (Estabrook.)

For Graduates

Phys. 200, 201. Introduction to Theoretical Physics. (5, 5)

First and second semesters. Five lectures per week. Given according to demand. Prerequisite, advanced standing in physics. A study of the fundamentals in physics from a mathematical standpoint. (Estabrook.)

PHYSIOLOGY

Physiol. 243. Cellular Physiology and Cytogenetics. (2)

First semester. Two lectures a week. A study of the physical, chemical and physiological activities of the cell, its components, and its integrated activities including cell division and inheritance. (Costello.)

Physiol. 244. Current Problems in Cellular Physiology and Cytogenetics. (1)

Second semester. One lecture a week. By means of lectures and assigned student discussion, current research trends in the field will be discussed in detail. (Costello.)

SCHOOL OF SOCIAL WORK

Professor: LEWIS.

Associate Professors: MCGINNIS AND STEIN.

Lecturer: KLEIN.

For Graduates

THE SOCIAL SERVICES

SW 200, 201. Social Services and Social Policy. (2, 2)

Both semesters. Identification of social needs and analysis of social services with particular reference to political, social, and economic forces affecting their development. The social control and melioration functions of social welfare programs. Examination of the growth, organization and function of governmental and voluntary services. Open to qualified part-time students with consent of instructor. (Lewis.)

SW 202. The Social Work Profession. (2)

Second year. The historical background and development of the profession. Current trends in professional practice. Professional concerns with social policy. Professional values and ethical behavior. (Staff.)

SW 203. Community Social Welfare Services. (1)

First semester, concurrent with SW 200. Participant observation of community provision for control of selected social problems: dependency, disordered behavior, indigent disability. Consideration of social work roles in alleviation and control of selected problems. Open to qualified part-time students enrolled in SW 200. (Lewis.)

SW 205. Social Welfare History. (1)

As arranged. The changing concept of charity from Biblical to modern times. Origin of English and American poor laws. Charity organization and the growth of voluntary

efforts. Origins and development of welfare state concept. Open to qualified part-time students with consent of instructor. (Lewis.)

GROWTH AND BEHAVIOR

SW 210. Human Behavior I. (3)

First semester. Concepts basic to understanding adult social functioning with particular reference to characteristic ways of responding to stressful situations arising out of economic disadvantage, sociocultural conflict, illness and disability. Attention to the family as a social system and the social roles of family members in the patterning of relationships. (McGinnis.)

SW 211. Human Behavior II. (2)

Second semester. Elaboration of concepts introduced in SW 210. Introduction of psychodynamic concepts used in assessment of psychosocial disorders. (McGinnis.)

SW 212. Human Behavior III. (2)

First semester, second year. Descriptive and dynamic considerations in psychosocial disorders and psychopathology likely to be encountered in social work practice, *i.e.*, indigency, marital disorder, delinquent and criminal behavior, personality disorders, retardations, illegitimate parenthood, child neglect and placement, neuroses, and psychoses. (Staff.)

SW 213. Human Behavior IV. (2)

Second semester, second year. Concepts basic to an understanding of personality development in childhood and adolescence. Application of psychodynamic formulations in differential diagnosis and planning use of casework and groupwork techniques appropriate to the client's needs. Analysis of social work, sociological and biographical case materials utilizing psychosocial concepts. (Staff.)

SW 215. Behavior of Human Groups. (2)

First semester. Examination of concepts underlying social work practice as drawn from theory of social systems. Special reference to families, small groups, neighborhoods, communities, to social institutions and to culture. Reference also to leadership theory and related formulations useful in understanding interpersonal relationships in families, committees, clubs, social agencies and special interest groups. Open to qualified part-time students with consent of instructor. (Klein.)

SOCIAL WORK PRACTICE

SW 220, 221. Social Casework. (2, 2)

Both semesters, first year. Fundamental concepts and principles of the casework method. Emphasis on understanding the person presenting the social problem, the environment, especially the family setting, in which it occurs, and the roles of the social agency and the social worker in using community resources in helpful ways. The relationship of study and history to psychosocial diagnosis and the formulation of appropriate treatment plans. (Stein.)

SW 222, 223. Social Casework. (2, 2)

Both semesters, second year. Further elaboration of basic concepts and introduction of more complex ideas. Case analysis directed toward development of skill in psychosocial diagnosis. Emphasis on selection of casework treatment techniques consistent with treatment objectives. Short-term and long-term casework treatment problems.

Social Work

Similarities and differences in casework practices in such varied settings as family and children's agencies, public assistance agencies, school social work departments, clinical (medical and psychiatric) services, correctional programs, etc. (Staff.)

SW 235. Social Groupwork. (2)

Second semester. Elementary concepts of social groupwork practice essential for the informed use of social groupwork resources in the community by social workers using casework method. Application of theories of group behavior to understanding committee and other group processes within social agencies and professional and related organizations. Open to qualified part-time students with consent of instructor. (Klein.)

SW 240. Community Organization and Development. (2)

Second year. Basic concepts useful in facilitating citizen participation in neighborhood and community organization for social welfare. Analysis of methods used to achieve social objectives in community provision of needed services and prevention and control of psychosocial disorders. (Staff.)

SW 250. Social Welfare Administration. (2)

Second year. Elementary concepts of administration applicable to social welfare agencies. Staff participation in decision-making, policy formulation, and communication. Role relationships within administrative structures. Open to qualified part-time students with consent of instructor. (Staff.)

SW 260. Social Investigation. (2)

Second semester. Methods of research in social work. Problem formulation, data collection and analysis, presentation of findings, and conclusions. Attention to classic and recent studies. The relationships of research to social work knowledge. Open to qualified part-time students with consent of instructor. (Lewis.)

SW 261, 262. Social Work Research. (2, 2)

Both semesters, second year. Analysis of significant social work studies and related social science research. A research report of substantial dimensions and high standards, presenting and analyzing findings of a study of some professional problem is required. (Staff.)

SW 280, 281. Field Work: Basic Social Casework. (4, 4)

Both semesters, first year. Placement in community agencies for practice instruction in social casework method. (Staff.)

SW 282, 283. Field Work: Advanced Social Casework. (5, 5)

Both semesters, second year. Placement in community agencies for practice instruction in social casework method. (Staff.)

The Graduate Council

Ex-Officio Members

WILSON H. ELKINS, D.PHIL., *President of the University*

HARRY C. BYRD, LL.D., D.SC., *President Emeritus*

R. LEE HORNBAKE, PH.D., *Vice President for Academic Affairs*

RONALD BAMFORD, PH.D., *Dean of the Graduate School*

CHARLES O. APPLEMAN, PH.D., *Dean Emeritus*

AUGUSTUS J. PRAHL, PH.D., *Associate Dean and Secretary of the Graduate Faculty Assembly*

Appointed Members

LEON W. COHEN, PH.D., <i>Professor of Mathematics</i>	1964
NOEL E. FOSS, PH.D., <i>Professor of Pharmacy (Baltimore)</i>	1962
HOWARD LASTER, PH.D., <i>Associate Professor of Physics</i>	1965
LEON P. SMITH, PH.D., <i>Professor of Foreign Languages</i>	1963

Elected Members

THOMAS C. ANDREWS, PH.D., <i>Professor of Psychology</i>	1965
GEORGE F. CORCORAN, M.S., <i>Professor of Electrical Engineering</i>	1963
ROBERT W. KRAUSS, PH.D., <i>Professor of Botany</i>	1965
AUBREY C. LAND, PH.D., <i>Professor of History</i>	1964
MONROE H. MARTIN, PH.D., <i>Professor of Mathematics</i>	1962
JAMES H. HUMPHREY, PH.D., <i>Professor of Physical Education</i>	1965
FRANCIS M. MILLER, PH.D., <i>Associate Professor of Chemistry (Baltimore)</i>	1964
MICHAEL J. PELCZAR, PH.D., <i>Professor of Microbiology</i>	1964
ELMER PLISCHKE, PH.D., <i>Professor of Government and Politics</i>	1963
CLYNE S. SHAFFNER, PH.D., <i>Professor of Poultry Physiology</i>	1962
JOHN I. WHITE, PH.D., <i>Professor of Physiology (Baltimore)</i>	1964
GLADYS WIGGIN, PH.D., <i>Professor of Education</i>	1963
CHARLES E. WHITE, PH.D., <i>Professor of Chemistry</i>	1965

The 1961-1962 Faculty of the Graduate School

Administrative Officers

RONALD BAMFORD, *Professor of Botany and Dean of the Graduate School*
B.S., University of Connecticut, 1924; M.S., University of Vermont, 1926; PH.D.,
Columbia University, 1931.

AUGUSTUS J. PRAHL, *Professor of Foreign Languages and Associate Dean of the Graduate School*

M.A., Washington University, 1928; PH.D., Johns Hopkins University, 1933.

LUCY A. LYNHAM, *Assistant to the Dean*

B.A., University of Maryland, 1933.

Professors

MYRON S. AISENBERG, *Professor of General and Oral Pathology and Dean of School of Dentistry*

D.D.S., University of Maryland, 1922.

ALFRED O. ALDRIDGE, *Professor of English*

B.S., Indiana University, 1937; M.A., University of Georgia, 1938; PH.D., Duke University, 1942; Docteur de l'Universite de Paris, 1955.

REDFIELD W. ALLEN, *Professor of Mechanical Engineering*

B.S., University of Maryland, 1937; PH.D., 1949.

DOUGLAS W. ALDEN, *Professor and Head of the Department of Foreign Languages*

A.B., Dartmouth College, 1933; PH.D., Brown University, 1938.

RUSSELL B. ALLEN, *Professor of Civil Engineering and Assistant Dean of College of Engineering*

B.S., Yale University, 1923.

GEORGE ANASTOS, *Professor of Zoology*

B.S., University of Akron, 1942; M.A., Harvard University, 1947; PH.D., 1949.

VERNON E. ANDERSON, *Professor and Dean of the College of Education*

B.S., University of Minnesota, 1930; M.A., 1936; PH.D., University of Colorado, 1942.

THOMAS C. ANDREWS, *Professor and Head of Department of Psychology*

B.A., University of Southern California, 1937; M.A., University of Nebraska, 1939;
PH.D., 1941.

Faculty

WENDELL S. ARBUCKLE, *Professor of Dairy*

B.S.A., Purdue University, 1933; A.M., University of Missouri, 1937; PH.D., 1940.

WILLIAM T. AVERY, *Professor and Head of Classical Languages and Literatures*

B.A., Western Reserve University, 1934; M.A., 1935; PH.D., 1937; Fellow of the American Academy in Rome, 1937-1939.

RONALD BAMFORD, *Professor of Botany and Dean of the Graduate School*

B.S., University of Connecticut, 1924; M.S., University of Vermont, 1926; PH.D., Columbia University, 1931.

RICHARD H. BAUER, *Professor of History*

PH.D., University of Chicago, 1923; M.A., 1928; PH.D., 1935.

GEORGE M. BEAL, *Professor of Agricultural Economics and Marketing*

B.S., Utah State Agricultural College, 1934; M.S., University of Wisconsin, 1938; PH.D., 1942.

ROBERT BADER BECKMANN, *Professor and Head of Department of Chemical Engineering*

B.S., University of Illinois, 1940; PH.D., University of Wisconsin, 1944.

WILLIAM E. BICKLEY, *Professor and Head of Department of Entomology*

B.S., University of Tennessee, 1934; M.S., 1936; PH.D., University of Maryland, 1940.

WILLIAM DEWEY BLAKE, *Professor and Head of Department of Physiology*

A.B., Dartmouth College, 1940; M.D., Harvard Medical School, 1943.

GLENN O. BLOUGH, *Professor of Education*

A.B., University of Michigan, 1929; A.M., 1932; LL.D., Central Michigan College of Education, 1950.

CARL BODE, *Professor of English*

PH.B., University of Chicago, 1933; M.A., Northwestern University, 1938; PH.D., 1941. Fellow of the Royal Society of Literature of the United Kingdom.

DONALD T. BONNEY, *Professor of Chemical Engineering*

B.E., Johns Hopkins University, 1926; PH.D., 1935.

FRANKLIN L. BURDETTE, *Professor of Government and Politics and Director of the Bureau of Governmental Research*

A.B., Marshall College, 1934; A.M., University of Nebraska, 1935; A.M., Princeton University, 1937; PH.D., 1938; L.L.D., Marshall College, 1959.

RICHARD H. BYRNE, *Professor of Education*

A.B., Franklin and Marshall College, 1938; M.A., Columbia University, 1947; ED.D., 1952.

GORDON M. CAIRNS, *Professor of Dairy Husbandry and Dean of College of Agriculture*

B.S., Cornell University, 1936; M.S., 1938; PH.D., 1940.

V. R. CARDOZIER, *Professor and Head of Department of Agricultural and Extension Education*

B.S., Louisiana State University, 1947; M.S., 1950; PH.D., Ohio State University, 1952.

MARY K. CARL, *Professor of Nursing*

B.S., Johns Hopkins University, 1946; PH.D., University of Maryland, 1951.

VERNE E. CHATELAIN, *Professor of History*

B.A., Nebraska State Teachers College, 1917; M.A., University of Chicago, 1925; PH.D., University of Minnesota, 1943.

ELI W. CLEMENS, *Professor of Business Organization*

B.S., Virginia Polytechnic Institute, 1930; M.S., University of Illinois, 1934; PH.D., University of Wisconsin, 1940.

- LEON W. COHEN, *Professor and Head of Department of Mathematics*
B.A., Columbia University, 1923; M.A., 1925; PH.D., University of Michigan, 1928.
- GERALD F. COMBS, *Professor of Poultry Nutrition*
B.S., University of Illinois, 1940; PH.D., Cornell University, 1948.
- J. ALLEN COOK, *Professor of Marketing*
A.B., College of William and Mary, 1928; M.B.A., Harvard University, 1936; PH.D., Columbia University, 1948.
- FRANKLIN D. COOLEY, *Associate Professor of English*
A.B., Johns Hopkins University, 1927; M.A., University of Maryland, 1933; PH.D., Johns Hopkins University, 1940.
- GEORGE F. CORCORAN, *Professor and Chairman of Department of Electrical Engineering*
B.S., South Dakota State College, 1923; M.S., University of Minnesota, 1926.
- GERALD CORNING, *Professor of Aeronautical Engineering*
B.S., New York University, 1937; M.S., Catholic University, 1954.
- JOHN M. CURTIS, *Professor and Head of Department of Agricultural Economics*
B.S., North Carolina State, 1947; M.S., 1949; PH.D., University of Maryland, 1961.
- RICHARD F. DAVIS, *Professor and Head of Dairy Department*
B.S., University of New Hampshire, 1950; M.S., Cornell University, 1952; PH.D., 1953.
- DOROTHY F. DEACH, *Professor of Physical Education for Women*
B.S., University of Illinois, 1931; M.S., 1932; PH.D., University of Michigan, 1951.
- HAROLD M. DE VOLT, *Professor of Veterinary Science*
B.S., Cornell University, 1936; D.V.M., 1923; M.S., 1926.
- JOAQUIN B. DIAZ, *Professor in Institute for Fluid Dynamics and Applied Mathematics*
B.A., University of Texas, 1940; PH.D., Brown University, 1945.
- DUDLEY DILLARD, *Professor and Head of Department of Economics*
B.S., University of California, 1935; PH.D., 1940.
- CONLEY H. DILLON, *Professor of Government and Politics*
A.B., Marshall College, 1928; A.M., Duke University, 1933; PH.D., 1936.
- LEWIS P. DITMAN, *Professor of Entomology*
B.S., University of Maryland, 1926; M.S., 1929; PH.D., 1931.
- RAYMOND N. DOETSCH, *Professor of Microbiology*
B.S., University of Illinois, 1942; A.M., Indiana University, 1943; PH.D., University of Maryland, 1948.
- BRICE M. DORSEY, *Professor and Head of Department of Oral Surgery*
D.D.S., University of Maryland, 1927.
- AVRON DOUGLIS, *Professor of Mathematics*
A.B., University of Chicago, 1938; M.A., New York University, 1949; PH.D., 1949.
- DICK DUFFEY, *Professor of Chemical Engineering*
B.S., Purdue University, 1939; M.S., University of Iowa, 1940; PH.D., University of Maryland, 1956.
- WILSON H. ELKINS, *President, University of Maryland*
B.A., University of Texas, 1932; M.A., 1932; LITT.B., Oxford University, 1936; D.PHIL., 1936.
- CAYLORD B. ESTABROOK, *Professor of Physics*
B.S.C., Purdue University, 1921; M.S.C., Ohio State University, 1922; PH.D., University of Pittsburgh, 1932.

Faculty

- JOHN E. FABER, JR., *Professor and Head of Department of Microbiology*
B.S., University of Maryland, 1926; M.S., 1927; PH.D., 1937.
- WILLIAM F. FALLS, *Professor of Foreign Languages*
A.B., University of North Carolina, 1922; Certificate d'Etudes Francaises, University of Toulouse, 1926; M.A., Vanderbilt University, 1928; PH.D., University of Pennsylvania, 1932.
- RICHARD A. FERRELL, *Professor of Physics*
B.S., California Institute of Technology, 1948; M.S., 1949; PH.D., Princeton University, 1952.
- FRANK H. J. FIGGE, *Professor and Head of Department of Anatomy*
A.B., Colorado College, 1927; PH.D., University of Maryland, 1934.
- ALLAN J. FISHER, *Professor of Accounting and Finance*
B.S., University of Pennsylvania, 1928; LITT.M., University of Pittsburgh, 1936; PH.D., 1937.
- RUSSELL S. FISHER, *Professor of Legal Medicine, School of Medicine*
B.S., Georgia School of Technology, 1937; M.D., Medical College of Virginia, 1942.
- NOEL E. FOSS, *Professor and Dean of School of Pharmacy*
PH.C., B.S., South Dakota State College, 1929; M.S., University of Maryland, 1932; PH.D., 1933.
- JOHN E. FOSTER, *Professor and Head of Department of Animal Husbandry*
B.S., North Carolina State College, 1926; M.S., Kansas State College, 1927; PH.D., Cornell University, 1937.
- LESTER M. FRALEY, *Professor and Dean of College of Physical Education, Recreation and Health*
A.B., Randolph-Macon College, 1928; M.A., Peabody College, 1937; PH.D., 1939.
- JOHN H. FREDERICK, *Professor of Transportation and Foreign Trade and Head of Department of Business Organization*
B.S., University of Pennsylvania, 1918; M.A., 1925; PH.D., 1927.
- ROBERT ELSTON FULLERTON, *Professor of Mathematics*
B.S., Heidelberg College, 1938; M.S., Syracuse University, 1940; PH.D., Yale University, 1945.
- HUGH C. GAUCH, *Professor of Plant Physiology*
B.S., Miami University, 1935; M.S., Kansas State College, 1937; PH.D., University of Chicago, 1939.
- DWIGHT L. GENTRY, *Professor of Marketing*
A.B., Elon College, 1941; M.B.A., Northwestern University, 1947; PH.D., University of Illinois, 1952.
- FLORENCE M. GIPE, *Professor and Dean of the School of Nursing*
B.S., Catholic University, 1937; M.S., University of Pennsylvania, 1940; ED.D., University of Maryland, 1952.
- RICHARD A. GOOD, *Professor of Mathematics*
A.B., Ashland College, 1939; M.A., University of Wisconsin, 1940; PH.D., 1945.
- FRANK GOODWYN, *Professor of Spanish and Latin American Civilization*
B.A., Texas College of Arts and Industries, 1940; M.A., 1941; PH.D., University of Texas, 1946.

- ROBERT L. GREEN, *Professor and Head of Department of Agricultural Engineering*
B.S.A.E., University of Georgia, 1934; M.S., Iowa State College; PH.D., Michigan State University, 1953.
- SHELDON E. GREISMAN, *Assistant Professor of Physiology*
M.D., New York University, 1949.
- ROBERT C. GRENELL, *Professor of Psychiatry*
A.B., College of the City of New York, 1935; M.S.C., New York University, 1936; PH.D., University of Minnesota, 1943.
- ROSE MARIE GRENTZER, *Professor of Music*
B.A., Carnegie Institute of Technology, 1935; B.A., 1936; M.A., 1939.
- ALLAN C. GRUCHY, *Professor of Economics*
B.A., University of British Columbia, 1926; M.A., McGill University, 1929; PH.D., University of Virginia, 1931.
- WILLIAM E. HAHN, *Professor of Anatomy*
A.B., University of Rochester, 1938; M.S., 1939; D.D.S., 1931.
- DANIEL HAMBERG, *Professor of Economics*
B.S., University of Pennsylvania, 1945; M.A., 1947; PH.D., 1952.
- P. ARNE HANSEN, *Professor of Microbiology*
PH.D., University of Copenhagen, 1922; M.S., Royal Technological College, Denmark, 1926; PH.D., Cornell University, 1934.
- I. C. HAUT, *Professor and Head of Department of Horticulture; Director Agricultural Experiment Station*
B.S., University of Idaho, 1928; M.S., State College of Washington, 1930; PH.D., University of Maryland, 1933.
- EDWARD J. HERBST, *Professor and Acting Head of Department of Biological Chemistry*
B.S., University of Wisconsin, 1943; M.S., 1944; PH.D., 1949.
- CHARLES M. HERZFELD, *Professor of Physics (P.T.)*
B.C.H.E., Catholic University, 1945; PH.D., University of Chicago, 1951.
- HAROLD C. HOFFSOMMER, *Professor and Head of Department of Sociology*
B.S., Northwestern University, 1921; M.A., 1923; PH.D., Cornell University, 1929.
- R. LEE HORNBAKE, *Vice President for Academic Affairs, Professor of Industrial Education*
B.S., California State College, Pa., 1934; M.A., Ohio State University, 1936; PH.D., 1942.
- WILLIAM FRANK HORNYAK, *Professor of Physics*
B.E.E., College of the City of New York, 1944; M.S., California Institute of Technology, 1949; PH.D., 1949.
- KENNETH O. HOVET, *Professor of Education*
B.A., St. Olaf College, 1926; PH.D., University of Minnesota, 1950.
- CHARLES Y. HU, *Professor of Geography*
B.S., University of Nanking, 1930; M.A., University of California, 1936; PH.D., University of Chicago, 1941.
- JAMES H. HUMPHREY, *Professor of Physical Education and Health*
B.A., Denison University, 1933; M.A., Western Reserve University, 1946; ED.D., Boston University, 1951.

Faculty

- CASIMIR T. ICHNIOWSKI, *Emerson Professor of Pharmacology*
PH.C., University of Maryland, 1929; B.S., 1930; M.S., 1932; PH.D., 1936.
- JOHN W. JACKSON, *Professor of Mechanical Engineering*
B.S.M.E., University of Cincinnati, 1934; M.E., 1937; M.S.M.E., California Institute of Technology, 1940.
- STANLEY B. JACKSON, *Professor of Mathematics*
A.B., Bates College, 1933; A.M., Harvard University, 1934; PH.D., 1937.
- WARREN R. JOHNSON, *Professor of Physical Education*
B.A., University of Denver, 1942; M.A., 1946; ED.D., Boston University, 1950.
- MARK KEENEY, *Professor of Dairy Husbandry*
B.S., Pennsylvania State College, 1942; M.S., Ohio State University, 1947; PH.D., Pennsylvania State College, 1950.
- AMIHUD KRAMER, *Professor of Horticulture*
B.S., University of Maryland, 1938; M.S., 1939; PH.D., 1942.
- JOHN C. KRANTZ, JR., *Professor of Pharmacology*
B.S., University of Maryland, 1923; M.S., 1924; PH.D., 1928.
- ROBERT W. KRAUSS, *Professor of Botany*
B.A., Oberlin College, 1947; M.S., University of Hawaii, 1949; PH.D., University of Maryland, 1951.
- ALBIN O. KUHN, *Professor of Agronomy and Executive Vice President*
B.S., University of Maryland, 1938; M.S., 1939; PH.D., 1948.
- JOHN J. KURTZ, *Professor of Education*
B.A., University of Wisconsin, 1935; M.A., Northwestern University, 1940; PH.D., University of Chicago, 1949.
- AUBREY C. LAND, *Professor and Head of Department of History*
B.ED., Southern Illinois University, 1934; M.A., Iowa State University, 1938; PH.D., 1948.
- GEORGE S. LANGFORD, *Professor of Entomology*
B.S., Clemson College, 1921; M.S., University of Maryland, 1924; PH.D., Ohio State University, 1929.
- PETER P. LEJINS, *Professor of Sociology*
PH.M., University of Latvia, 1930; LL.M., 1933; PH.D., University of Chicago, 1938.
- VERL S. LEWIS, *Professor of Social Work and Dean of the School of Social Work*
A.B., Huron College, 1933; M.A., University of Chicago, 1938; D.S.W., Western Reserve University, 1954.
- HENRY A. LEPPER, JR., *Professor of Civil Engineering*
B.S., George Washington University, 1936; M.S., University of Illinois, 1938; D.ENG., Yale University, 1947.
- CONRAD B. LINK, *Professor of Floriculture*
B.SC., Ohio State University, 1933; M.SC., 1934; PH.D., 1940.
- SELMA F. LIPPEATT, *Professor and Dean of the College of Home Economics*
B.S., Arkansas State Teachers College, 1938; M.S., University of Tennessee, 1945; PH.D., Pennsylvania State University, 1953.
- ELLIS R. LIPPINCOTT, *Professor of Chemistry*
B.A., Earlham College, 1943; M.S., Johns Hopkins University, 1944; PH.D., 1947.

- CHARLES T. G. LOONEY, *Professor and Head of the Department of Civil Engineering*
B.S., Carnegie Institute of Technology, 1932; M.S., IN C.E., University of Illinois, 1934;
PH.D., in Engineering, 1940.
- DONALD MALEY, *Professor and Head of Department of Industrial Education*
B.S., Pennsylvania State Teachers College, California, Pa., 1943; M.S., University of
Maryland, 1947; PH.D., 1949.
- MONROE H. MARTIN, *Professor of Mathematics and Director of Institute for Fluid Dy-
namics and Applied Mathematics*
B.S., Lebanon Valley College, 1928; PH.D., Johns Hopkins University, 1932.
- EDWARD A. MASON, *Professor of Chemistry*
B.S., Virginia Polytechnic Institute, 1947; PH.D., Massachusetts Institute of Technology,
1950.
- BENJAMIN H. MASSEY, *Professor of Physical Education*
A.B., Erskine College, 1938; M.S., University of Illinois, 1947; PH.D., 1950.
- FREDERIC THEODORE MAVIS, *Professor of Civil Engineering and Dean of College of Engi-
neering*
B.S., University of Illinois, 1922; M.S., 1926; C.E., 1932; PH.D., 1935.
- JOHN R. MAYOR, *Professor of Mathematics and Education*
B.S., Knox College, 1928; M.A., University of Illinois, 1929; PH.D., University of Wis-
consin, 1933.
- L. MORRIS MC CLURE, *Professor and Assistant Dean of Education*
A.B., Western Michigan University, 1940; M.A., University of Michigan, 1946; ED.D.,
Michigan State University, 1953.
- ELLIOTT M. MC GINNIES, *Professor of Psychology*
B.A., University of Buffalo, 1943; M.A., Brown University, 1944; PH.D., Harvard Uni-
versity, 1948.
- JAMES G. MC MANAWAY, *Professor of English (P.T.)*
B.A., University of Virginia, 1919; M.A., 1920; PH.D., Johns Hopkins University, 1931.
- BRUCE L. MELVIN, *Professor of Sociology*
B.S., University of Missouri, 1916; M.A., 1917; PH.D., 1921.
- HORACE S. MERRILL, *Professor of History*
B.E., Wisconsin State Teachers' College, River Falls, 1932; PH.M., University of Wis-
consin, 1933; PH.D., 1942.
- MADELAINE MERSHON, *Professor of Education*
B.S., Drake University, 1940; M.A., University of Chicago, 1943; PH.D., 1950.
- T. FAYE MITCHELL, *Professor and Head of Department of Textiles and Clothing*
B.S., Missouri State Teachers College, Springfield, 1930; M.A., Columbia University,
1939.
- LORIN J. MULLINS, *Professor and Head of Department of Biophysics*
B.S., University of California, 1937; PH.D., 1940.
- DOROTHY R. MOHR, *Professor of Physical Education for Women*
S.B., University of Chicago, 1932; A.M., 1933; PH.D., University of Iowa, 1944.
- DELBERT T. MORGAN, JR., *Professor of Botany*
B.S., Kent State University, 1940; M.A., Columbia University, 1942; PH.D., 1948.

Faculty

HUGH C. MORGAN, *Professor of Education and Assistant Director of Institute of Child Study*

B.A., Furman University, 1940; M.A., University of Chicago, 1943; PH.D., 1946.

RAYMOND MORGAN, *Professor of Physics*

A.B., Indiana University, 1916; A.M., 1917; PH.D., University of Pennsylvania, 1922.

CHARLES D. MURPHY, *Professor and Head of Department of English*

B.A., University of Wisconsin, 1929; M.A., Harvard University, 1930; PH.D., Cornell University, 1940.

RALPH D. MYERS, *Professor of Physics*

A.B., Cornell University, 1934; A.M., 1935; PH.D., 1937.

WALLE J. H. NAUTA, *Professor of Anatomy (P.T.)*

M.D., University of Leiden (Holland), 1942; PH.D., University of Utrecht (Holland), 1945.

CLARENCE A. NEWELL, *Professor of Education*

A.B., Hastings College, 1935; A.M., Columbia University, 1939; PH.D., 1943.

ERNST J. OPIK, *Professor of Physics*

Cand. Astro., Moscow Imperial University, 1916; D. Phil. Nat., University of Estonia, 1923.

LOUIS E. OTTS, JR., *Professor of Civil Engineering*

B.A., East Texas State Teachers College, 1933; B.S., Agricultural and Mechanical College of Texas, 1946; M.S., 1946.

ARTHUR S. PATRICK, *Professor of Business Education*

B.S., Wisconsin State College, 1931; M.A., University of Iowa, 1940; PH.D., American University, 1956.

MICHAEL J. PELCZAR, JR., *Professor of Microbiology*

B.S., University of Maryland, 1936; M.S., 1938; PH.D., University of Iowa, 1941.

WILLIAM A. PENNINGTON, *Professor of Chemical Engineering*

B.S., Union University, 1925; PH.D., Iowa State College, 1933.

HUGH V. PERKINS, *Professor of Education*

A.B., & SCH. MUS.B., Oberlin College, 1941; A.M., University of Chicago, 1946; PH.D., 1949; ED.D., New York University, 1956.

ELMER PLISCHKE, *Professor and Head of Department of Government and Politics*

PH.B., Marquette University, 1937; M.A., American University, 1938; PH.D., Clark University, 1943; Certificate, Columbia University, Naval School of Military Government, 1944.

PAUL R. POFFENBERGER, *Professor and Assistant Dean of Instruction, College of Agriculture*

B.S., University of Maryland, 1935; M.S., 1937; PH.D., American University, 1953.

AUGUSTUS J. PRAHL, *Professor of Foreign Languages and Associate Dean of the Graduate School*

M.A., Washington University, 1928; PH.D., Johns Hopkins University, 1933.

GORDON W. PRANCE, *Professor of History*

A.B., University of Iowa, 1932; A.M., 1934; PH.D., 1937.

- ERNEST F. PRATT, *Professor of Chemistry*
A.B., University of Redlands, 1937; M.S., Oregon State College, 1939; M.A., University of Michigan, 1941; PH.D., 1942.
- DANIEL A. PRESCOTT, *Professor of Education and Director of Institute for Child Study*
B.S., Tufts College, 1920; ED.M., Harvard College, 1922; ED.D., 1923.
- D. VINCENT PROVENZA, *Professor of Histology and Embryology*
B.S., University of Maryland, 1939; M.S., 1941; PH.D., 1952.
- W. ARTHUR PURDUM, *Professor of Hospital Pharmacy*
PH.C., University of Maryland, 1930; B.S., 1932; M.S., 1934; PH.D., 1941.
- J. FREEMAN PYLE, *Professor and Dean of the College of Business and Public Administration*
PH.B., University of Chicago, 1917; M.A., 1918; PH.D., 1925.
- HENRY R. REED, *Professor of Electrical Engineering, Registered Professional Engineer*
B.S., University of Minnesota, 1925; M.S., 1927; E.E., South Dakota State College, 1930; PH.D., University of Iowa, 1941.
- WILKINS REEVE, *Professor of Chemistry*
B.S., Drexel Institute of Technology, 1936; PH.D., University of Wisconsin, 1940.
- CARL L. ROLLINSON, *Professor of Chemistry*
B.S., University of Michigan, 1933; PH.D., University of Illinois, 1939.
- RUSSELL C. ROTHGEB, *Professor of Agronomy*
B.S., University of Maryland, 1924; M.S., Iowa State College, 1925; PH.D., University of Maryland, 1928.
- HOMER W. SCHAMP, JR., *Professor in Institute of Molecular Physics*
A.B., Miami University, 1944; M.SC., University of Michigan, 1947; PH.D., 1951.
- ALVIN W. SCHINDLER, *Professor of Education*
B.A., Iowa State Teachers' College, 1927; M.A., Iowa State University, 1929; PH.D., 1934.
- HENRY W. SCHOENBORN, *Professor of Zoology*
A.B., DePauw University, 1933; PH.D., New York University, 1939.
- WILBURN C. SCHROEDER, *Professor of Chemical Engineering*
B.S., University of Michigan, 1930; M.S.E., 1931; PH.D., 1933.
- LELAND E. SCOTT, *Professor of Horticultural Physiology*
B.S., University of Kentucky, 1927; M.S., Michigan State College, 1929; PH.D., University of Maryland, 1943.
- CLYNE S. SHAFFNER, *Professor and Head of Department of Poultry Husbandry*
B.S., Michigan State University, 1938; M.S., 1940; PH.D., Purdue University, 1947.
- JAMES B. SHANKS, *Professor of Floriculture*
B.SC., Ohio State University, 1939; M.SC., 1946; PH.D., 1949.
- DONALD E. SHAY, *Professor and Head of Department of Bacteriology and Immunology*
B.S., Lebanon Valley College, 1937; M.S., University of Maryland, 1938; PH.D., 1943.
- A. WILEY SHERWOOD, *Professor of Aerodynamics and Head of Department of Aeronautical Engineering*
M.E., Rensselaer Polytechnic Institute, 1935; M.S., University of Maryland, 1943.

Faculty

- CHARLES A. SHREEVE, JR., *Professor and Head of Department of Mechanical Engineering*
B.E., Johns Hopkins University, 1935; M.S., University of Maryland, 1943.
- S. F. SINGER, *Professor of Physics*
B.E.E., Ohio State University, 1943; A.M., Princeton University, 1944; PH.D., 1948.
- FRANK J. SLAMA, *Professor of Pharmacognosy*
PH.G., University of Maryland, 1924; PH.C., 1925; B.S., 1928; M.S., 1930; PH.D., 1935.
- DIETRICH C. SMITH, *Professor of Physiology and Associate Dean of the School of Medicine*
A.B., University of Minnesota, 1923; A.M., 1924; PH.D., Harvard University, 1928.
- LEON P. SMITH, *Professor of Foreign Languages and Dean of the College of Arts and Sciences*
B.A., Emory University, 1919; M.A., University of Chicago, 1928; PH.D., 1930; Diplome de l'Institute de Touraine, 1932.
- GEORGE A. SNOW, *Professor of Physics*
B.S., College of the City of New York, 1945; M.A., Princeton University, 1947; PH.D., 1949.
- FRANCIS C. STARK, JR., *Professor of Vegetable Crops*
B.S., Oklahoma Agriculture and Mechanical College, 1940; M.S., University of Maryland, 1941; PH.D., 1948.
- REUBEN G. STEINMEYER, *Professor of Government and Politics*
A.B., American University, 1929; PH.D., 1935
- KARL L. STELLMACHER, *Professor of Mathematics*
D.PHIL., University of Gottingen, 1936.
- FRANK STERN, *Professor of Physics (P.T.)*
B.S., Union College, 1949; PH.D., Princeton University, 1955.
- WILLIAM S. STONE, *Dean of the School of Medicine and Director of Medical Education and Research*
B.S., University of Idaho, 1924; M.S., 1925; M.D., University of Louisville, 1929; PH.D., (hon.) 1946.
- WARREN L. STRAUSBAUGH, *Professor and Head of Department of Speech*
B.S., Wooster College, 1932; M.A., State University of Iowa, 1935.
- ORMAN E. STREET, *Professor of Agronomy*
B.S., South Dakota State College, 1924; M.S., Michigan State College, 1927; PH.D., 1933.
- WILLIAM J. SVIRBELY, *Professor of Chemistry*
B.S., Carnegie Institute of Technology, 1931; M.S., 1932; D.SCI., 1935.
- CHARLES T. SWEENEY, *Professor of Accounting*
B.S., Cornell University, 1921; M.B.A., University of Michigan, 1928; C.P.A., Iowa, 1934; C.P.A., Ohio, 1936.
- HAROLD FREDERIC SYLVESTER, *Professor of Business Organization*
PH.D., Johns Hopkins University, 1938.
- CHARLES A. TAFF, *Professor of Transportation*
B.S., University of Iowa, 1937; M.A., 1941; PH.D., University of Maryland, 1952.

- CLIFFORD CURTIS TAYLOR, *Visiting Professor of Agricultural Economics*
B.S., Colorado State College, 1917; M.S., Iowa State College, 1923; M.A., Harvard University, 1926; PH.D., 1930.
- ARTHUR H. THOMPSON, *Professor of Pomology*
B.S., University of Minnesota, 1941; PH.D., University of Maryland, 1945.
- FRED R. THOMPSON, *Professor of Education*
B.A., University of Texas, 1929; M.A., 1935; ED.D., University of Maryland, 1952.
- JOHN TOLL, *Professor and Head of Department of Physics*
B.S., Yale University, 1944; M.A., Princeton University, 1948; PH.D., 1952.
- HOMER ULRICH, *Professor and Head of the Department of Music*
A.M., University of Chicago, 1939.
- E. G. VANDEN BOSCHE, *Professor of Biochemistry*
A.B., Lebanon Valley College, 1922; M.S., University of Maryland, 1924; PH.D., 1927.
- WILLIAM VAN ROYEN, *Professor and Head of Department of Geography*
M.A., Rijksuniversiteit te Utrecht, 1925; PH.D., Clark University, 1928.
- JAMES A. VAN ZWOLL, *Professor of Education*
A.B., Calvin College, 1933; M.A., University of Michigan, 1937; PH.D., 1942.
- FLETCHER P. VEITCH, *Professor of Chemistry*
B.S., University of Maryland, 1931; M.S., 1934; PH.D., 1936.
- WILLIAM S. VERPLANCK, *Professor of Psychology*
B.S., University of Virginia, 1937; M.A., 1938; PH.D., Brown University, 1941.
- WALTER B. WAETJEN, *Professor of Education*
B.S., Pennsylvania State Teachers College, Millersville, 1942; M.S., University of Pennsylvania, 1947; ED.D., University of Maryland, 1951.
- T. C. GORDON WAGNER, *Professor of Electrical Engineering*
B.S., Harvard University, 1937; M.A., University of Maryland, 1940; PH.D., 1943.
- WILLIAM P. WALKER, *Professor of Agricultural Economics*
B.S., University of Maryland, 1921; M.S., 1925.
- KENNETH F. WARNER, *Professor of Extension Studies and Training*
B.S., University of Nebraska, 1912; M.S., University of Minnesota, 1915; D. AGR., University of Nebraska, 1954.
- JOSEPH WEBER, *Professor of Electrical Engineering and Physics*
B.S., U.S. Naval Academy, 1940; PH.D., Catholic University, 1951.
- S. M. WEDERBERG, *Professor of Accounting*
B.B.A., University of Washington, 1925; A.M., Yale University, 1935; C.P.A., Maryland, 1934.
- JAMES P. WHARTON, *Professor and Head of Department of Art*
B.A., Wofford College, 1914; B.A., Duke University, 1914; Graduate, Maryland Institute of Fine Arts, 1923; M.F.A., University of Guanajuato, Mexico, 1952.
- CHARLES E. WHITE, *Professor and Head, Chemistry Department*
B.S., University of Maryland, 1923; M.S., 1924; PH.D., 1926.
- JOHN I. WHITE, *Professor and Head of Physiology*
B.A., University of Illinois, 1939; PH.D., Rutgers University, 1950.

Faculty

GLADYS A. WIGGIN, *Professor of Education*

B.S., University of Minnesota, 1929; M.A., 1939; PH.D., University of Maryland, 1947.

CHARLES L. WISEMAN, JR., *Professor and Head of Department of Microbiology*

B.A., Southern Methodist University, 1941; M.S., Kansas State College, 1943; M.D., Southwestern Medical College, 1946.

G. FORREST WOODS, *Professor of Chemistry*

B.S., Northwestern University, 1935; M.S., Harvard University, 1937; PH.D., 1940.

HOWARD W. WRIGHT, *Professor of Accounting*

B.S.C., Temple University, 1937; M.A., University of Iowa, 1940; PH.D., 1947.

W. GORDON ZEEVELD, *Professor of English*

A.B., University of Rochester, 1924; M.A., Johns Hopkins University, 1929; PH.D., 1936.

Research Professors

WILLIAM J. BAILEY, *Research Professor of Chemistry*

B. CHEM., University of Minnesota, 1943; PH.D., University of Illinois, 1946.

JOHANNES MARTANUS BURGERS, *Research Professor in Institute for Fluid Dynamics and Applied Mathematics*

DOCTOR OF MATHEMATICS AND PHYSICS, University of Leiden, 1918; DOCTOR HONORIS CAUSA, Université Libre de Bruxelles, 1948; DOCTOR HONORIS CAUSA, Université de Poitiers, 1950; DOCTOR OF SCIENCE IN TECHNOLOGY, The Technion, 1955.

GEORGE J. BURKHARDT, *Research Professor Agricultural Engineering*

B.S.A., University of Wisconsin, 1933; B.S.M.E., 1934; M.S.A.E., 1935.

FRANCIS R. HAMA, *Research Professor in Institute for Fluid Dynamics and Applied Mathematics*

M.ENGR., Tokyo Imperial University, 1940; D.SC., University of Tokyo, 1952.

FELIX WEBSTER MC BRYDE, *Consulting Professor of Geography*

B.A., Tulane University, 1930; PH.D., University of California, 1940.

SHIH-I PAI, *Research Professor in Institute for Fluid Dynamics and Applied Mathematics*

B.S.C., National Central University, China, 1935; M.S., Massachusetts Institute of Technology, 1938; PH.D., California Institute of Technology, 1940.

LAWRENCE E. PAYNE, *Research Professor in Institute for Fluid Dynamics and Applied Mathematics*

B.S., Iowa State College, 1946; M.S., 1948; PH.D., 1950.

VICTOR ROTERUS, *Consulting Professor of Geography (P.T.)*

PH.B., University of Chicago, 1930; M.S., 1931.

MARY S. SHORB, *Research Professor of Poultry Husbandry.*

B.S., The College of Idaho, 1928; SC.D., Johns Hopkins University, 1933.

ALEXANDER WEINSTEIN, *Research Professor in Institute for Fluid Dynamics and Applied Mathematics*

PH.D., University of Zurich, 1921; D.SC., MATH., University of Paris, 1937.

JOHN R. WESKE, *Visiting Research Professor in Institute for Fluid Dynamics and Applied Mathematics*

DIPL. ING., Technical University, German, 1923; M.A., Harvard University, 1932; SC.D., 1934.

Associate Professors

- BENJAMIN F. ALLEN *Associate Professor of Pharmacy*
B.S., University of Maryland, 1937; PH.D., 1949.
- THORNTON H. ANDERSON, *Associate Professor of Government and Politics*
A.B., University of Kentucky, 1937; M.A., 1938; PH.D., University of Wisconsin, 1948.
- ROY ASHMEN, *Associate Professor of Business Organization*
B.S., Drexel Institute, 1935; M.S., Columbia University, 1936; PH.D., Northwestern University, 1950.
- JOHN H. AXLEY, *Associate Professor of Agronomy*
B.A., University of Wisconsin, 1937; PH.D., 1945.
- EDWARD S. BARBER, *Associate Professor of Civil Engineering*
B.S., University of Maryland, 1935; C.E., 1952.
- LEON BERNSTEIN, *Associate Professor of Physiology*
B.S., University of London, 1939; M.R.C.S., 1949; L.R.C.P., 1949; PH.D., 1957.
- SAMUEL P. BESSMAN, *Associate Professor of Pediatrics and Biochemistry*
M.D., Washington University Medical School, 1944.
- ALFRED JEPSON BINGHAM, *Associate Professor of Foreign Languages*
B.A., Yale University, 1933; PH.D., Columbia University, 1939.
- GERARD A. BOURBEAU, *Associate Professor of Agronomy*
B.A., St. Francis Xavier College, 1938; B.S., Laval University, 1943; M.S., University of Wisconsin, 1946; PH.D., 1948.
- BLANCHE LUCILLE BOWIE, *Associate Professor of Education*
B.S., University of Maryland, 1942; M.A., Columbia University, 1946; ED.D., University of Maryland, 1957.
- JOHN W. BRACE, *Associate Professor of Mathematics*
B.A., Swarthmore College, 1949; A.M., Cornell University, 1951; PH.D., 1953.
- RICHARD M. BRANDT, *Associate Professor of Education*
B.M.E., University of Virginia, 1943; M.A., University of Michigan, 1949; ED.D., University of Maryland, 1954.
- PELA F. BRAUCHER, *Associate Professor of Foods and Nutrition*
B.A., Goucher College, 1927; M.S., Pennsylvania State University, 1929.
- HELEN I. BROWN, *Associate Professor of Home Economics*
B.S., University of Vermont, 1938; M.A., Columbia University, 1948; PH.D., Michigan State University, 1960.
- JOSHUA R. C. BROWN, *Associate Professor of Zoology*
A.B., Duke University, 1948; M.A., 1949; PH.D., 1953.
- RUSSELL G. BROWN, *Associate Professor of Botany*
B.S., AGR., West Virginia University, 1929; M.S., 1930; PH.D., University of Maryland, 1934.
- RAYMOND M. BURGISON, *Associate Professor of Pharmacology*
B.S., Loyola College, 1945; M.S., University of Maryland, 1948; PH.D., 1950.
- ROBERT J. BYRNE, *Associate Professor of Veterinary Science*
D.V.M., Cornell University, 1944; M.S., George Washington University, 1958.

Faculty

- PAUL KEITH CONKIN, *Associate Professor of History*
B.A., Milligan College, 1951; M.A., Vanderbilt University, 1953; PH.D., 1957.
- LESLIE C. COSTELLO, *Associate Professor of Anatomy and Physiology*
B.S., University of Maryland, 1952; M.S., 1954; PH.D., 1957.
- CORNELIA M. COTTON, *Associate Professor of Veterinary Science*
A.B., Cornell University, 1921; M.A., Syracuse University; PH.D., University of Maryland, 1943.
- JOHN B. COURNYN, *Associate Professor of Civil Engineering*
B.S., University of Alabama, 1946; M.S., 1948.
- TOWNES L. DAWSON, *Associate Professor of Business Law*
B.B.A., University of Texas, 1943; B.S., U.S. Merchant Marine Academy, 1946; M.B.A., University of Texas, 1947; PH.D., 1950; LL.B., 1954; Member Texas Bar.
- THOMAS B. DAY, *Associate Professor of Physics*
B.S., University of Notre Dame, 1952; PH.D., Cornell University, 1957.
- A. MORRIS DECKER, JR., *Associate Professor of Agronomy*
B.S., Colorado Agricultural and Mechanical College, 1949; M.S., Utah State College, 1951; PH.D., University of Maryland, 1953.
- NORMAN J. DOORENBOS, *Associate Professor of Pharmaceutical Chemistry*
B.S., University of Michigan, 1950; M.S., 1951; PH.D., 1953.
- ARTHUR JAMES EMERY, JR., *Associate Professor of Biological Chemistry*
B.S., Bucknell University, 1946; PH.D., University of Rochester, 1954.
- ADDISON BERNARD EYLER, *Associate Professor of Mechanical Engineering*
B.S., University of Maryland, 1947; M.S., 1950.
- MARVIN HOWARD EYLER, *Associate Professor of Physical Education*
A.B., Houghton College, 1942; M.S., University of Illinois, 1948; PH.D., 1956.
- HENRY C. FREIMUTH, *Associate Professor of Legal Medicine*
B.S., College of the City of New York, 1932; M.S., New York University, 1933; PH.D., 1938.
- ALVIN F. GARDNER, *Associate Professor of Pathology*
A.A., University of Florida, 1940; M.S., University of Illinois, 1957; PH.D., Georgetown University, 1959.
- DONALD C. GORDON, *Associate Professor of History*
A.B., College of William and Mary, 1934; M.A., Columbia University, 1937; PH.D., 1947.
- ROLFE ELDRIDGE GLOVER, *Associate Professor of Physics*
A.B., Bowdoin, 1948; B.S., Massachusetts Institute of Technology, 1948; PH.D., University of Gottingen, 1953.
- HENRY W. GRAYSON, *Associate Professor of Economics*
B.A., University of Saskatchewan, 1937; M.A., University of Toronto, 1947; PH.D., 1950.
- HANS GRIEM, *Associate Professor of Physics*
PH.D., Universitat Kiel, 1954.
- SIDNEY GROLLMAN, *Associate Professor of Zoology*
B.S., University of Maryland, 1947; M.S., 1949; PH.D., 1952.

- A. JAMES HALEY, *Associate Professor of Zoology*
B.S., University of New Hampshire, 1949; M.S., 1950; SC.D., Johns Hopkins University, 1955.
- ARTHUR B. HAMILTON, *Associate Professor of Agricultural Economics and Marketing*
B.S., University of Maryland, 1929; M.S., 1931.
- HORACE V. HARRISON, *Associate Professor of Government and Politics*
B.A., Trinity University, 1932; M.A., University of Texas, 1941; PH.D., 1951.
- PAUL E. HARRISON, JR., *Associate Professor of Industrial Education*
B.ED., Northern Illinois State College, 1942; M.A., Colorado State College, 1947; PH.D., University of Maryland, 1955.
- ELLEN E. HARVEY, *Associate Professor of Physical Education, Recreation and Health*
B.S., Columbia University, 1935; M.A., 1941; ED.D., University of Oregon, 1951.
- GUY B. HATHORN, *Associate Professor of Government and Politics*
A.B., University of Mississippi, 1940; M.A., 1942; PH.D., Duke University, 1950.
- CHARLES RAYMOND HAYLECK, JR., *Associate Professor of Mechanical Engineering*
B.S., University of Maryland, 1943; M.S., 1949.
- RICHARD HENDRICKS, *Associate Professor of Speech*
A.B., Franklin College of Indiana, 1937; M.A., Ohio State University, 1939; PH.D., 1956.
- CHRISTOPH HERING, *Associate Professor of Foreign Languages*
PH.D., University of Bonn, 1950.
- JOHN HORVATH, *Associate Professor of Mathematics*
PH.D., University of Budapest, 1947.
- JAMES A. HUMMEL, *Associate Professor of Mathematics*
B.S., California Institute of Technology, 1949; M.A., Rice Institute, 1953; PH.D., 1955.
- BURRIS F. HUSMAN, *Associate Professor of Physical Education*
B.S., University of Illinois, 1941; M.S., 1948; ED.D., University of Maryland, 1954.
- ECKHART A. JACOBSEN, *Associate Professor of Industrial Education*
M.S., Cornell University, 1946; PH.D., University of Connecticut, 1957.
- RICHARD H. JAQUITH, *Associate Professor of Chemistry*
B.S., University of Massachusetts, 1940; M.S., 1942; PH.D., Michigan State University, 1955.
- WILHELMINA JASHEMSKI, *Associate Professor of History*
A.B., York College, 1931; A.M., University of Nebraska, 1933; PH.D., University of Chicago, 1942.
- BERNARD R. JERMAN, *Associate Professor of English*
B.A., Ohio State University, 1946; M.A., 1948; PH.D., 1951.
- MURRAY CLEMENS JOHNSON, *Associate Professor of Education*
B.S., University of Minnesota, 1943; M.A., 1950; PH.D., 1954.
- JACK COLVARD JONES, *Associate Professor of Entomology*
B.S., Alabama Polytechnic Institute, 1942; M.S., 1947; PH.D., Iowa State University, 1950.

Faculty

- H. BRYCE JORDAN, *Associate Professor of Music*
B.MUS., University of Texas, 1948; M.MUS., 1949; PH.D., University of North Carolina, 1956.
- ROGER R. KELSEY, *Associate Professor of Education*
B.A., St. Olaf College, 1934; M.A., University of Minnesota, 1940; ED.D., George Peabody College for Teachers, 1954.
- VERNON E. KRAHL, *Associate Professor of Anatomy*
B.S., University of Pittsburgh, 1939; M.S., 1940; PH.D., University of Maryland, 1946.
- NORMAN C. LAFFER, *Associate Professor of Microbiology*
B.S., Allegheny College, 1929; M.S., University of Maine, 1932; PH.D., University of Illinois, 1937.
- HOWARD LASTER, *Associate Professor of Physics*
A.B., Harvard College, 1951; PH.D., Cornell University, 1957.
- THELMA Z. LAVINE, *Associate Professor of Philosophy*
A.B., Radcliffe, 1936; A.M., 1937; PH.D., 1939.
- EMORY C. LEFFEL, *Associate Professor of Animal Husbandry*
B.S., University of Maryland, 1943; M.S., 1947; PH.D., 1953.
- ROBERT C. LEFFEL, *Associate Professor of Agronomy*
B.S., University of Maryland, 1948; M.S., Iowa State College, 1950; PH.D., 1952.
- JOHN LEMBACH, *Associate Professor of Art*
B.A., University of Chicago, 1934; M.A., Northwestern University, 1937; ED.D., Columbia University, 1946.
- THEODORE F. LEVEQUE, *Associate Professor of Anatomy*
B.A., University of Denver, 1949; M.S., 1950; PH.D., University of Colorado, 1954.
- WILLIAM V. LOVITT, JR., *Associate Professor of Legal Medicine*
B.S., University of Nebraska, 1941; M.D., University of Colorado, 1944.
- WILLIAM MC CULLOUGH MACDONALD, *Associate Professor of Physics*
B.S., University of Pittsburgh, 1950; PH.D., Princeton University, 1955.
- THOMAS M. MAGOON, *Associate Professor of Psychology*
B.A., Dartmouth College, 1947; M.A., University of Minnesota, 1951; PH.D., 1954.
- HERMAN MARIL, *Associate Professor of Art*
Maryland Institute of Fine Art, 1928.
- JERRY B. MARION, *Associate Professor of Physics*
B.A., Reed College, 1952; M.A., Rice Institute, 1953; PH.D., 1955.
- JOSEPH F. MATTICK, *Associate Professor of Dairy*
B.S., Pennsylvania State University, 1942; PH.D., 1950.
- JEROME K. MERLIS, *Associate Professor of Physiology*
B.S., University of Louisville, 1933; M.D., 1937; M.S., 1938.
- FRANCIS M. MILLER, *Associate Professor of Chemistry*
B.S., Western Kentucky State College, 1946; PH.D., Northwestern University, 1949.
- CHARLES C. MISH, *Associate Professor of English*
B.A., University of Pennsylvania, 1936; M.A., 1946; PH.D., 1951.

- RAY A. MURRAY, *Associate Professor of Agricultural Economics*
B.S., University of Nebraska, 1934; M.S., Cornell University, 1938; PH.D., 1949.
- BOYD L. NELSON, *Associate Professor of Business Organization*
B.A., University of Wisconsin, 1947; M.A., 1948; PH.D., 1952.
- LEO WILLIAM O'NEILL, JR., *Associate Professor of Education*
A.B., University of Chicago, 1938; M.A., University of Kansas City, 1952; ED.D., University of Colorado, 1955.
- ARTHUR C. PARSONS, *Associate Professor of Foreign Languages*
A.B., University of Maryland, 1926; M.A., 1928.
- ALAN PASCH, *Associate Professor of Philosophy*
B.A., University of Michigan, 1949; M.A., New School for Social Research, 1952; PH.D., Princeton University, 1955.
- GEORGE W. PIAVIS, *Associate Professor of Anatomy*
A.B., Western Maryland College, 1948; M.ED., 1952; PH.D., Duke University, 1958.
- HUGH B. PICKARD, *Associate Professor of Chemistry*
A.B., Haverford College, 1933; PH.D., Northwestern University, 1938.
- BURTON R. POLLACK, *Associate Professor of Physiology*
D.D.S., University of Maryland, 1946.
- HENRY W. PRICE, JR., *Associate Professor of Electrical Engineering*
B.S., University of Maryland, 1943; M.S., 1950.
- WILLIAM C. PURDY, *Associate Professor of Chemistry*
B.S., Amherst College, 1951, PH.D., Massachusetts Institute of Technology, 1955.
- WILLIAM R. QUINN, *Associate Professor of Foreign Languages*
B.A., University of Virginia, 1922; M.A., 1923; PH.D., Johns Hopkins University 1934; OFFICER D'ACADEMIE (1951).
- GORDON M. RAMM, *Associate Professor of Zoology*
B.A., University of Buffalo, 1949, M.A., 1950, PH.D., New York University, 1954.
- MARGUERITE C. RAND, *Associate Professor of Foreign Languages*
B.A., Pomona College, 1919; M.A., Stanford University, 1921; PH.D., University of Chicago, 1951.
- ROBERT D. RAPPEYE, *Associate Professor of Botany*
B.S., University of Maryland, 1941; M.S., 1947; PH.D., 1949.
- CHARLES W. REYNOLDS, *Associate Professor of Vegetable Crops*
A.B., University of Alabama, 1941; B.S., Alabama Polytechnic Institute, 1947; M.S., 1949; PH.D., University of Maryland, 1954.
- ROBERT C. RISINGER, *Associate Professor of Education*
B.S., Ball State Teachers College, 1940; M.A., University of Chicago, 1947; ED.D., University of Colorado, 1955.
- ROBERT M. RIVELLO, *Associate Professor of Aeronautical Engineering*
B.S., University of Maryland, 1943; M.S., 1948.
- ALBERT ROSEN, *Associate Professor of Psychology*
A.B., University of Pittsburgh, 1940; M.A., University of Minnesota, 1948; PH.D., 1952.

Faculty

- LEONORA C. ROSENFELD, *Associate Professor of Foreign Languages*
B.A., Smith College, 1930; A.M., Columbia University, 1931; PH.D., 1940.
- GIOVANNI P. RUTELLI, *Associate Professor of Electrical Engineering*
PH.D., (Physics), University of Palermo, 1932; PH.D., (Electrical Engineering), Polytechnic Institute of Turin, 1928.
- CLIFFORD LEROY SAYRE, JR., *Associate Professor of Mechanical Engineering*
B.S.M.E., Duke University, 1947; M.S., Stevens Institute of Technology, 1950.
- WALTER E. SCHLARETZKI, *Associate Professor of Philosophy*
A.B., Monmouth College, 1941; A.M., University of Illinois, 1942; PH.D., Cornell University, 1948.
- PAUL W. SHANKWEILER, *Associate Professor of Sociology*
PH.B., Muhlenberg College, 1919; M.A., Columbia University, 1921; Diploma, Union Theological Seminary, 1922; PH.D., University of North Carolina, 1934.
- E. RODERICK SHIPLEY, *Associate Professor of Physiology*
A.B., Johns Hopkins University, 1938; M.D., University of Maryland, 1942; CERTIFICATE, University of Pennsylvania, 1947; DIPLOMATE, American Board of Surgery, 1948.
- DAVID ELIE SIMONS, *Associate Professor of Electrical Engineering*
B.S., University of Maryland, 1949; M.S., 1951.
- HUGH D. SISLER, *Associate Professor of Botany*
B.S., University of Maryland, 1949; M.S., 1951; PH.D., 1953.
- JOSEPH SILVERMAN, *Associate Professor of Chemical Engineering*
B.A., Brooklyn College, 1944; A.M., Columbia University, 1948; PH.D., 1951.
- ANDREW GEORGE SMITH, *Associate Professor of Medical Microbiology*
B.S., Pennsylvania State University, 1940; M.S., University of Pennsylvania, 1947; PH.D., 1950.
- HAROLD D. SMITH, *Associate Professor of Agricultural Economics and Marketing*
B.A., Bridgewater College, 1943; M.S., University of Maryland, 1947; PH.D., American University, 1952.
- DAVID S. SPARKS, *Associate Professor of History*
A.B., Grinnell College, 1944; A.M., University of Chicago, 1945; PH.D., 1951.
- MABEL S. SPENCER, *Associate Professor of Home Economics Education*
B.S., University of West Virginia 1925; M.S., 1946; ED.D., American University, 1959.
- CLINTON SPIVEY, *Associate Professor of Business Organization*
B.S., University of Illinois, 1946; M.S., 1947; PH.D., 1957.
- EDWARD A. STERN, *Associate Professor of Physics*
B.S., California Institute of Technology, 1951; PH.D., 1955.
- EDWARD STRICKLING, *Associate Professor of Agronomy*
B.S., Ohio State University, 1937; PH.D., 1949.
- ROLAND N. STROMBERG, *Associate Professor of History*
A.B., University of Kansas City, 1939, M.A., American University, 1946; PH.D., University of Maryland, 1952.
- CALVIN F. STUNTZ, *Associate Professor of Chemistry*
B.A., University of Buffalo, 1939; PH.D., 1947.

- JOSEPH SUCHER, *Associate Professor of Physics*
B.S., Brooklyn College, 1952; PH.D., Columbia University, 1958.
- WILLIAM FRANCIS TIERNEY, *Associate Professor of Industrial Education*
B.S., Teachers College of Connecticut, 1941; M.A., Ohio State University, 1949; ED.D., University of Maryland, 1952.
- EDWARD B. TRUITT, JR., *Associate Professor of Pharmacology*
B.S., Medical College of Virginia, 1943; PH.D., University of Maryland, 1950.
- ORVAL L. ULRY, *Associate Professor of Education and Director of Summer Session*
B.S.C., Ohio State University, 1938; M.A., 1944; PH.D., 1953.
- JOSEPH T. VANDERSLICE, *Associate Professor in the Institute of Molecular Physics*
B.S., Boston College, 1949; PH.D., Massachusetts Institute of Technology, 1953.
- PRESLEY A. WEDDING, *Associate Professor of Civil Engineering*
B.S., University of Maryland, 1937; M.S., 1952.
- ROBERT C. WILEY, *Associate Professor of Horticulture*
B.S., University of Maryland, 1949; M.S., 1950; PH.D., Oregon State College, 1953.
- LEDA AMICK WILSON, *Associate Professor of Home Economics*
B.S., Lander College, 1943; M.S., University of Tennessee, 1950; PH.D., 1954.
- HOWARD E. WINN, *Associate Professor of Zoology*
A.B., Bowdoin College, 1948; M.S., University of Michigan, 1950; PH.D., 1955.
- MARVIN ZELEN, *Associate Professor of Mathematics*
B.S., City College of New York, 1949; M.A., University of North Carolina, 1951; PH.D., American University, 1957.

Associate Research Professors

- DEREK ALBERT TIDMAN, *Associate Research Professor in Institute of Fluid Dynamics*
B.S.C., London University, 1952; PH.D., 1955.
- PAUL N. WINN, JR., *Associate Research Professor of Agricultural Engineering*
B.S.A.E., Virginia Polytechnic Institute, 1947; M.S.A.E., 1958.

Assistant Professors

- FRANK OSWALD AHNERT, *Assistant Professor of Geography*
PH.D., University of Heidelberg, 1953.
- FRANK GIBBS ANDERSON, *Assistant Professor of Sociology*
A.B., Cornell University, 1941; PH.D., University of New Mexico, 1951.
- J. PAUL ANDERSON, *Assistant Professor of Education*
B.S., University of Minnesota, 1942; M.A., 1948; PH.D., 1960.
- NANCY S. ANDERSON, *Assistant Professor of Psychology*
B.A., University of Colorado, 1952; M.S., Ohio State University, 1953; PH.D., 1956.
- OTHO T. BEALL, JR., *Assistant Professor of English*
A.B., Williams College, 1930; M.A., University of Minnesota, 1933; PH.D., University of Pennsylvania, 1952.

Faculty

- ALFRED C. BOYD, JR., *Assistant Professor of Chemistry*
B.S., Canisius College, 1951; M.S., Purdue University, 1953; PH.D., 1957.
- SAMUEL E. BROWN, *Assistant Professor of English*
A.B., Indiana University, 1934; M.A., 1946; PH.D., Yale University, 1955.
- ELBERT M. BYRD, JR., *Assistant Professor of Government and Politics*
B.S., The American University, 1953; M.A., 1954; PH.D., 1959.
- GEORGE H. CALLCOTT, *Assistant Professor of History*
A.B., University of South Carolina, 1950; M.A., Columbia University, 1951; PH.D., University of North Carolina, 1956.
- HAROLD DOTSON CATHER, *Assistant Professor of Mechanical Engineering*
B.S.M.E., University of West Virginia, 1949; M.S.M.E., 1954.
- MARVIN C. CLINE, *Assistant Professor of Psychology*
B.A., Dartmouth College, 1948; M.A., Cornell University, 1950; PH.D., 1954.
- CHARLES H. COATES, *Assistant Professor of Sociology*
B.S., United States Military Academy, 1924; M.A., Louisiana State University, 1952; PH.D., 1955.
- RICHARD D. CREEK, *Assistant Professor of Poultry Nutrition*
B.S.A., Purdue University, 1951; M.S., 1954; PH.D., 1955.
- MARGARET T. CUSSLER, *Assistant Professor of Sociology*
M.A., New York State College of Teachers, 1932; M.A., Radcliffe College, 1941; PH.D., 1943.
- NORTON T. DODGE, *Assistant Professor of Economics*
A.B., Cornell University, 1948; M.A., Harvard University, 1951; PH.D., 1960.
- GERTRUDE EHRLICH, *Assistant Professor of Mathematics*
B.S., Georgia State College for Women, 1943; M.A., University of North Carolina, 1945; PH.D., University of Tennessee, 1953.
- OLLIE R. EYLAR, JR., *Assistant Professor of Microbiology*
B.A., University of Minnesota, 1952; M.S., 1955; PH.D., 1959.
- DAVID M. FARQUHAR, *Assistant Professor of History*
B.A., University of Washington, 1952; M.A., 1955; PH.D., Harvard University, 1960.
- E. JAMES FERGUSON, *Assistant Professor of History*
B.A., University of Washington, 1939; M.A., 1941; PH.D., 1951.
- RAYMOND A. GALLOWAY, *Assistant Professor of Botany*
B.S., University of Maryland, 1952; M.S., 1956; PH.D., 1958.
- FRANK OTTO GATELL, *Assistant Professor of History*
B.A., City College, N. Y., 1956; M.A., Harvard University, 1958; PH.D., 1960.
- JACOB D. GOERING, *Assistant Professor of Education*
B.A., Bethel College, 1941; B.D., Bethany Seminary, 1949; PH.D., University of Maryland, 1959.
- GILBERT GORDON, *Assistant Professor of Chemistry*
B.S., Bradley, 1955; PH.D., Michigan State University, 1959.
- LEWIS R. GOLLUB, *Assistant Professor of Psychology*
A.B., University of Pennsylvania, 1955; PH.D., Harvard University, 1958.

- ALBERT GOMEZPLATA, *Assistant Professor of Chemical Engineering*
 B.C.H.E., Brooklyn Polytechnic Institute, 1952; M.C.H.E., Rensselaer Polytechnic Institute, 1954; PH.D., 1958.
- FRANCIS S. GRUBAR, *Assistant Professor of Art*
 B.A., University of Maryland, 1948; M.A., 1949; PH.D., Johns Hopkins University, 1952.
- FLOYD P. HARRISON, *Assistant Professor of Entomology*
 B.S., Louisiana State University, 1951; M.S., 1953; PH.D., University of Maryland, 1955.
- ELIZABETH E. HAVILAND, *Assistant Professor of Entomology*
 B.A., Wilmington College, 1923; M.A., Cornell University, 1926; M.S., University of Maryland, 1936; PH.D., 1945.
- EMIL FRANCIS HEERMANN, *Assistant Professor of Psychology*
 B.A., University of Cincinnati, 1952; M.A., Ohio State University, 1957; PH.D., 1959.
- NORMAN V. HELBACKA, *Assistant Professor of Poultry Products Technology*
 B.A., University of Minnesota, 1952; M.S., 1954; PH.D., 1956.
- ROGER W. HEMKEN, *Assistant Professor of Dairy*
 B.S., University of Illinois, 1950; M.S., 1954; PH.D., Cornell University, 1957.
- HUBERT P. HENDERSON, *Assistant Professor of Music*
 A.B., University of North Carolina, 1941; M.A., 1950.
- KENNETH R. HENERY-LOGAN, *Assistant Professor of Chemistry*
 B.S., McGill University, 1954; PH.D., 1946.
- RICHARD T. HIGHTON, *Assistant Professor of Zoology*
 B.A., New York University, 1950; M.S., University of Florida, 1953; PH.D., 1956.
- ROBERT K. HIRZEL, *Assistant Professor of Sociology*
 B.A., Pennsylvania State University, 1956; M.A., 1950; PH.D., Louisiana State University, 1954.
- SIDNEY ISHEE, *Assistant Professor of Agricultural Economics*
 B.S., Mississippi State College, 1950; M.S., Pennsylvania State College, 1952; PH.D., 1957.
- LEO M. KARPELES, *Assistant Professor of Physiology*
 B.S., University of North Carolina, 1941; M.D., University of Washington, 1955.
- RAYMOND L. KING, *Assistant Professor of Dairy*
 A.B., University of California, 1955; PH.D., 1958.
- LORIN R. KRUSBERG, *Assistant Professor of Botany*
 B.S., University of Delaware, 1954; M.S., North Carolina State College, 1956; PH.D., 1959.
- LEONARD LUTWACK, *Assistant Professor of English*
 B.A., Wesleyan University, 1939; M.A., 1940; PH.D., Ohio State University, 1950.
- GEORGE L. MARX, *Assistant Professor of Education*
 B.A., Yankton College, 1953; M.A., State University of Iowa, 1958; PH.D., 1959.
- THEODORE MC NELLY, *Assistant Professor of Government and Politics*
 B.S., University of Wisconsin, 1941; M.A., 1942; PH.D., Columbia University, 1952.

Faculty

WILLIAM J. MASSEY, *Assistant Professor of Education*

B.A., Louisiana State Normal College, 1936; M.ED., University of Missouri, 1954; ED.D., 1955.

ANNABELLE B. MOTZ, *Assistant Professor of Education*

B.S., University of Wisconsin, 1941; M.A., University of Chicago, 1943; PH.D., 1950.

ROBERT MASON MYERS, *Assistant Professor of English*

B.A., Vanderbilt University, 1941; M.A., Columbia University, 1942; M.A., Harvard University, 1943; PH.D., Columbia University, 1948.

GRACIELA P. NEMES, *Assistant Professor of Foreign Languages*

B.S., Trinity College, 1942; M.A., University of Maryland, 1949; PH.D., 1952.

MAURICE E. O'DONNELL, *Assistant Professor of Government and Politics*

B.S., Eastern Illinois State, 1948; M.S., University of Wisconsin, 1951; PH.D., 1954.

BETTY ELEANOR ORR, *Assistant Professor of Education*

A.B., Beloit College, 1943; M.A., University of Chicago, 1945; PH.D., 1958.

ROBERT A. PATERSON, *Assistant Professor of Botany*

B.A., University of Nevada, 1949; M.A., Stanford University, 1951; PH.D., University of Michigan, 1957.

BERNARD PECK, *Assistant Professor of Education*

A.B., Indiana University, 1939; M.A., Columbia University, 1942; ED.D., University of Maryland, 1957.

LEONARD M. PITT, *Assistant Professor of History*

B.A., University of California, 1952; M.A., 1955; PH.D., 1958.

LAJOS PUKANSKY, *Assistant Professor of Mathematics (P.T.)*

B.A., Gymnasium, Debrecan, Hungary, 1947; M.A., University Budapest, 1951; PH.D., University Szeged, 1955.

BRUCE L. REINHART, *Assistant Professor of Mathematics*

B.A., Lehigh University, 1952; M.A., Princeton University, 1954; PH.D., 1956.

HELEN ANNE RIVLIN, *Assistant Professor of History*

B.A., University of Rochester, 1949; M.A., Radcliffe College, 1950; PH.D., Oxford University, 1953.

LEONARD S. RODBERG, *Assistant Professor of Physics*

A.B., Johns Hopkins University, 1954; PH.D., Massachusetts Institute of Technology, 1956.

WILLIAM C. ROSEN, *Assistant Professor of Mathematics*

B.S., University of Illinois, 1943; M.S., 1947; PH.D., 1954.

PAUL WILLIAM SANTELMANN, *Assistant Professor of Agronomy*

B.S., University of Maryland, 1950; M.S., Michigan State College, 1952; PH.D., Ohio State University, 1954.

LYLE D. SCHMIDT, *Assistant Professor of Education*

B.A., St. Cloud State Teachers College, 1955; A.M., University of Missouri, 1957; PH.D., 1959.

- RALPH F. SHANGRAW, *Assistant Professor of Pharmacy*
B.S., 1952, Massachusetts College of Pharmacy; M.S., 1954; PH.D., University of Michigan, 1958.
- CLODUS R. SMITH, *Assistant Professor of Agricultural Education*
B.S., Oklahoma A & M College, 1950; M.S., 1955; D.ED., Cornell University, 1960.
- SPENCER M. SMITH, JR., *Assistant Professor of Economics*
B.A., State University of Iowa, 1941; M.A., 1942; PH.D., 1948.
- MERRILL J. SNYDER, *Assistant Professor of Medicine in Clinical Microbiology and Instructor in Microbiology*
B.S., University of Pittsburgh, 1940; M.S., University of Maryland, 1950; PH.D., 1953.
- PHILLIP H. STEINBERG, *Assistant Professor of Physics*
B.S., University of Cincinnati, 1954; PH.D., Northwestern University, 1960.
- ALLEN L. STEINHAEUER, *Assistant Professor of Entomology*
B.S.A., University of Manitoba, 1953; M.S., Oregon State College, 1955; PH.D., 1958.
- WOLCOTT E. STEWART, *Assistant Professor of Dairy*
B.S., Cornell University, 1953; M.S., 1956; PH.D., 1957.
- DANIEL AUGUSTUS SWOPE, *Assistant Professor of Agricultural Economics*
B.S., Pennsylvania State University, 1942; M.S., Cornell University, 1953; PH.D., Pennsylvania State University, 1958.
- JOHN M. VANDERSALL, *Assistant Professor of Dairy*
B.S., Ohio State University, 1950; M.S., 1954; PH.D., 1959.
- JUNE C. WILBUR, *Assistant Professor of Textiles and Clothing*
B.S., University of Washington, 1936; EDUC., 1937; M.S., Syracuse University, 1940.
- FRANK HERBERT WILCOX, JR., *Assistant Professor of Poultry Husbandry*
B.S., University of Connecticut, 1951; M.S., Cornell University, 1953; PH.D., 1955.
- WALTER F. WILLIAMS, *Assistant Professor of Dairy*
A.B., University of Missouri, 1951; M.S., 1952; PH.D., 1955.
- JACK B. WILSON, *Assistant Professor of Botany*
B.S., West Virginia University, 1953; M.S., 1954; PH.D., 1957.
- JOHN WRIGHT WYSONG, *Assistant Professor of Agricultural Economics*
B.S., Cornell University, 1953; M.S., University of Illinois, 1954; PH.D., Cornell University, 1957.
- MATTHEW YARCZOWER, *Assistant Professor of Psychology*
B.B.A., City College of New York, 1953; M.A., University of Maryland, 1955; PH.D., 1958.
- EDGAR PAUL YOUNG, *Assistant Professor of Animal Husbandry*
B.S., Ohio State University, 1954; M.S., 1956; PH.D., 1958.
- MISHAEL ZEDEK, *Assistant Professor of Mathematics*
M.S.C., Hebrew University, 1952; PH.D., Harvard University, 1956.
- DAVID M. ZIPOY, *Assistant Professor of Physics*
B.S., University of Minnesota, 1954; PH.D., 1957.

Faculty

Assistant Research Professor

GEORGE WEISS, *Assistant Research Professor, Institute of Fluid Dynamics*
A.B., Columbia University, 1951; M.A., University of Maryland, 1953; PH.D., 1958.

Lecturers

- ALFRED H. AITKEN, *Lecturer in Physics (P.T.)*
B.S., Lehigh University, 1949; M.S., Indiana University, 1950; PH.D., 1955.
- JOSEPH VINCENT BRADY, *Lecturer in Psychology*
B.S., Fordham University, 1943; PH.D., University of Chicago, 1951.
- G. DONALD CAUSEY, *Lecturer in Speech*
B.A., University of Maryland, 1950; M.A., 1951; PH.D., 1954.
- YAOHAN CHU, *Lecturer in Electrical Engineering*
B.S., Chiao-Tung University, 1942; M.S., Massachusetts Institute of Technology, 1945; SC.D., 1953.
- JACOB J. FREEMAN, *Lecturer in Electrical Engineering*
B.S., College of William and Mary, 1933; M.A., Columbia University, 1935; PH.D., Catholic University, 1949.
- WILLIAM L. HABERMAN, *Lecturer in Mechanical Engineering*
B.M.E., Cooper Union, 1949; M.S., University of Maryland, 1952; PH.D., 1956.
- EDGAR A. J. JOHNSON, *Lecturer in Economics*
B.S., University of Illinois, 1922; A.M., Harvard, 1924; PH.D., 1929.
- MARTIN KATZIN, *Lecturer in Electrical Engineering*
B.S.E., (E.E.), University of Michigan, 1928; B.S.E., (Mathematics), 1929; M.S.E., (E.E.), 1929.
- HERMAN H. KURZWEG, *Lecturer in Aeronautical Engineering*
PH.D., University of Leipzig, 1933.
- HOYT LEMONS, *Lecturer in Geography*
B.ED., Southern Illinois University, 1936; M.A., University of Nebraska, 1938; PH.D., 1941.
- RICHARD LINDENBERG, *Lecturer in Anatomy*
GRADUATION, University of Munich Medical School, 1934; M.D., University of Berlin, 1944.
- R. KENNETH LOBB, *Lecturer in Aeronautical Engineering*
B.S., University of Alberta; M.S., University of Toronto, 1948; PH.D., 1950.
- JOHN DUDLEY NICOLAIDES, *Lecturer in Aeronautical Engineering*
B.A., Lehigh University, 1946; M.S.E., Johns Hopkins University, 1952.
- SAMUEL PENNER, *Lecturer in Physics (P.T.)*
B.A., University of Buffalo, 1952; M.S., University of Illinois, 1954; PH.D., 1956.
- HOWARD R. REISS, *Lecturer in Physics (P.T.)*
B. AERO. E., Polytechnic Institute of Brooklyn, 1950; M. AERO. E., 1951; PH.D., University of Maryland, 1958.
- EARL A. SCHUCHARD, *Lecturer in Electrical Engineering*
B.S., University of Washington, 1933; M.S., 1934; PH.D., 1940.

- ARNOLD E. SEIGEL, *Lecturer in Mechanical Engineering*
 B.S., University of Maryland, 1944; S.M., Massachusetts Institute of Technology, 1947;
 PH.D., University of Amsterdam, 1952.
- R. EDWIN SHUTTS, *Lecturer in Audiology and Speech Pathology*
 A.B., Indiana State Teachers' College, 1933; M.A., Northwestern University, 1947;
 PH.D., 1950.
- MILTON M. SLAWSKY, *Lecturer in Physics (P.T.)*
 B.S., Rensselaer Polytechnic Institute, 1933; M.S., California Institute of Technology,
 1935; PH.D., University of Michigan, 1938.
- EARL R. STADTMAN, *Lecturer in Microbiology*
 B.S., University of California, 1942; PH.D., 1949.
- HORACE M. TRENT, *Lecturer in Electrical Engineering*
 B.A., Berea College, 1928; M.A., Indiana University, 1929; PH.D., 1934.
- JOHN L. VANDERSLICE, *Lecturer in Electrical Engineering*
 B.S., University of Pennsylvania, 1928; A.M., 1930; PH.D., Princeton University, 1934.
- WALTER W. WADA, *Lecturer in Physics (P.T.)*
 B.A., University of Utah, 1943; M.A., University of Michigan, 1946; PH.D., 1951.
- EDWARD C. WATTERS, *Lecturer in Electrical Engineering*
 B.S., University of Notre Dame, 1943; M.S., 1946; PH.D., University of Maryland, 1954.
- ROBERT E. WILSON, *Lecturer in Aeronautical Engineering*
 B.S., Georgia Institute of Technology, 1941; M.S., 1942; PH.D., University of Texas,
 1952.
- WALTER R. WISE, JR., *Lecturer in Mechanical Engineering*
 B.S.M.E., Duke University, 1952; M.S., University of Maryland, 1955; PH.D., 1959.
- ROBERT W. ZWANZIG, *Lecturer in Physics (P.T.)*
 B.S., Polytechnic Institute of Brooklyn, 1948; M.S., University of Southern California,
 1950; PH.D., California Institute of Technology, 1952.

Instructors

- WILLIAM HARRY CAPITAN, *Instructor in Philosophy*
 B.A., University of Michigan, 1954; M.A., 1958; PH.D., 1960.
- ENNIS C. LAYNE, *Instructor in Pediatrics and in Biological Chemistry (P.T.)*
 B.S., George Washington University, 1949; M.S., 1953; PH.D., 1955.
- WILLIAM F. MYERS, *Instructor of Microbiology*
 A.B., University of Kansas, 1949; M.A., 1955; PH.D., 1958.
- EDWARD C. ROSENZWEIG, *Instructor of Microbiology*
 A.B., Centre College, 1951; M.S.C., University of Maryland, 1956; PH.D., 1959.
- JOSEPH H. SEIPP, JR., *Instructor in Histology*
 A.B., Loyola College; D.D.S., University of Maryland, 1955; M.S., University of Pitts-
 burgh, 1959.

THE UNIVERSITY is the rear guard and the advance agent of society. It lives in the past, the present and the future. It is the storehouse of knowledge; it draws upon this depository to throw light upon the present; it prepares people to live and make a living in the world of today; and it should take the lead in expanding the intellectual horizons and the scientific frontiers, thus helping mankind to go forward—always toward the promise of a better tomorrow.

From “The State and the University”
the inaugural address of
President Wilson H. Elkins,
January 20, 1955,
College Park, Maryland.





